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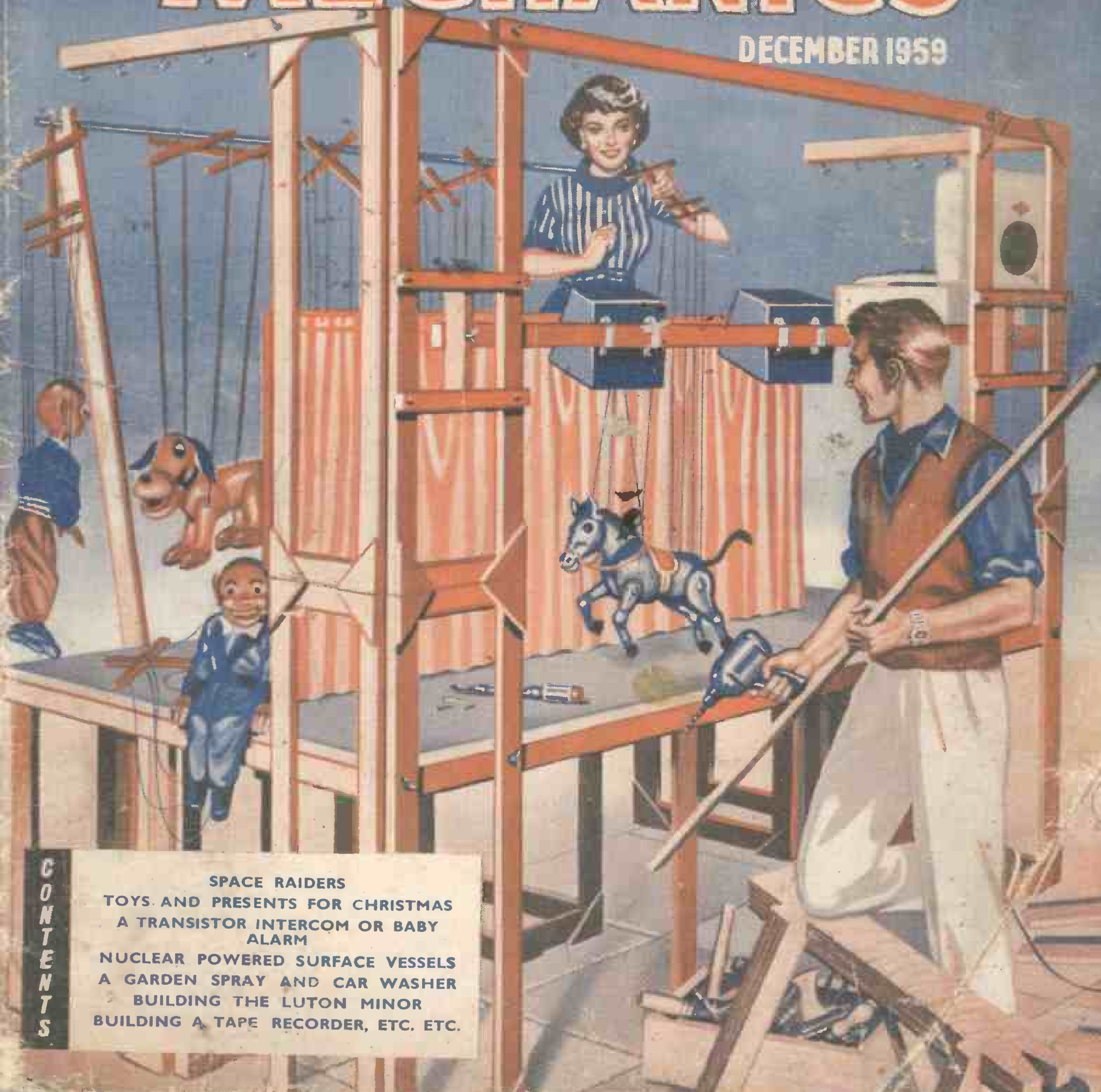

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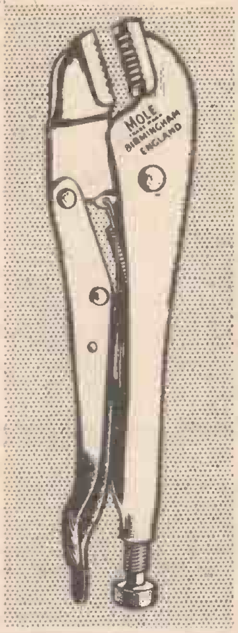

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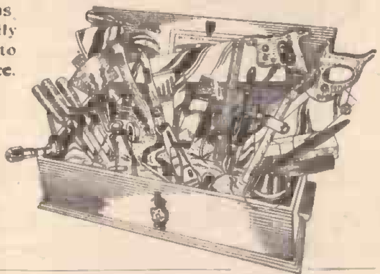

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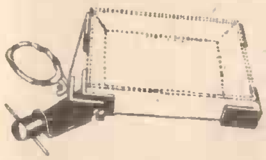

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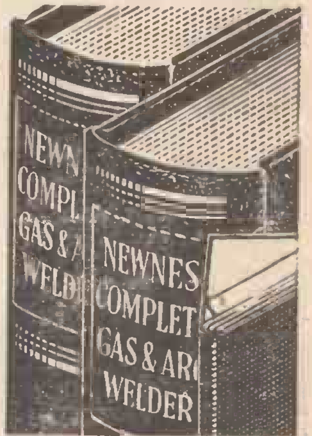

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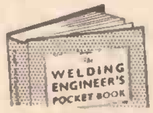

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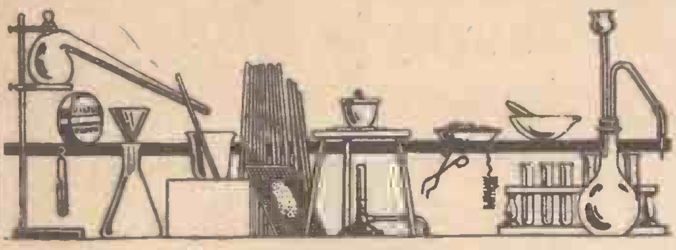

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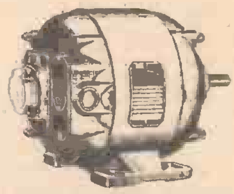

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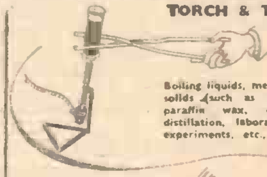

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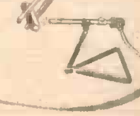

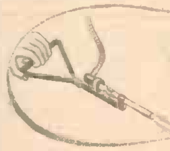

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FAIR COMMENT

THE FAR SIDE OF THE MOON

IN October the first pictures of the far side of the moon were released by the Russians. They were taken by a camera mounted on the rocket Lunik III and later transmitted some 300,000 miles to the earth by radio.

A superficial inspection of the photographs would appear to indicate that there are fewer major features on the far side, but this can by no means be taken as certain. The photographs were taken when Lunik III was directly between the sun and the moon which means that the illumination, so far as the camera was concerned, was directly vertical. These are the worst possible lighting conditions for taking such photographs. It is well known that to avoid these conditions the moon as we see it from earth is never photographed when it is full, but only when waxing or waning. It is the shadows thrown by having the light source at one side which enable astronomers to observe, photograph and recognize features on the moon's surface.

If a sphere is illuminated by a bright light, the point nearest the light source shows the strongest reflection. This reduces gradually, the increasing areas of shadow taking roughly the form of successive crescents, resembling closely the effect seen on the Lunik photographs.

The bright spot appears to be so bright that the photograph was over-exposed at this point and practically devoid of detail. A little more can be seen on the fringes of this area, while towards the edge of the moon's disc farthest from the "highlight," which incidentally is the part of the surface visible from the earth, detail is very much more abundant.

The side of the moon visible from earth has been photographed by many astronomers over a period of about 100 years and new features are still being discovered, so it is not surprising, nor is it disappointing that the first batch of photographs of the moon's far side should not show the intricate detail of some of the best photographs taken from earth. Considering that the space projects of man are in their infancy, the Russian scientists responsible deserve the congratulations and admiration of the world for their very considerable technical achievement in obtaining any photographs—whatever the quality.

Should the over-exposure theory, which we are inclined to favour, not be true and if it is established without doubt that the far side of the moon is as monotonous as it would appear at first glance, then scientists and astronomers are indeed faced with an exciting problem. The extreme contrast between the two sides would certainly have considerable bearing on the several theories of the origin of the moon's characteristic features.

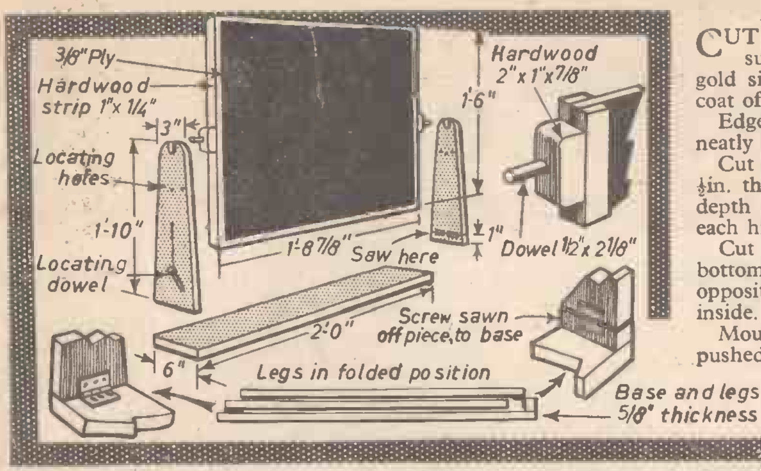
IS IT WORTH WHILE?

SPACE research with its rockets, satellites, etc., is extremely expensive, and it is the opinion of many people that the millions of pounds being spent could be better employed here on earth. Such worthy projects as cancer research, famine relief and the education of backward peoples are often cited as being far more deserving of attention. These, of course, are very urgent problems, but let us not lose sight of the vast potential benefits which may accrue from space research. Before Columbus sailed across the Atlantic, people in Europe were saying much the same thing and with much more reason. It was not then established that the earth was a globe and it was popularly thought that these intrepid mariners would sail off the edge of the world. Think, however, for a moment of the fabulous riches given to the world by the discoveries made by this man and others, who sailed in spite of short-sighted criticism.

These benefits came to us, as we developed technically, merely from the exploration of our own planet. Who knows what might result from the exploration of some of the other worlds in space?

The January, 1960, issue will be published on December 31st. Order it now!

A FOLDAWAY BLACKBOARD



CUT and sand both surfaces of the board very smooth. On these surfaces paint two thin coats of a mixture containing drop black gold size and fine emery powder. If the chalk skids apply another coat of the solution, but this time add more emery.

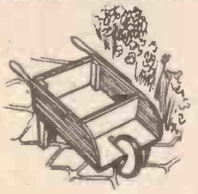
Edge both sides of the board with hardwood strips and mitre them neatly in the corners. Glue, sandpaper and paint or varnish.

Cut the two swivel blocks from hardwood and glue as shown. Drill ½in. through the middle of each and into the board for ½in., a total depth of 1½in., then glue the dowel hinge-pins in place. 3in. below each hinge block drill another hole ¼in. diameter to a depth of ¾in.

Cut the base and the two uprights as shown. An inch from the bottom edge of one of the uprights saw it through and hinge. The opposite upright is not cut and is hinged direct to the base on the inside. This allows the uprights to lie flush when folded.

Mount the board between the uprights with a short piece of pencil pushed into the peg hole in the board. Move the board so that the pencil describes an arc and on it drill three ¼in. holes at 1in. centres. Pieces of ¼in. dowel hold the board rigidly in three alternative positions. Finish with stain and varnish.

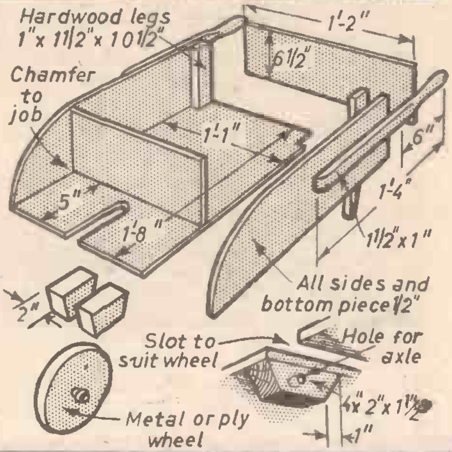
A BOY'S BARROW



CUT the hardwood baseboard first and cut-outs in two corners to accommodate the two legs at the rear. At the opposite end cut a slot wide enough to take any suitable wheel. A wheel could be cut from ⅜in. plywood, with a fretsaw. Drill the centre ½in. diameter and round off the rim with a file and glasspaper.

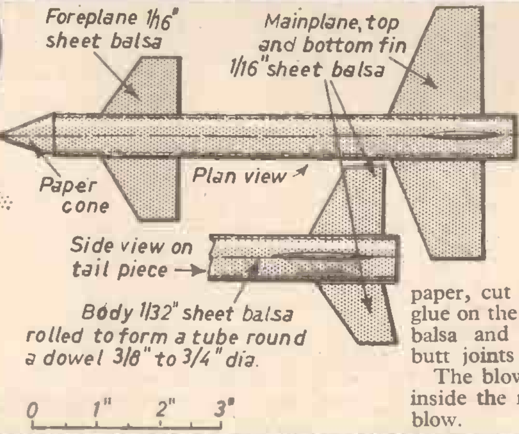
Cut out the two sides, the back and front from hardwood, then glue and pin them on the base.

Next, cut the two rear legs of the barrow and taper 4in. at one end of each to 1in. square at the base. Glue and screw these in place. Cut the handles and round off the grips and the front ends. Screw in position. Push one end of a ½in. dowel into one of the blocks, fit a ½in. washer, then the wheel and another washer and finally the second block. Then screw the assembly to the body base with 1½in. woodscrews.



TOYS FOR CHRISTMAS

A GUIDED MISSILE

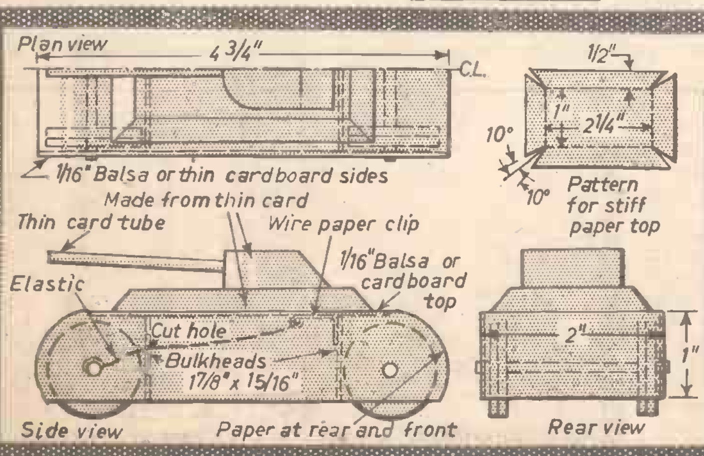


THIS model can fly over 60ft. The body is made by wrapping wood round an 8in. × ⅜in. dowel and butt jointing. Mark a sheet of 1/32in. balsa wood into four equal parts by means of three lines running along the length; these are to assist in aligning the fins. Soak it in warm water, wrap it round the former, bind in position and leave to dry. When dry cement the edges of the tube together.

Cut out a 2in. dia. circle of stiff drawing paper, cut from edge to centre, form into a cone and glue on the front of the tube. Cut out the fins from 1/16in. balsa and glue in position using the ruled lined and butt joints as guides.

The blowpipe is a 10in. paper tube which fits loosely inside the missile body. To fire, hold horizontally and blow.

A WORKING MODEL TANK



FIRST mark out the two sides and cut holes for axles in identical positions on both. Cut out and form the top panel and cement tabs inside each corner to hold edges together. Cut the two rectangular bulkheads. The front bulkhead should have a hole in the centre to give clearance for the elastic.

Cut eight 1in. dia. discs with holes to suit the pencil axles. Cement discs together in pairs to form wheels approximately ⅛in. thick. Cut the top and bottom panels of the turret. A 7/16in. wide strip of stiff paper forms the turret sides. Roll a paper tube to make a gun. Stiff paper is used for front and rear curved portions of tank.

Drill a small hole in front axle on the centre line. Push the axles through the sides and slide the wheels into place; then cement firmly. Add the top, then cement turret and gun into place, followed by the front and rear curved pieces.

Fit elastic between the axle and cemented paper clip, via the hole in the front bulkhead. Work the model by drawing the tank rearwards along the floor and then letting it go.

THE PUZZLE TUMBLER

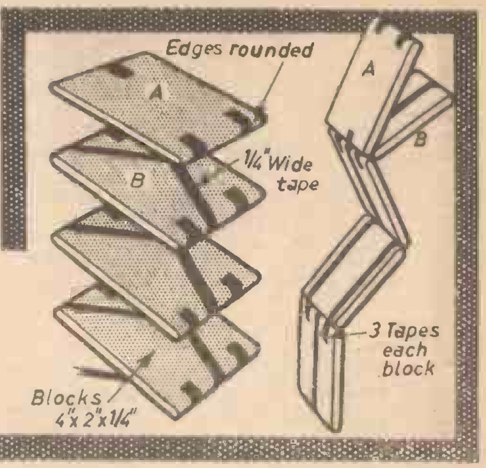
A NUMBER of blocks of wood 4in. 2in. ¼in. are required. Seven give a good effect; 12 is a generous number.

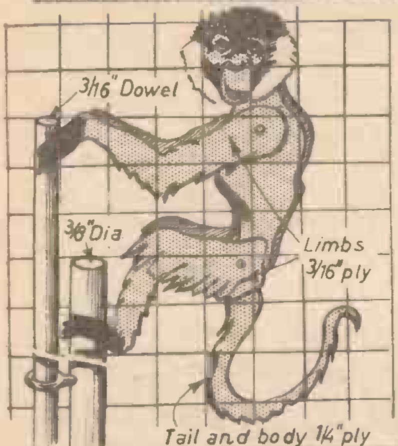
The edges and corners of the blocks should be rounded and all surfaces smoothed with glasspaper. Procure some thin tape about ¼in. wide and cut it into strips long enough to pass along the blocks and over each end by about ½in., as shown herewith. Three tapes are required for each block and are threaded as shown, being firmly glued at each overlap. They should be taut so that when the blocks lie flat, one upon the other, there is no excess movement.

Paint the blocks with two bright contrasting colours—say red on one side and blue on the other—so that when lying flat the underside of one block contrasts in colour with the upperside of its neighbour.

The sketch also shows how the toy should be held to make it work. The op block " A " and the second block " B " are turned upwards, as shown, and, upon the release of " B " the top block " A " will fall and appear to pass rapidly down the chain, first on one side and then the other, until it reaches the bottom. By alternating holding the second block and letting fall the first, the illusion can be repeated *ad lib*.

What really happens is that the second block becomes reversed and falls back again in its former position. This makes it come level with the third block, which at once falls over on to the fourth, and so on to the end of the ladder.



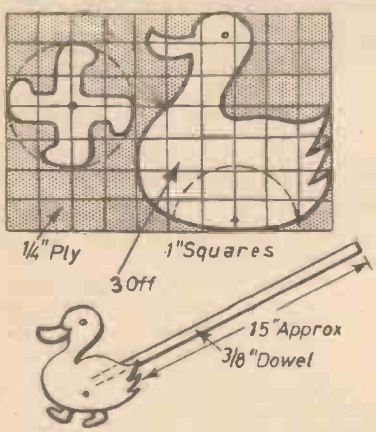


THE CLIMBING MONKEY

THE squares on the drawing represent ⅜in. squares. The body can be cut from a piece of ¼in. plywood about 1½in. wide by 3½in. long, and the limbs from $\frac{3}{16}$in. plywood. The thinner dowel is about 18in. long, and the other 15in. The screw-eye connecting the two is placed about 8in. from the top of the thick dowel and the eye should be large enough to afford a sliding fit for the $\frac{3}{16}$in. dowel. Small holes are bored in the body and limbs where shown, and through these are threaded lengths of wire bent over at each end. The tail may be of hairy string and the ears of washleather or felt. The monkey should be painted as realistically as possible.

The toy is worked by holding both dowels near their bottom ends and sliding them up and down quickly.

AND PRESENTS for the Stocking



THE WALKING DUCK

FROM ¼in. plywood cut three duck shapes as shown. On one side of each of two of the shapes glue very thin cardboard, one right-hand and one left-hand, so they will be on the inside. From the third shape cut out the semi-circular piece as per dotted line. Glue and pin all three shapes together, the centre shape being the one from which the semi-circle has been cut.

Also from ¼in. plywood, cut out the legs. Drill a small hole in the centre and also in the built-up duck as shown. Pass a thin nail through to enable the legs to revolve freely on it.

A slanting hole is now bored in the rear of the duck to take a suitable length of dowel which the child will hold.

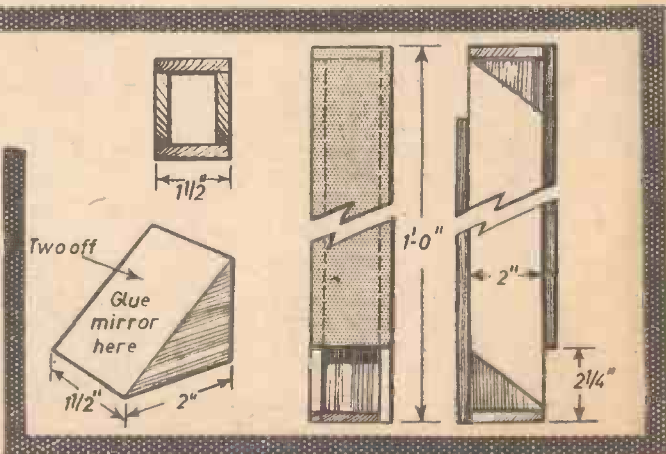
Glasspaper and paint in bright colours.

MAKING A HANDY PERISCOPE

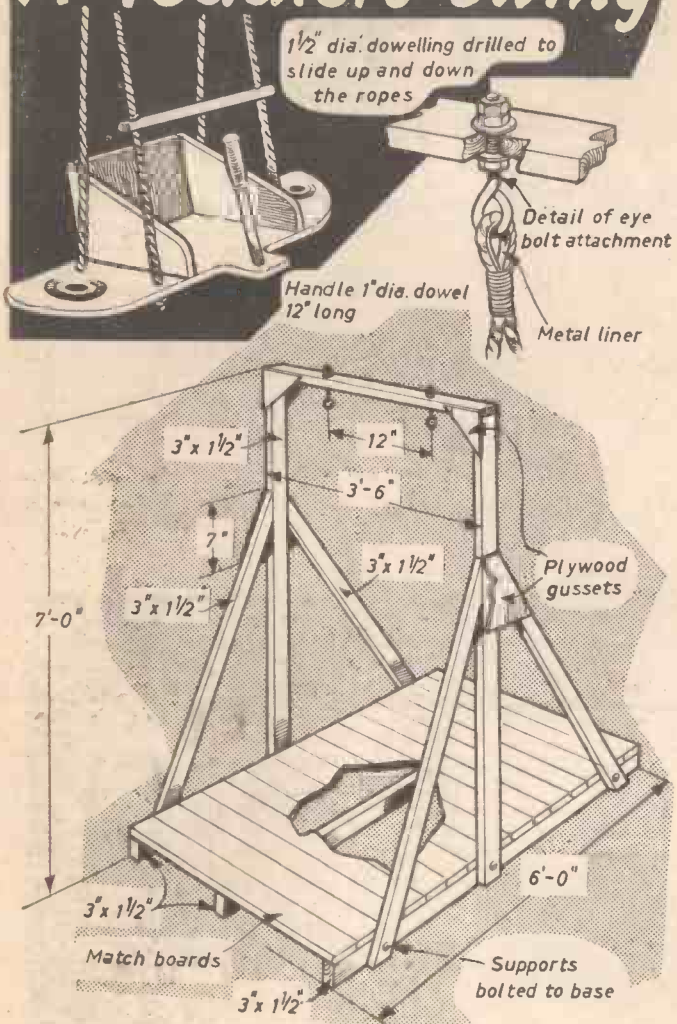
HERE is a handy, simple design; easy to make up, but quite efficient in working. Measurements are, of course, entirely elastic within reason. There is no limit to the length, nor to the shape or area of the inside; the mirrors available regulate these dimensions. Suitable ones—ladies' handbag size—can be bought in all stores for a shilling or so. Two will be required.

The mirrors are glued to wooden blocks one side of which has been cut to 45 deg. as shown lower left of the illustration. From the base-size of these blocks construct the sides which can be of ¼in. plywood pinned and glued. Note that before assembling these sides they must be painted a dull black on the inside; under no circumstances must the paint be glossy or the reflections will fog. Note also that two of the sides are shorter by the vertical height of the inclined mirrors and are set at opposite ends. These form the viewing holes.

For the sake of appearance the outside may be painted or stained, or covered with some form of leatherette paper.



A Toddler's Swing



General details of the swing.

MAKE IT IN TIME FOR CHRISTMAS

THIS sturdy swing is comparatively cheap and easy to make and, being movable, can be placed in any convenient part of the garden.

Construction

Cut the three base runners first, each of which is 3in. × 1½in. × 6ft. long. These are spaced 17½in. apart. Starting at the ends, which must be level, screw or nail in place side by side the lengths of matchboarding. Tongued and grooved panels or floor boarding will do. Cut off any surplus at the opposite ends of the base runners.

Centre Main Frame

Deal, 3in. × 1½in. is used. Cut two lengths each 6ft. 10½in. and at one end of each drill a ½in. diameter hole in the middle of the 3in. face and 1½in. from the end. Cut a cross-piece 3ft. 6in. long and screw this across the two uprights at the opposite end to the holes as shown in the drawing.

The two corners of the frame thus made are reinforced at each side with ½in. thick triangular plywood gussets. Cut four of them, each with two sides approximately 9in. long and make sure the angle formed by these sides is a true right-angle. Screw the gussets in the corner of the frame with 1½in. woodscrews.

In the cross-piece, spaced 12in. apart, drill two ½in. dia. holes right through to accept the ring bolts and metal liners (see drawing) which can be bought ready made for the purpose. Place large washers under the heads of the bolts and under the nuts.

Prop the frame (or get someone to hold it) in an upright position, astride the base and exactly in the middle. With a pencil, mark through the holes in the bottom of the uprights into the base runners. Drill the runners ½in. dia. and bolt the frame in position with ½in. bolts, nuts and large washers.

The four diagonal stays are made and fitted next. These are cut from 3in. × 1½in. deal and extend to within approximately 12in. from the frame top and about 6in. from the base runner ends. Place one piece, roughly cut to length, against the side of the structure already made and check that the centre bolted frame is vertical. When in approximately the correct position (indicated above) mark off in pencil the angle cut necessary. Trim the stay and at the bottom end drill a ½in. hole 1½in. from the bottom edge. Mark the position of this hole in the bottom runner by scribing through the hole in the stay, drill the hole, and bolt stay to runner with a ½in. bolt and the usual washers. Secure the opposite end of the stay to the edge of the frame upright with a 2in. woodscrew.

Repeat this procedure with the three remaining stays. The junctions of stays and frame uprights are reinforced on the outside with ⅜in. plywood or hardwood gussets about 7in. deep. Place a 7in. piece of the wood centrally over each joint and draw the outline of the triangular shape formed by the stays. Cut out the shapes, drill them down the centre and along the sloping edges with 3/16in. pilot holes and screw them in place with 1½in. woodscrews.

The Seat

The general arrangement seat details are shown in the drawing. Mark out the shape of the base on ¾in. plywood or hardwood divided into 1in. squares, cut it out and drill it in the positions marked with holes just big enough to make a neat fit for the rope you intend to use. This should be new sisal rope not less than ½in. dia. The local hardware store probably stocks it.

Cut the sides and back in a similar way from ½in. wood and then glue and screw them in place. Reinforce the corners if you wish with quarter-round beading. A piece of 1in. dowel 12in. long making a tight glued joint in the appropriate hole forms the "joystick" which can be fitted with a cycle handlebar "grip" at the top.

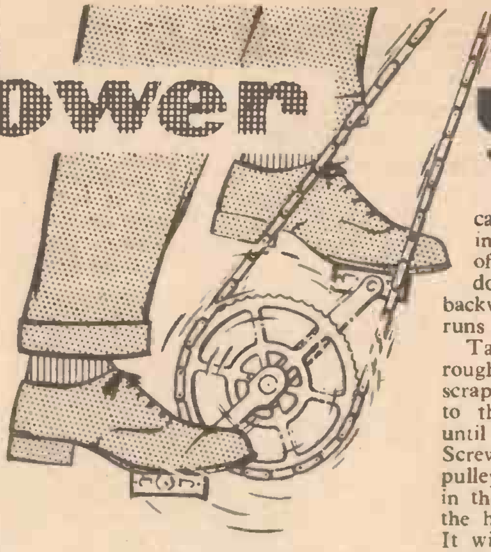
Sling the chair as shown on the main drawing. A piece of broom handle or thick dowel drilled to take the rope as shown provides an adequate safety bar. Tie large tight knots underneath the chair and bind the rope securely just below the metal liners at the top with thick copper wire.

Prime and paint the entire structure in the usual way or give it a thorough coat of wood preservative. Secure all nuts by "Peening" over the heads of the protruding bolts with a hammer.

YOU NEED

Deal 3in. × 1½in.: 60ft. comprising two 7ft. lengths and the rest in 6ft. lengths (main structure).
Matchboard: 15 lengths 4ft. 6in. long × 4in. wide or equivalent (base).
Other wood: 1 piece 2ft. 11in. × ¾in. (seat base).
1 piece 2ft. 6in. 6in. × ½in. (seat sides and back).
⅜in. plywood 4ft. × 9in. (gussets).
Miscellaneous: Screws, ½in. Whitworth, bolts, nuts, washers, ring bolts, liners, rope, dowel.

Pedal Power your Lathe



And Details of Some Basic Accessories

By R. N. T. Burke

THOSE living in a remote part of the country or whose workshop is far from any supply point will find this pedal-power method of great advantage. The proposed device is cheaper than electrical tools, variable speeds are available, it will not interfere with T.V., it is quiet, and many suitable attachments can be made at low cost.

The main essential is a spindle rotating at a high speed, and this was provided in the original by the headstock of a "Hobbies Handy Bench Lathe," but other machines may be used if they are driven by belt.

As both hands must be left entirely free for operating the tools, it is obvious that the power must be provided by the feet, and by far the best method of using them is by means of the pedals and chainwheel of an old bicycle frame.

The lathe must be mounted upon a bench or stout plank, giving plenty of knee room for pedalling—36in. clearance at least is necessary, but do not fasten the machine down yet.

Pedal Arrangements

Take an old bicycle frame and cut off the tubes as shown in Fig 1, taking care to leave sufficient tube to give 3in. ground clearance to the pedals when the device is screwed to the floor. One inch from the bottom of the "feet" make a small hacksaw cut and hammer in the upper side of the frame tube, making a hole for the fastening screw (Fig. 1). Screw the pedalling frame to the floor beneath the bench at a point directly beneath where the lathe headstock will be.

Pulley Arrangement

Now obtain an old bicycle rear wheel hub —a Sturmey Archer geared type is best as it has a larger hub diameter. It is not necessary for the gears to work as in practice only top gear is used. Drill out four of the spoke holes to ⅛in. dia. and bolt on a plywood disc, 11in. × ⅜in., mounting the assembly as shown in Figs. 1 and 2 beneath the bench with the chain connected. Take care that the free-wheel device is working in the right direction, i.e., the nearest side of the plywood discs must be driven downwards when the pedals are operated backwards. Check that the plywood disc runs true and adjust if necessary.

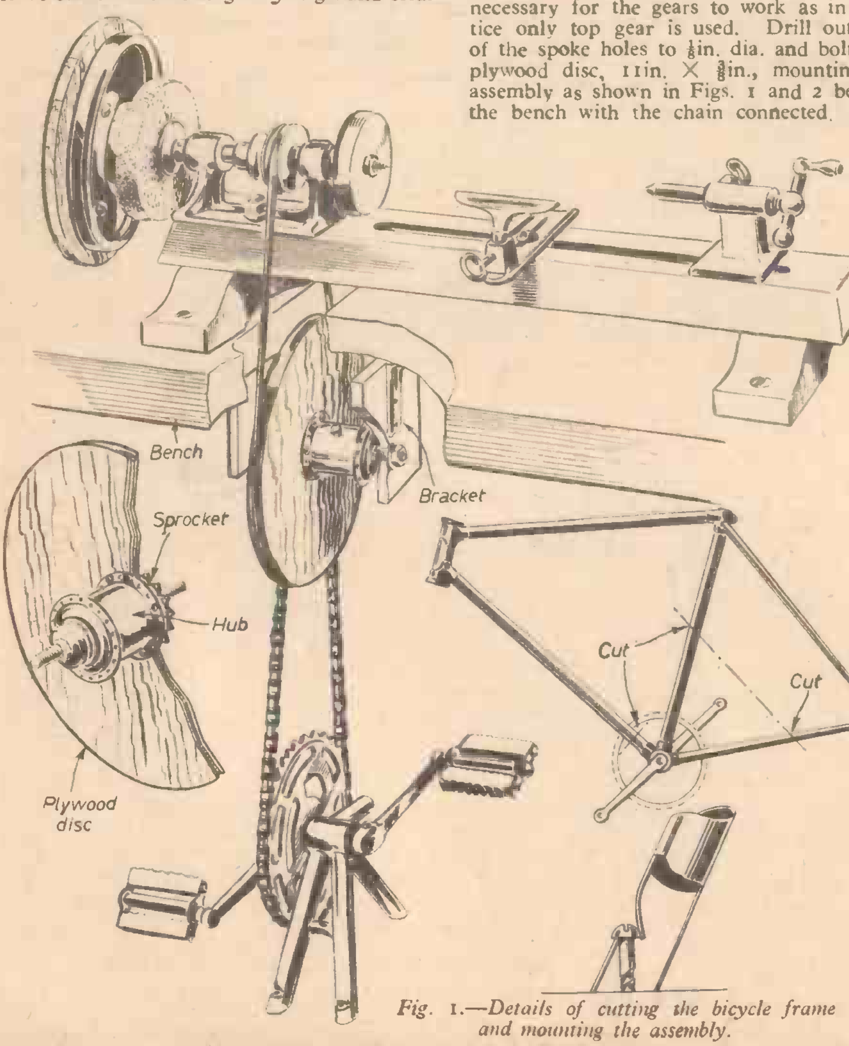


Fig. 1.—Details of cutting the bicycle frame and mounting the assembly.

Take a piece of dowel and wrap some rough sandpaper round it. Grip a piece of scrap plywood on either side of it and apply it to the plywood disc, pedalling vigorously until a groove is worn round the periphery. Screw the lathe into position with the driving pulley directly above the disc and cut holes in the bench to allow a belt to pass round the headstock pulley and the plywood disc. It will also be necessary to cut away part of the wooden lathe mounts.

The driving belt can be made from a piece of plastic-covered curtain wire of the expanding type by cutting off one of the end hooks where the thread finishes and screwing half of the threaded piece into each end of the wire. This might appear to be rather a weak joint, but one has been in use for three years without breakage.

Fig. 2.—The completed pedal powered lathe.

The Drive in Use

High speed and light effort is the secret of power tools success, and throughout the operation of the pedal-driven lathe it is essential to keep the speed high and the load low; neither must it be forgotten that your tools should be kept sharp, as no amount of power will compensate for a blunt tool. There is no difficulty in pedalling whilst keeping a steady hand for manipulation, and the operator will be quite at home with the machine after only a few minutes use.

Some Basic Accessories

The lathe is supplied with a grindstone, two sizes of pulley and a flywheel. The

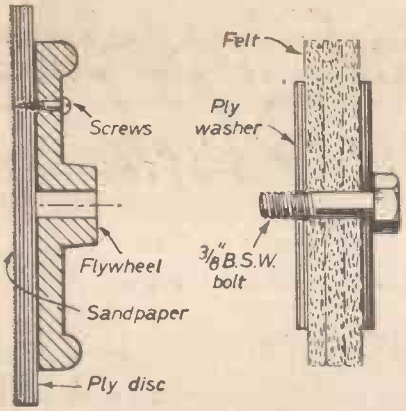


Fig. 3.—Details of the flywheel sander and radial buff.

grindstone may be mounted to the left of the headstock, leaving an inch or so of spindle for the flywheel, which can be converted to a sander. Drill three small holes in the thin part of the flywheel and screw a large disc of stout plywood to the flat side, using short screws that will not pass right through the plywood when driven home (Fig. 3). Mount the assembly on the headstock spindle. Sand the face smooth using the lathe power and glue on a disc of sandpaper after varnishing to prevent the glue making removal difficult when replacing. If a sanding table is required, it need only be a box standing squarely upon the bench and as high as the centre of the disc.

A $\frac{3}{8}$in. B.S.W. × $\frac{1}{2}$in. bolt will fit into the headstock and thus a plywood (or even hardboard) disc may be bolted to the face of the headstock. Felt or sandpaper glued to them will make a variety of buffs and sanders, and a soft cloth bonnet can be made up to slip on for final polishing. The bolt head gives no trouble, but if desired, it may be filed down to a thin section and the plywood chiselled out to countersink it.

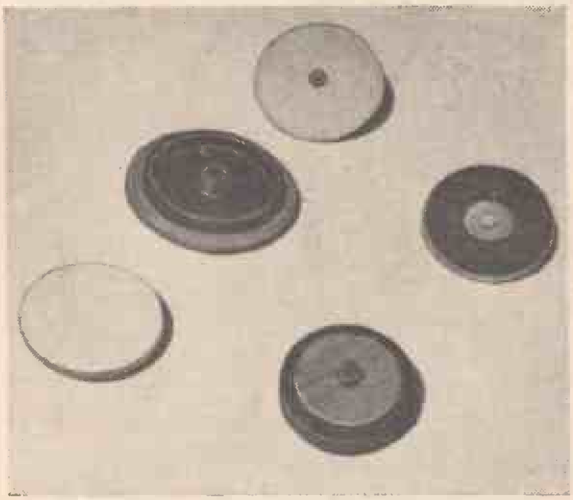


Fig. 4.—Some accessories for buffing and sanding.

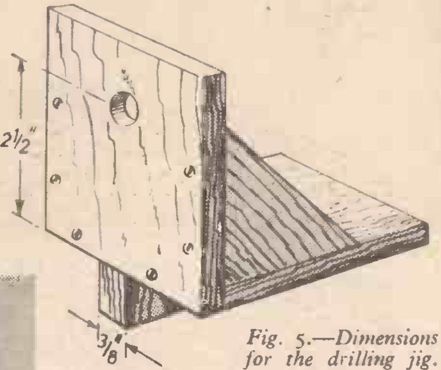


Fig. 5.—Dimensions for the drilling jig.

A radial buff may be made by using a longer bolt and clamping a number of discs of thick felt between two washers (Figs. 3 and 4).

An extra for the lathe is a drill chuck which fits into the headstock and to this may be fitted a flexible drive also terminating in a chuck. This piece of equipment will prove rather costly unless a Government surplus drive can be found, but fortunately they do appear on the market from time to time. A drill can be used directly in the lathe chuck for small components if a jig is made up as shown in Fig. 5.

YOUR snapshots will take on a new look when seen with the aid of this viewer. It will give you a greatly enlarged image of photographs, drawings, and indeed almost anything up to about post-card size. There are three main parts.

The Magnifying Mirror

That used in the original was a shaving mirror, one side of which magnifies; the reverse side being a plain mirror. The one chosen was swivel mounted with handle and was purchased from a multiple chemists for 2s. 11d.

A Convenient Way to see Your Snapshots

By F. D. CROSS

Holder

The snapshot or picture holder is made of metal and is of a type used for displaying small show, or price cards. Enamelled white, it was obtained from a stationers for 9d. A similar one could, of course, be shaped from thin steel metal.

Baseboard

A suitable piece of hard wood should be obtained and cut to the size shown.

Assembly

First remove the handle by sawing off close to where it joins the swivel frame. The remaining two loops (marked X) form a convenient means of anchorage to the baseboard. Two round headed screws with washers pass through these loops and are secured to the end of the base as shown.

All that is now necessary is to position the picture holder, and this is best determined by trial. The best position was found to be about 5½in. from the mirror. The picture holder is fixed by two panel pins through the back flange, and one through the centre of the picture support trough.

General details and measurements of the viewer.

Transistorised Intercom or Baby Alarm

Two Transistors and Some ex-Government Parts are Used in This Design

By H. S. Thorpe

Fig. 1.—The completed unit.

THE unit shown in Figs. 1 and 5 was first intended as a Baby Alarm. The circuit is shown in Fig. 3. Later the switch was fitted to the master unit, enabling the master unit to send to, or receive from, the slave unit.

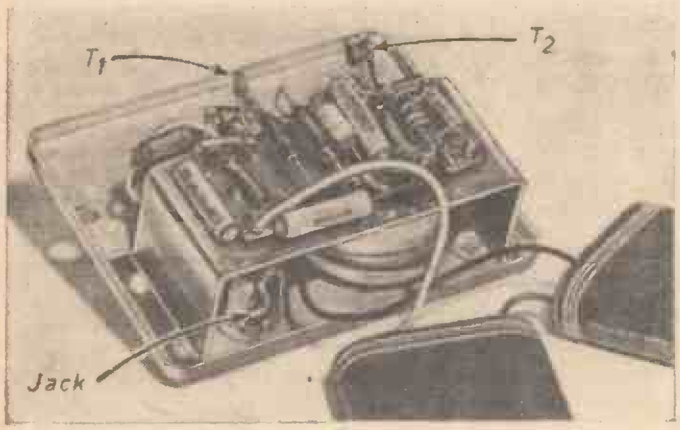


Fig. 2.—A view of the unit with the cover removed.

The master unit consists of the amplifier and a means of switching a moving iron unit to the input or output of the amplifier.

The slave unit consists solely of a moving iron unit at a remote point, the switch in the master unit, switching it to the input or output of the amplifier, and using it as a microphone or speaker.

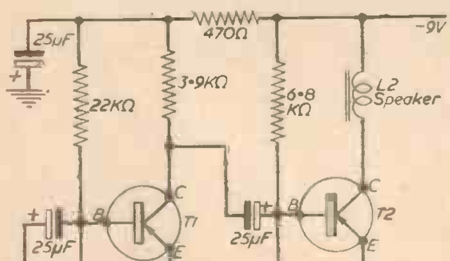


Fig. 3.—Theoretical circuit.

Moving Iron Units

Two are required and are readily obtainable on the surplus market, singly, or in low impedance headphones. It is essential that the armature on these units is quite free to move between the pole pieces, and the back of each earpiece should be removed to ensure that this is so. The armature can be adjusted if necessary by slackening off the 10 B.A. locknut, and then adjusting the other nut until the armature is central between the pole pieces. Tighten locknut when adjustment is complete.

Amplifier Circuit

The amplifier consists of a transistor (red spot) input stage which is R.C. coupled to the output stage, a yellow-green spot transistor.

They are biased and D.C. stabilised by potential dividers, and emitter resistors which are by-passed at audio frequencies. The operation is as follows:—Any increase in collector current gives rise to an increase in emitter voltage, and hense decreases the input voltage between base and emitter, giving a drop in base current and, therefore, a high degree of feedback opposing the original change.

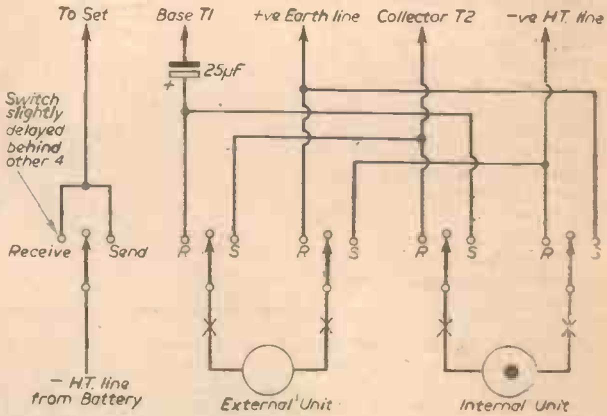


Fig. 4.—Method of switching as an intercom.

Fig. 4 shows the method of switching as an intercom., and it will be seen that in the "send" position the moving iron unit in the master acts as a microphone, and the unit in the "slave" position as a speaker.

When switched to "receive," the master unit becomes a speaker, and the "slave" becomes a microphone.

The first wafer of the switch should have

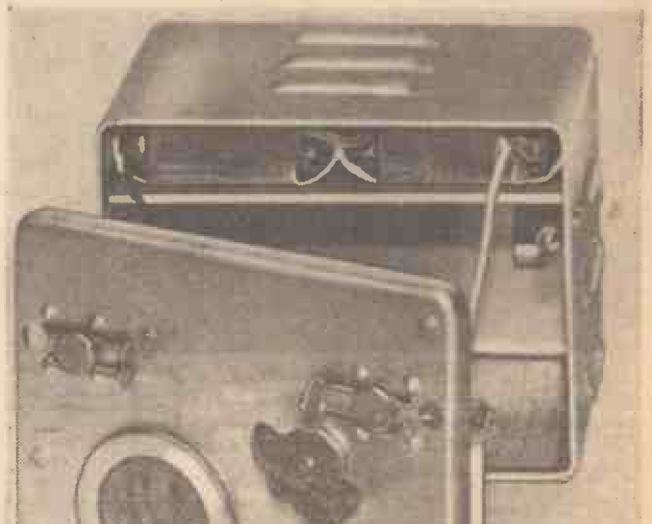


Fig. 5.—Front view showing battery shelf.

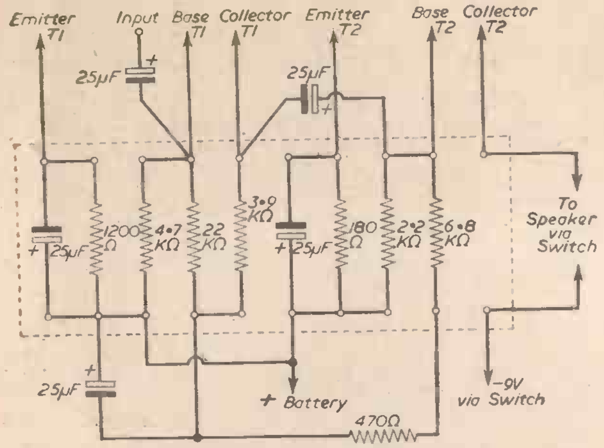


Fig. 6.—The tagboard connections.

its wiper filed to half normal width to delay it slightly behind the other wafers.

This is done to ensure that base and emitter are connected before the voltage supply is connected.

Tagboard

The tagboard connections are shown in Fig. 6. This can be made up of two tag strips, or a Bulgin Type C.125 tagboard can be used. It can be seen mounted on its bracket in Figs. 2 and 8.

The bracket to hold the tagboard is shown in Fig. 7, and is made up with 18 s.w.g. aluminium. Fixing holes are drilled to line up with holes in the front of the case, and the tagboard drilling.

An ideal case for both master and slave units is the case of the Packard Bell pre-amplifier, easily obtainable on the surplus market and shown in Figs. 1 and 5.

The front panel layout of the master unit is shown in Fig. 9, the slave unit requires drilling for the moving iron unit only.

A length of flex can be permanently connected between units, but a jack and plug on the master unit is recommended. Before switching on, check that the battery polarity is correct!

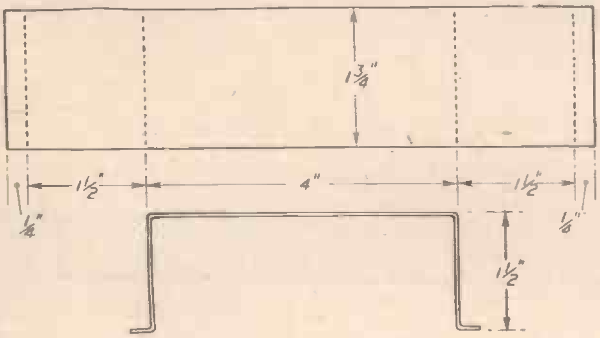


Fig. 7.—Details and dimensions of the tagboard bracket.

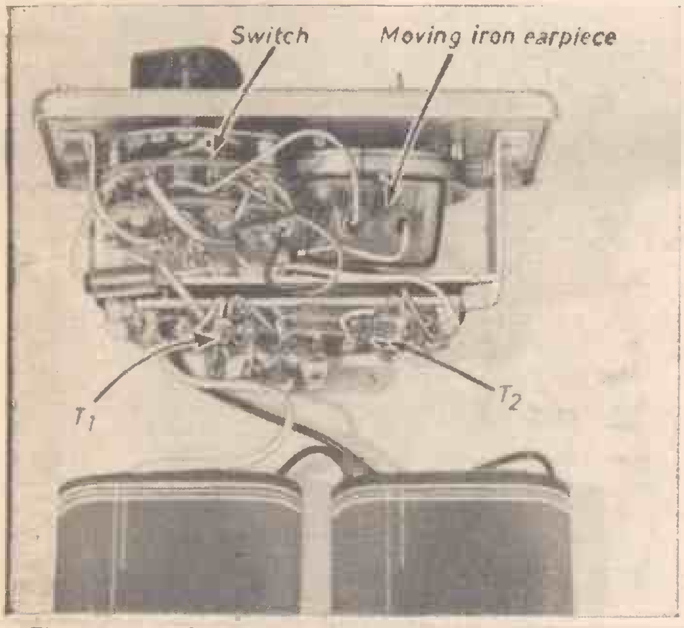


Fig. 8.—A further view of the wiring.

When switched to master or slave if both units are brought close together a howling should be heard, due to feedback between the speaker and microphone. It will be seen that two 4½v. cells are a neat fit in the top of the unit, a piece of 1/16in. plywood acting as a shelf on the case fixing bars.

Although the units illustrated were constructed in small amplifier cases, such as are now available on the "surplus" market, metal cases (possibly of aluminium, for ease of construction) can be made to a similar design. It is not, however, essential to make the cases of metal.

PARTS LIST

2 moving iron earpieces.
5 25μF 12 v. capacitors. Radiospares.
1 22 K Ω resistor. ¼ w. Radiospares.
1 3.9 K Ω resistor. ¼ w. Radiospares.
1 4.7 K Ω resistor. ¼ w. Radiospares.
1 1,200 Ω resistor. ¼ w. Radiospares.
1 6.8 K Ω resistor. ¼ w. Radiospares.
1 2.2 K Ω resistor. ¼ w. Radiospares.
1 180 Ω resistor. ¼ w. Radiospares.
1 470 Ω resistor. ¼ w. Radiospares.
1 transistor Red Spot.
1 transistor Yellow-Green spot.
1 switch 5-pole 3-way.
2 cases. Packard Bell type.
2 4½ v. batteries. EverReady 1289.

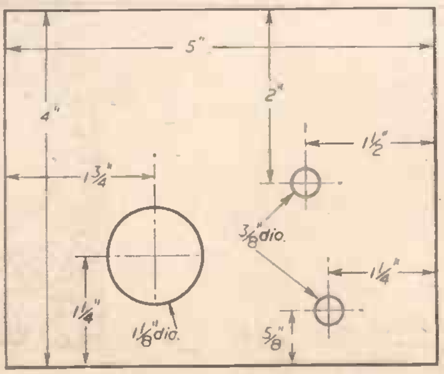
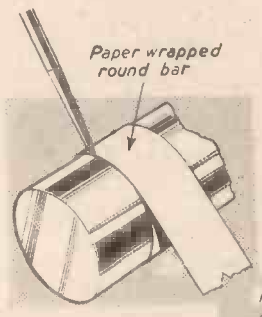


Fig. 9.—Layout of the front panel.

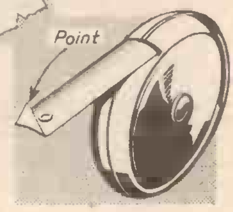
HINTS & TIPS

To Draw a True Circumferential Line on a Bar

A TRUE circumferential mark can be made on a bar simply by wrapping a piece of paper with a straight edge round the bar and scribing along the edge. This method can be used for metal bar or wooden strip of any nonreentrant cross-section. A more permanent tool for the job would ge a piece of "fivethou" copper foil.



(Left) Scribing a true circumferential line on a bar.



(Right) A scribing point on an extensible steel rule.

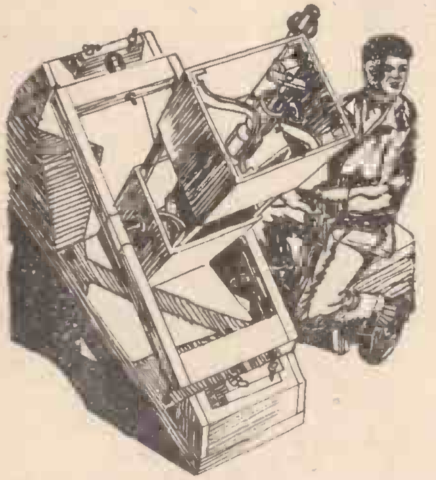
Improving Extensible Steel Ruler

AN extensible steel rule can be made more useful by forming a point on the end tab which will be found very handy for marking out accurately. The operation can be performed with a file if the tab is made of mild steel, but if it is made of the same material as the ruler a grindstone will have to be used (see sketch above).

"How to use your P.M. Reflecting Telescope"

Observing Jupiter, Saturn, Uranus, Neptune, Pluto and Comets

By F. W. Cousins



JUPITER is the largest planet of the Sun's family of planets. He is in opposition (due south at midnight) at intervals of 13 months.

He is attended by 12 moons four of which were known to Galileo, these are the brightest of this system and they were the first new members of the Sun's family to be discovered with the telescope. The four Galilean satellites provide us with constant delight. They transit the face of the planet, become eclipsed within his shadow and occulted by his disc.

There is an interesting relation (commensurability) between the mean daily motions of satellite I, II and III such that if n_1 is the mean motion of satellite I the rule may be written in the form

$$n_1+2n_3-3n_2=0$$

This relation derives from gravitational forces and its permanence ensures that all three of these satellites never exhibit similar phenomena at the same time.

The noble disc of the planet which shows some ellipticity is crossed by changing bands comprising dark belts and bright zones; extending substantially along his parallels of latitude (Figs. 1 and 2). Irregularities (spots) may be detected in both the belts and the zones.

The principal work of observation is directed to the determination of the rotation periods of the planet in diverse latitudes. The planet as a whole is in rapid rotation (approximately 9 hours 58 minutes for his day), but this is different for different parts of the surface.

See *The Planet Jupiter*, by B. M. Peek, Faber & Faber, 1958.

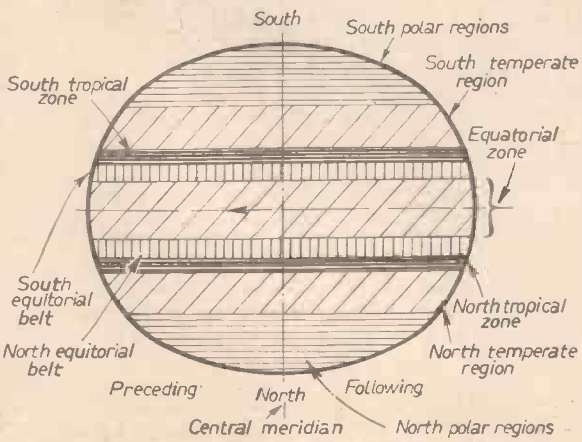


Fig. 1.—The parallel bands of Jupiter. The mean diameter is 85,750 miles and there is a polar flattening 1/15th of the mean equatorial. Jupiter rotates once in 9 hrs. 58 mins.

Observing Saturn

Saturn is one of the most beautiful objects to contemplate in a telescope. Even observers with many years of experience confess to an unwearying interest in this magnificent object.

Saturn is the outermost of the so-called naked eye planets. (Uranus was not known to the ancients.)

He is nearly 900 millions of miles from the Sun. The luminous system of rings attending the planet and the nine moons form together a system at once unique and of consumate beauty (Fig. 3).

Fig 2.—A photograph of Jupiter.

The axis of the globe of Saturn is tilted at an angle of 36° 44′ to the plane of the earth's orbit and for this reason every half sidereal period (approximately 15 years) the rings appear to vanish, i.e., they are presented edge on to the earth (Figs. 4 and 5). The rings are specified by the letters A, B and C. The main divisions between the rings are named after their discoverers; Cassini and Encke. The disposition of the rings and their main dimensions are shown in Fig. 6.

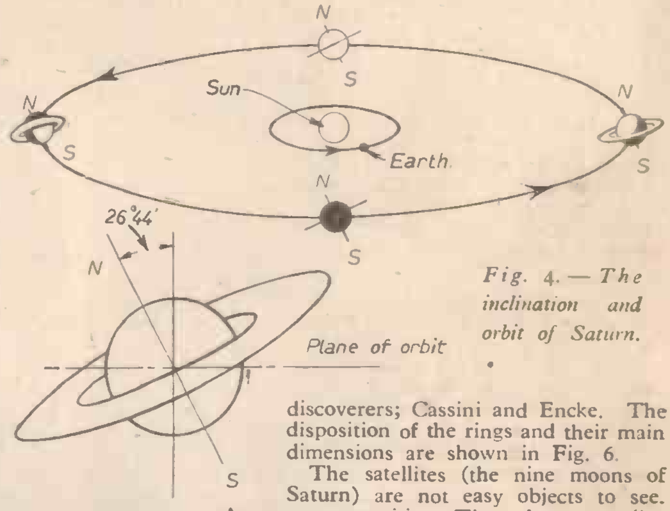


Fig. 4.—The inclination and orbit of Saturn.

The satellites (the nine moons of Saturn) are not easy objects to see. At mean opposition Titan has a stellar magnitude of 8.3. All the others are below the tenth magnitude. The position of Titan for the observing months in any year is given in diagrams to be found in The Handbook of the British Astronomical Association.

Observing Uranus, Neptune and Pluto

These are so far from the Sun that they do not repay study with a 6in. refractor or reflector. Their positions can be obtained from The Handbook of the British Astronomical Association.

Uranus, though a naked eye object was only discovered by Herschel in 1781. It is a greenish disc of 3.75 seconds of arc.

Neptune was discovered in 1846, it shows a bluish-green disc of 2.04 seconds of arc.

Pluto, the outermost planet of the Sun's family, does not show a disc.

Observing Comets

By the nature of things we have to wait with patience for the appearance of a bright

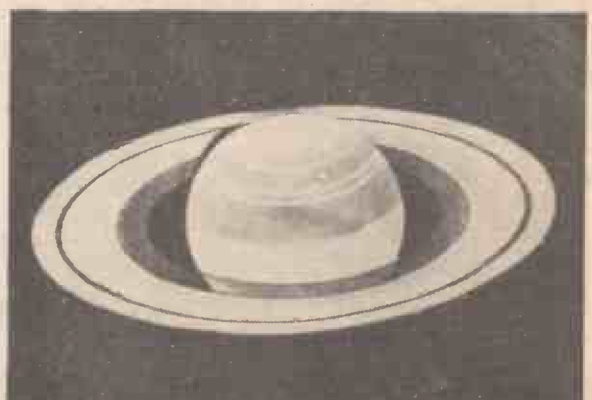


Fig. 3.—The planet Saturn.

comet. Many readers will, however, recall the beauty of the comet Arend-Roland (1956h) a conspicuous naked eye object in the north-western heavens during the evenings of late April and early May in 1956.

When a bright comet is examined in a telescope or in a photograph we are often able to distinguish its components.

(i) The nucleus which is the small star-like point at the centre of

(ii) the coma, a cloud-like mass forming a nebulous light around the nucleus and

(iii) the tail, a large, elongated gas cloud, which appears as the comet approaches close in to the Sun (its perihelion position).

The largest nucleus recorded was that of Comet 1845 III with a diameter of 8,000 miles. The coma diameter is always in the region of some tens of thousands of miles. The longest comet tail on record was that of the great Comet 1843 I, which stretched over 200 millions of miles; a distance in excess of the diameter of the Earth's orbit about the Sun.

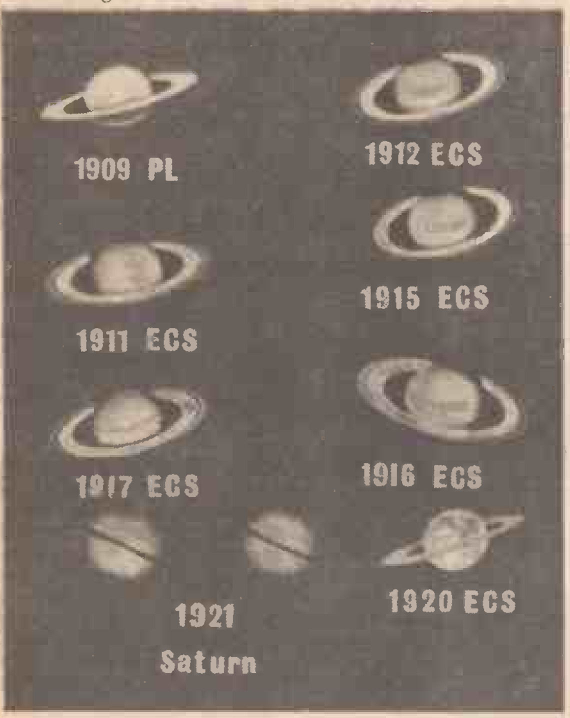


Fig. 5.—Saturn over a period of 12 years, photographed by Dr. Lowell (PL) and E. C. Sliphar (E.C.S.) at Lowell Observatory.

Comet orbits are linked with the classic conic sections. Comets have been known to travel in paths having the shape of the ellipse, parabola or hyperbola with the Sun at the focus (in the case of the ellipse at one of the foci).

The orbits are often very elongated, as shown in Fig. 8.

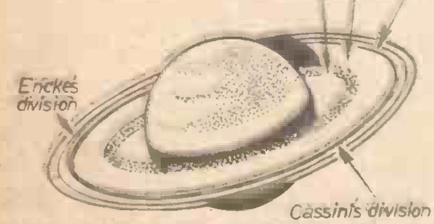


Fig. 6.—Main features of Saturn. Ring B is the brightest and the forces at work on the millions of particles in the rings sweep clean the Cassini and Encke divisions. The dimensions of the ring system are in miles A—169,300-149,000, B—145,500-112,600, C—92,900. Equatorial dia. is 75,100 and Polar 67,200 miles.

The orbit if elliptical is defined by seven elements; if parabolic by five.

The seven elements for the elliptical orbit are (see Fig. 9):

a the major semi-axis XP.

e the eccentricity $\frac{XS}{XP}$—($b = a\sqrt{1-e^2}$)

b is the semi-minor axis.

i the inclination of the orbit plane to that of the ecliptic.

☊ the longitude of the ascending node.

ω the argument of perihelion, i.e., angle ☊SP.

P the period of revolution.

T the date and time at which the comet reaches perihelion.

In a parabolic orbit e is unity and the curve is an open one. There is no major semi-axis a and no period can be assigned to the orbit.

If you wish to search for comets remember that their movements are not restricted to the Zodiac, as are the major planets. They can appear in any region of the sky.

Use a wide field eyepiece of low power. As soon as it is dark commence sweeping on the horizon 90 deg. or so of the Sun, that is west or south-west after sunset and in the east or south-east before dawn. The reason for this is that most of the brighter comets are discovered in the region inside the orbit of Mars and are brightest when nearest the Sun.

Fig. 7 (Right).—The Arend Roland Comet.

Sweeps consist of moving the telescope in a horizontal direction, or substantially horizontal direction, and, at the end of each traverse, raising the telescope slightly half a field—that is to say, a star in the centre of the field is moved to the edge of the field and the sweep repeated. Continue until the telescope is pointing about 70 deg. above the horizon. (70 deg. of altitude.)

If, during the sweep, a fuzzy object is found which cannot be identified with any of the nebulae or clusters in the star atlas (Norton's) an accurate field sketch should be drawn. A 2in. diameter circle is a good size to represent the boundary of the telescope field. Let the field trail after making the drawing and enter the letters p and f on the preceding and following sides of the field respectively. Do not fail to record the time. After the sketch has been made examine the field again in about an hour's time, if the fuzzy object has altered position against the stars you may have a comet. If no movement is detected it may be a slowly-moving comet so check again on successive nights.

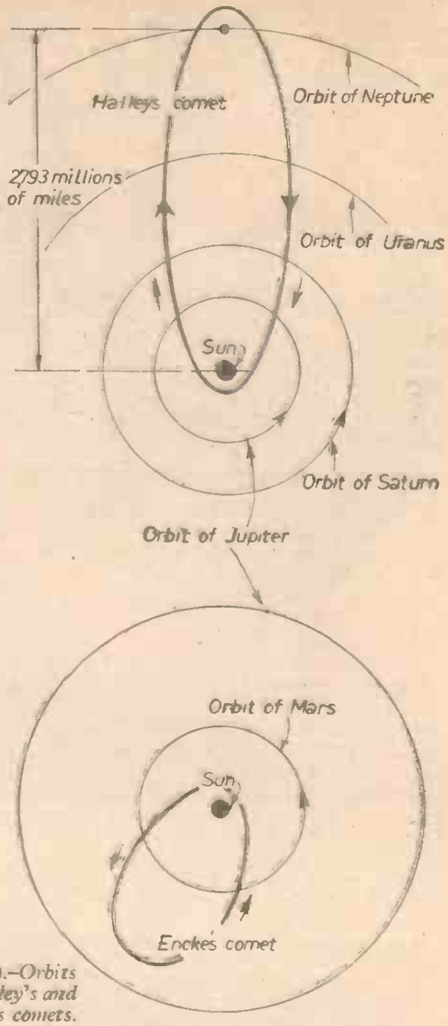


Fig. 8 (Right).—Orbits of Halley's and Encke's comets.

The position of a new comet should be reported to the nearest observatory.

The following data are essential:

(1) Date, time (stating whether local standard or universal time). (2) Position in R.A. and declination (state epoch). (3) Estimation of daily movement in R.A. and declination. (4) Magnitude by comparison with neighbouring stars of known magnitude. (5) Physical features, nucleus, coma, diameter, tail (length, position and angles).

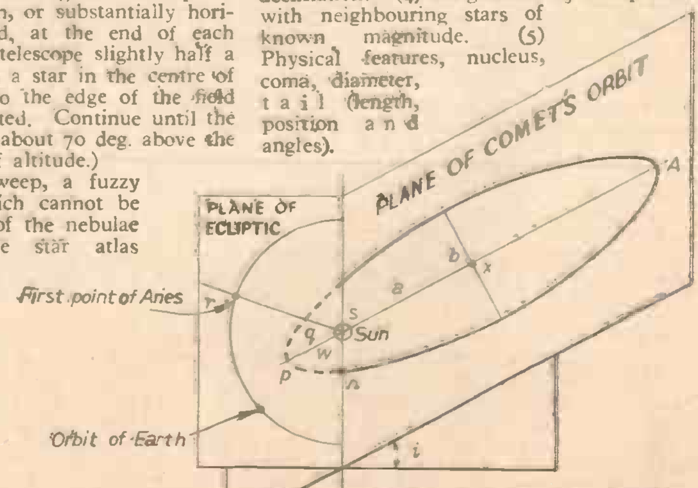


Fig. 9.—Seven elements for a comet moving in an elliptical orbit.

Nuclear Powered Surface Vessels

D. A. Watt Describes How Atomic Energy is Obtained, How the Reactor Works and How it is Applied to Power a Ship

THE first nuclear powered ship, the submarine *Nautilus* completed a voyage of 62,000 miles without refuelling and proved to the world that nuclear propulsion for a ship is practical. For a conventional submarine to have travelled an equal distance 2,000,000 gallons of diesel fuel would have been required.

The strategic advantages given to a submarine by nuclear power were well appreciated but the success of the *Nautilus* aroused great interest throughout the shipping industry as it was realised that a nuclear powered merchant ship could carry extra cargo in the space made available by the elimination of fuel tanks.

The last four years have seen the change from the "dreams and plans" stage to reality. Russia and the U.S.A. have both commenced the construction of non-military surface vessels; the ice-breaker *Lenin* and the passenger cargo ship N.S. *Savannah*. The latter was launched recently by Mrs. Eisenhower and is rapidly nearing completion.

Nuclear power is obtained from an atomic reaction which takes place in a specially designed vessel called a reactor under controlled conditions. Fig. 1 is a cutaway view of a pressurised-water reactor plant designed for a nuclear-powered ship. This reaction is called *Nuclear Fission* and generates heat which is converted into mechanical work, for our purpose to drive a ship. To make it easier to understand how nuclear power can be applied to a ship it is necessary to understand the basic principles of this reaction.

The Nature of Matter

All matter is composed of atoms which can be visualised as tiny solar systems. There is a group of particles in the centre which is called the nucleus (equivalent to our sun) and around the nucleus several particles called electrons move in orbits, as do the planets around the sun. The nucleus contains two kinds of particles, protons and neutrons. The number of protons equals the number of electrons and determines the chemical properties of the atom, but the number of neutrons only affects the physical properties such as weight. As a result some substances can exist in several forms each having identical chemical properties but different physical properties. These different forms are called isotopes of the substance.

Fission

A material which can be used to produce nuclear fission is said to be fissile. The atoms of a fissile material have a large number of protons in the nucleus and if a neutron is added to the nucleus of such an atom the whole complicated structure splits up into two smaller solar systems each containing approximately half the number of protons in the nucleus and half the number of electrons moving about the nucleus. These new atoms, called the fission products, have an energy content less than that of the original atom and the balance is given out as heat. Also there are two or three neutrons left over which can be used to cause more fission.

The only fissionable atom existing in nature is an isotope of uranium called U235, and the process of fission in such an atom is shown in Fig. 2.

Obviously to generate sufficient quantities of heat to provide useful power one fission alone is not sufficient, therefore the neutrons released must be used to cause more fission. This is what happens in the reactor and is known as a chain reaction. It is shown diagrammatically in Fig. 3 in which it is assumed that two neutrons are available from each fission to cause more fission.

By studying Fig. 3 it will be obvious that if the number of neutrons which causes further fission is greater than one, the reaction increases, and if less than one the reaction dies out. If for every fission one neutron causes a further fission then the reaction continues at a steady rate. This

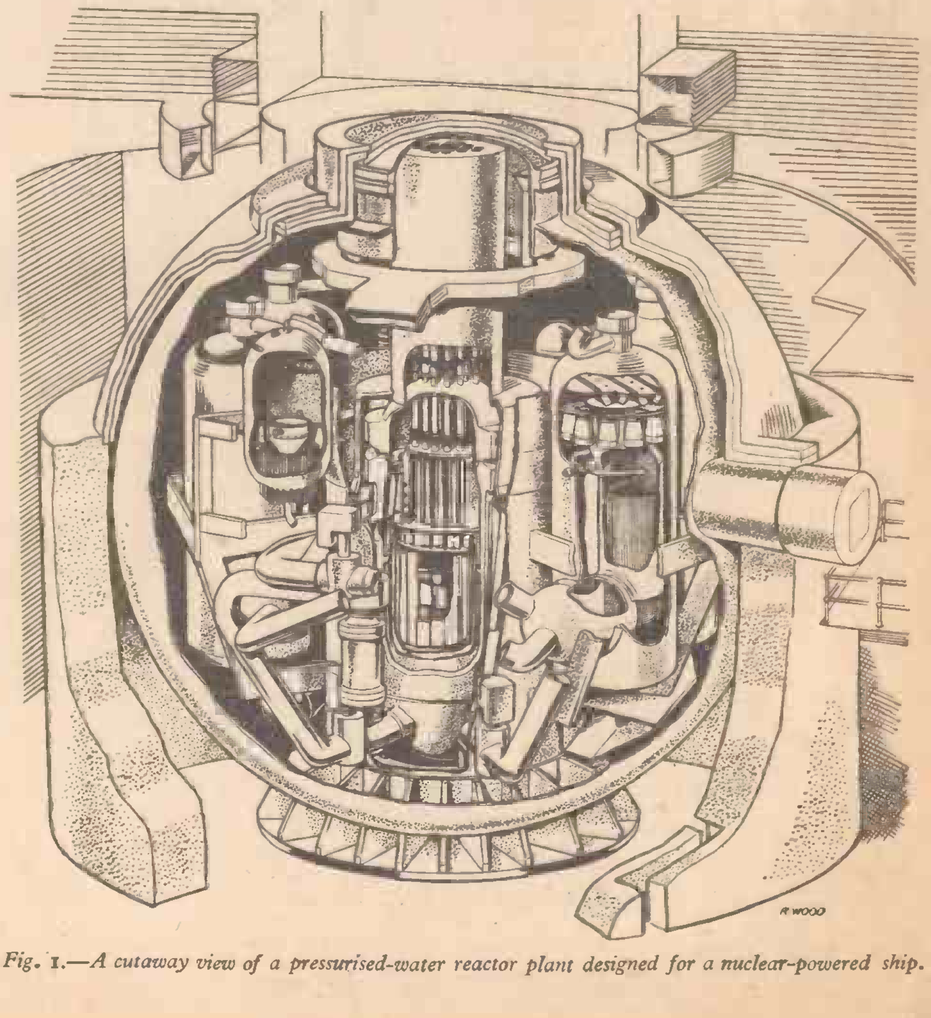


Fig. 1.—A cutaway view of a pressurised-water reactor plant designed for a nuclear-powered ship.

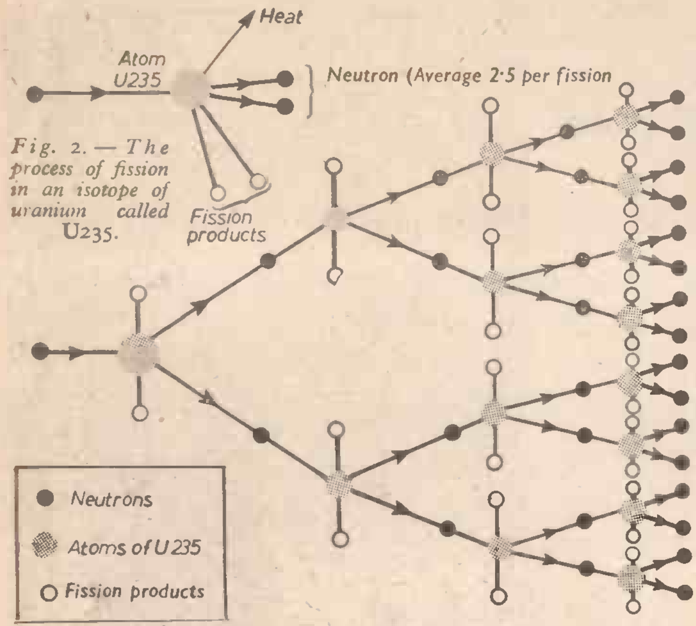


Fig. 2.—The process of fission in an isotope of uranium called U235.

Fig. 3.—How neutrons cause more fission. This is known as a chain reaction.

fact is the key to the method of controlling the reaction, as we shall see later. The centre part of the reactor where this reaction takes place is known as the core.

In natural uranium there are 140 atoms of a non fissile isotope called U238 for every atom of U235, so that if we cause a fission of one atom of U235 in natural uranium the continuation of the reaction depends on whether one or more of the neutrons released can strike another atom of U235 and not get absorbed in an atom of U238. It is, therefore, necessary to do something to ensure that further fission is caused by the neutrons released.

One way of doing this is to increase the number of atoms of U235 in the uranium used in the core by a process called gaseous diffusion which is based on the fact that the two isotopes have different weights. Uranium treated in this way is called enriched uranium, but to enrich it to a very great extent would be exceedingly costly.

Using a Moderator

A more attractive solution is offered by the fact that when neutrons are released by a fission they are travelling at very high speed but if their speed is reduced there is much less likelihood that they will be trapped in the atoms of U238. To do this the neutrons are made to collide with suitable atoms and in doing so give up some of their energy to these atoms and are slowed down. Materials which are used in this way are called moderators, two very suitable substances being graphite and hydrogen.

In practice slightly enriched uranium is used in conjunction with a moderator to reduce the size and weight of the core.

Control

Having found a way to ensure that the reaction will continue let us now consider how it can be controlled so that the heat generated can be used to produce power as and when required. We know that the reaction will continue at a certain rate if every fission produces one neutron which strikes another atom of U235. To be able to increase or decrease the reaction at will we must capture the neutrons which do not wish to cause fissions. This is done by inserting into the core rods of boron or special steel alloys which are capable of absorbing neutrons. The further the rods are inserted the more neutrons are absorbed and vice versa, thus the reaction can be maintained at any desired rate, according to the position of the control rods. Similar rods, called shut-off rods, are necessary and when inserted into the core in an emergency will absorb all the neutrons to completely stop the reaction.

The Coolant and Shielding

The heat generated by the reaction must be removed from the core, otherwise it will overheat and be damaged. This heat is removed by circulating a coolant (gas or liquid) through the core, and it is usually the maximum rate at which the heat can be removed that limits the output of a reactor.

At the core of the reactor intense radioactivity is emitted and to protect operating personnel suitable shielding must be provided.

Pressurised Water Reactor

Although there are many types of reactor at various stages of development the most suitable type for marine propulsion at present is the pressurised water reactor, and has been chosen for both the *Lenin* and the N.S. *Savannah*. It is the most highly developed type, being the only one with which operating experience under seagoing conditions has been established, and it has a relatively low core weight. This type of reactor is shown in Fig. 4. The moderator is hydrogen but as water is a combination of hydrogen and oxygen it is a very convenient material to use. The core is uranium oxide in a stainless steel container submerged in the moderator. The control rods pass through the top of the reactor into the uranium oxide. The uranium oxide is made from slightly enriched uranium. Metallic uranium cannot be used in the core of this type as it would cause a chemical reaction with the water.

The reactor can be made very compact as the moderator is used as coolant to remove heat from the reactor by pumping it through the heat exchanger. This exchanger generates steam which is used to drive a turbine geared to the propeller shaft. The condensed exhaust steam from the turbine is used to feed the heat exchanger.

A primary shield is placed around the reactor to absorb the greater part of the radio-activity, and a secondary shield is placed around all the parts of the system containing radio-active material.

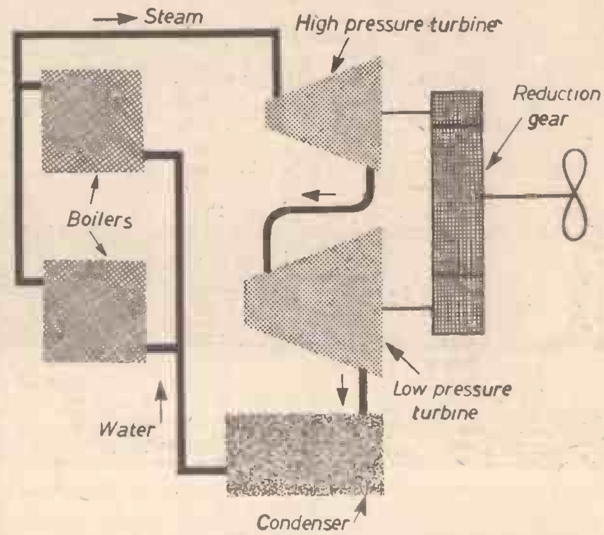


Fig. 5.—The layout of a typical steam turbine-driven ship.

The moderator operates at a temperature of about 500 deg. F. and must be kept at a pressure of 1,750 lb. per square inch, or higher, to ensure that it will not boil (water boils at 212 deg. F. at atmospheric pressure but as the pressure is increased so the boiling point rises).

How the Reactor is Applied

At the present time most ships of large power are propelled by steam turbines geared to the propeller shaft, the steam for the turbines being supplied by two or more boilers. The heat to generate the steam in the boilers is produced by burning fuel oil in the boiler furnace. The layout of a typical steam turbine driven ship is shown in Fig. 5.

If we wish to use nuclear energy to provide the power then all we need do is to replace the boilers with a reactor to provide heat to generate the steam for the turbines. Unfortunately, it is not quite so simple as it may seem owing to the fact that by the very nature of the reaction elaborate safety precautions are necessary, and complicate the design of the plant.

There are three basic design differences between a nuclear power plant for marine use and a land-based set. These are safety considerations, weight and the effects of rolling and pitching.

The latter is relatively easily overcome by equipping the ship with stabilisers which greatly reduce these effects, and the importance of the safety and weight considerations depends to a certain extent on the type of ship considered.

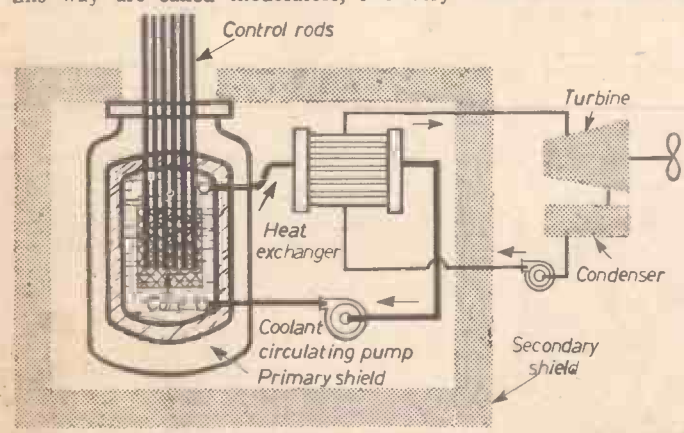


Fig. 4.—This pressurised water reactor is the most suitable type for marine propulsion.

Safety Problems

These are due to radiation and the handling of radio-active materials, and also to the effects of mechanical breakdown of the plant.

The first step in design is to decide what amount of radiation is permissible in the spaces outside the reactor secondary shielding. When this is settled the shielding can be designed to meet these conditions and will be placed as close to the reactor as is practical in order to reduce the weight of shielding required.

Apart from the control of radiation levels it is essential that any radio-active waste material must be handled in a safe way. In the pressurised water reactor all radio-active materials are inside the secondary shield and

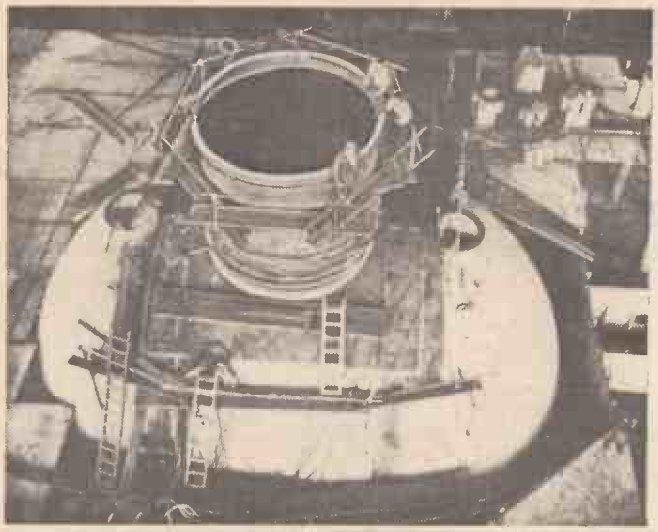


Fig. 6.—The top of the reactor pressure vessel for N.S. Savannah in position.

if this shield is constructed as a vessel which can be sealed, any leaks in the system will be collected in it. It is then called the containment vessel. Leaks are liable to occur at the pump seals, valves and the control rod seals, and the wastes that will accumulate are coolant water and radio-active gases. The latter are gases released from the air originally contained in the coolant water. The quantity of gases released will be so small that it will be permissible to blow them out with air and release the mixture of air and gases at the masthead. Shielded storage tanks will be needed so that liquid accumulation can be stored for disposal when the ship is in dock.

The containment vessel will be designed so that in the unlikely event of sudden rupture of the reactor or any part of the pressurised system it will have sufficient strength to hold all the radio-active material and to absorb the excessive heat which will be momentarily released by such an accident. It will also be well protected to prevent damage in a collision.

The N.S. *Savannah* is a passenger cargo vessel and incorporates all the problems of other types of ships. She is 595½ft. long, 78ft. beam, 21,800 tons displacement, will carry 60 passengers and will travel at 20 knots. Fig. 6 (reproduced by courtesy of Babcock and Wilcox Ltd.) shows the layout of the reactor plant which is located just ahead of the superstructure in order to reduce shielding weight and to avoid having to provide access to the reactor through the superstructure. Fig. 7 shows the N.S. *Savannah* during building.

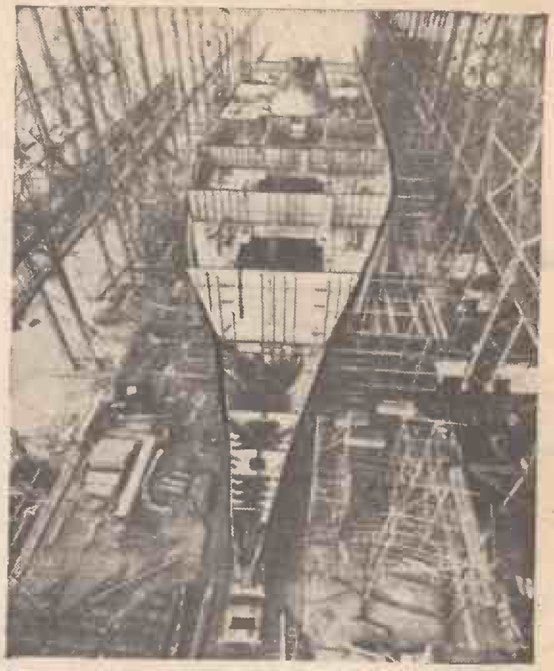


Fig. 7.—The N.S. Savannah in the shipbuilding yard.

The primary shield is a lead covered water tank containing a 33-inch thickness of water surrounded by lead in graduated thicknesses up to 4 inches. The secondary shield is a combination of lead, polythene and ordinary concrete, the upper portion being 6 inches of lead plus 8 inches of polythene and 4ft. walls of concrete for the lower portion. Salt water ballast and fresh water tanks serve as shielding beneath the containment vessel.

Proposals for a British nuclear-powered ship have recently been considered and it was decided to investigate the possibility of applying nuclear power to a fleet auxiliary tanker. Let us hope that this project will be progressed even if such a ship cannot compete economically with other ships at present, as we already lag behind Russia and the U.S.A., who will soon be obtaining valuable operating experience.

No doubt present-day nuclear power plants will in 20 years time seem as antiquated to engineers as the early steam engines do to us to-day. However, without taking these first steps now we cannot hope to keep pace with other countries, which surely we should as we are one of the leading maritime nations.

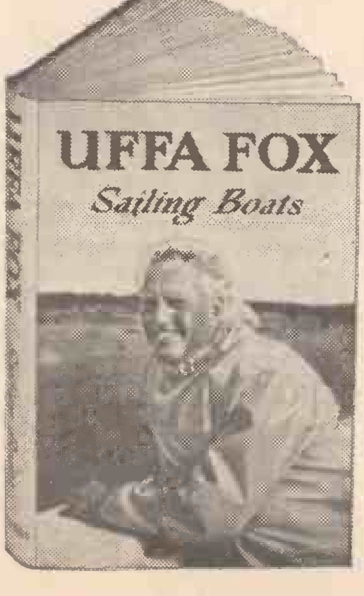
BOOKS *Received*

"Sailing Boats," by Uffa Fox. Over 200 pages. Price 17s. 6d. net. Published by Geo. Newnes Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

UFFA FOX is perhaps the best-known name in yachting and it is to the yachtsman that this book is primarily addressed. If you are not a yachtsman, however, and you read it, you will certainly obtain a better understanding of boats and why people sail them.

The most popular types of sailing craft are all illustrated and described both from the point of view of their construction characteristics and sailing capabilities. There is also a wealth of interesting information that would certainly not be found in the boat plans or the sailing instructions.

A separate chapter is devoted to each of the following craft: International Cadet, R.Y.A. Firefly, R.Y.A. 12ft. Dinghy, International Fourteen Footer, R.Y.A. 14ft. Redwing, Pegasus, International Canoe, 18ft. Jolly Boat, Twenty-four Footer, Catamarans Shearwater III and BellCat. In part two fixed keel craft are dealt with and included are R.Y.A. Flying Fifteen, International Dragon, International One-design, Fresh Breeze, Lumberjack, Carina and the "America's Cup" boats. The description of each boat is accompanied by scale plans and a sail plan and in addition most of the boats are shown under sail in a series of magnificent photographic plates.

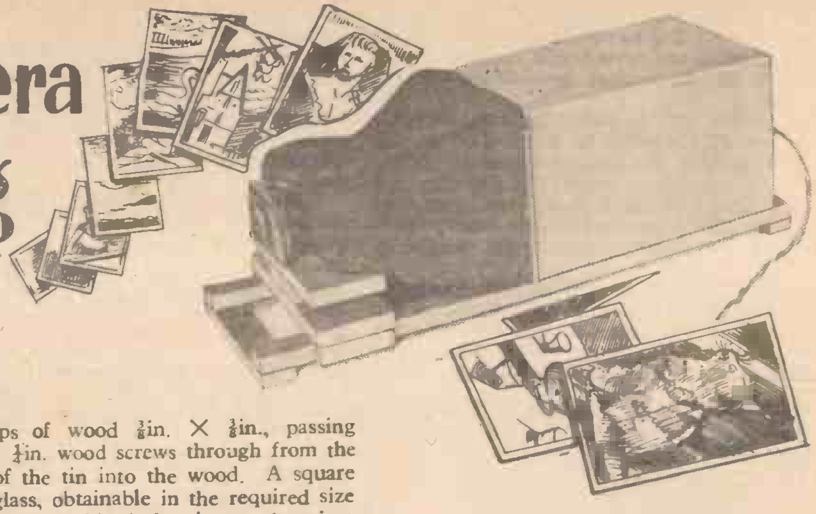


This is a book written for the enthusiast by the greatest enthusiast of them all and is a volume that no yachtsman should be without.

"Model Radio-Control," by Edward L. Safford, Jr. Published by Gernsback Library, Inc., 154, West 14th Street, New York 11, N.Y. 192 pages.

IN this book an effort has been made to start at the very beginning, to show what is required to obtain radio control and to present this information in simple everyday language and terms. This is a complete and up-to-the-minute handbook of radio-control of model planes, boats, trains, etc., and it covers all aspects of the subject from theory to construction of coders, decoders and other complex components as well as complete systems. Some of the chapter headings in this well illustrated book are: Servo Motors; Transistors; Practical Receivers; Practical Transmitters; Construction of Coders and Decoders and many others.

Use your Camera for Enlarging



A. E. Bensusan Tells You How to do It

THE horizontal enlarger described here costs only a few shillings to make yet it will produce good quality enlargements of any reasonable size. The need for a separate lens is eliminated by the use of your own camera, provided that this is not of the box or very inexpensive folding type. If the lens is marked "anastigmat," or it has a maximum aperture of f7.7 or larger, the camera is quite suitable for use in this enlarger. The complete arrangement is shown in Fig. 1.

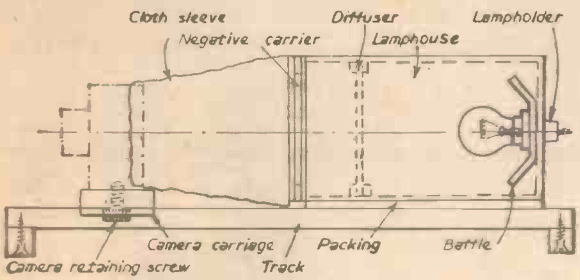


Fig. 1.—General arrangement.

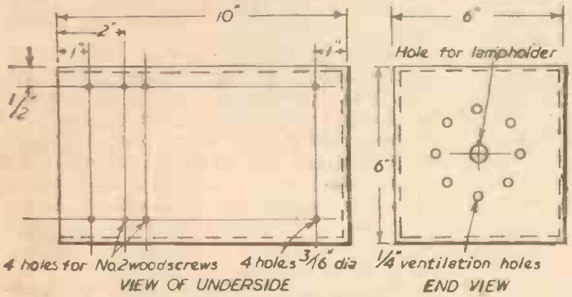


Fig. 2.—Lamphouse.

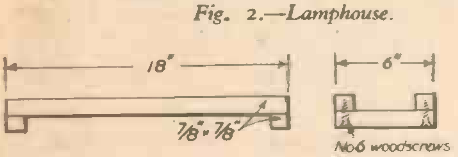


Fig. 3.—Track.

The Lamphouse

First obtain a tin box of suitable size for the lamphouse, say, 6in. square and 10in. deep. The size is not critical, but the tin should be large enough to permit free passage of the air around the light bulb and to accommodate a diffusing screen at a safe distance from the end of the lamp. Cut a 1½in. dia. hole in the end of the tin, to take a standard lampholder, and surround this hole with a number of ventilation holes drilled or punched ¼in. dia. Drill or punch four holes 3/16in. dia. to take the fixing bolts as shown in Fig. 2. The lid of the tin is cut and bent to form a light baffle, as shown in Fig. 1, and held under the lampholder ring. The entire interior of the lamphouse is painted white, and a special 75-watt enlarging bulb is fitted.

About 2in. from the mouth of the tin fit two strips of wood ⅜in. × ⅜in., passing No. 2 × ½in. wood screws through from the outside of the tin into the wood. A square of opal glass, obtainable in the required size from a photographic dealer, is rested against these strips and a second pair fitted in exactly the same way to hold the glass in place.

The Track

This is made from two pieces of ⅞in. × ⅞in. wood. The length will depend on the type of camera used but, if it has a 4in. focal length lens, as is usual for apparatus taking negatives 3¼in. × 2¼in., and the enlargements are to vary from just above contact print size, 18in. would be a safe estimate. As shown in Fig. 3 the track is held together with 6in. long cross members, ⅞in. × ⅞in. in section. No. 6 × 1½in. countersunk head wood screws and glue are used to obtain firm joints.

The camera carriage, Fig. 4, is made from wood ⅜in. thick × 3in. × 7¼in., with a piece ⅝in. × ⅝in. × 3in. secured with No. 6 × ¾in. countersunk head wood screws and glue at each end, so that the carriage slides smoothly along the track without any side movement. A hole to suit a camera retaining screw, either ¼in. or 5/16in. dia., according to the size of the tripod bush, is drilled centrally in the ⅜in. thick part.

The centre of the lamphouse must now be adjusted to agree with the centre of the lens in both planes when the camera is mounted on its carriage. This will probably entail packing up the lamphouse to suit.

MATERIALS REQUIRED

Lamphouse
1 tin box, approx. 6in. × 6in. × 10in. deep, with lid.
4 pieces of wood, ⅜in. × ⅜in. × 6in.
1 lampholder.
1 75-watt enlarging bulb.
1 6in. × 6in. opal glass.
4 2B.A. × 2in. long countersunk head bolts.
4 2B.A. nuts.
8 No. 2 × ½in. long wood screws.
As required—packing.

Track
2 pieces of wood, ⅞in. × ⅞in. × 18in.
2 pieces of wood, ⅞in. × ⅞in. × 6in.
4 No. 6 × 1½in. long countersunk head wood screws.

Camera Carriage
1 piece of wood, ⅜in. × 3in. × 7¼in.
2 pieces of wood, ⅝in. × ⅝in. × 3in.
4 No. 6 × ¾in. long countersunk head wood screws.
1 camera retaining screw.

Negative Carrier
2 pieces of plywood, ¼in. × 6in. × 6in.
2 pieces of plywood or wood, 7/32in. × ½in. × 6in.
2 pieces of glass. 5in. × 7in.
2 No. 4 × 1¼in. long countersunk head wood screws.
As required—black cloth.
As required—elastic braid.
1 dozen upholsterer's tacks.

The sizes given may require adjustment according to the camera. All wood sizes are finished sizes, not nominal.

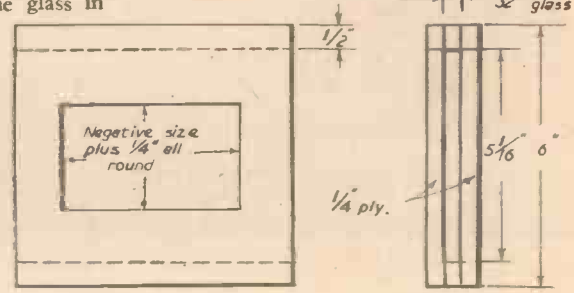
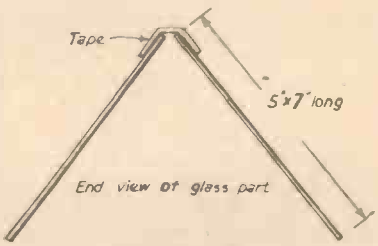


Fig. 5.—Negative carrier.



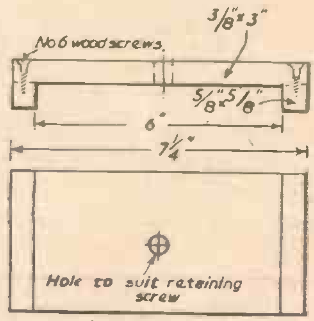


Fig. 4.—Camera carriage.

Negative Carrier

This is made from two pieces of glass 5in. × 7in. in size, hinged together with adhesive tape along one of the longer edges, and containing a 5in. × 7in. black paper mask with a centrally placed cut-out to suit the negative size. Two pieces of ¼in. thick plywood are used to make the static part

(Concluded on page 137)

Building the 'Luton Minor'

(*Continued from page 75, November issue*)

Part 4 Concludes Construction of the Wings and Starts on the Fuselage

NEXT we deal with wire bracing. Thread string through the wing ribs between the bracing lugs for the wire bracing to determine the exact run of the wires. The material used for bracing is a hard, stiff wire commonly called piano wire. Form the ends of the wire as shown in Fig. 20. The sleeves are ½in. long and are made of flattened copper tube. Soft-solder them to the wire—do not braze or silver solder them as the heat will affect the strength of the wire.

One end of the wire fits a 5 cwt. wire strainer or turn-buckle; the other takes an aircraft shackle, both of which then pick up on the bracing lugs (Fig. 21).

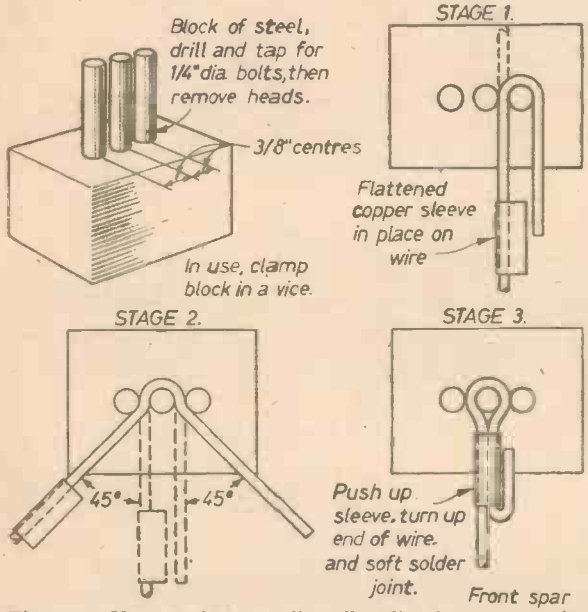


Fig. 20.—How to form an "eye" splice in piano wire.

Make each of the four wires in each wing in this manner, thread them through the wing ribs and then remove the guide string. Attach them to the lugs with shackle pins and 1/16in. split cotter pins. Leave the wires untensioned for the moment.

Use a large square to make sure that the spars at the root end are in line with each other. Since the wing is really a parallelogram, slight movement of the spars to produce the desired rectangle can be accomplished by adjusting the tension of the wires.

When the wing is trued up, tension the wires just sufficiently to produce a low twang when they are plucked. Overtensioning of the wires can, in extreme cases, cause the splitting of the spar webs and any such pre-stressing of the wing is undesirable.

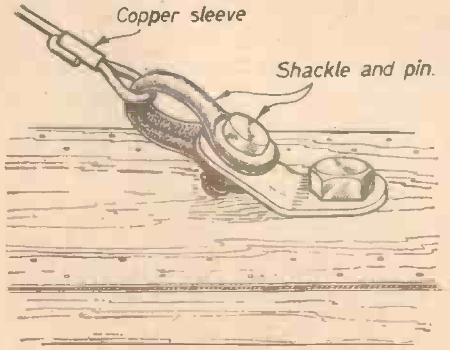


Fig. 21.—Attachment of bracing wires. The other end of the wire is fixed with a turn-buckle.

Wing Tip Bows

Make a simple jig for the laminations of the wing tip bows and, while the bows are setting in the jig, fit the leading and trailing edge members to the wing. Note that the aileron is not yet severed from the rest of the wing.

Make the root end rib. This is cut from 1/16in. or 1mm. birch ply with a top and bottom capstrip of rib-stock. This is then built on to the spar roots and the drag strut as shown on the plan.

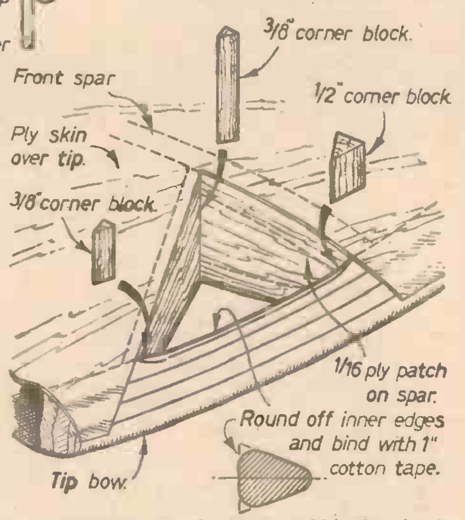


Fig. 22.—Details of the hand hold in the wingtip.

Clean up and fit the wing tip bows. Scarf the bow to the leading-edge member and also the trailing edge. Fit the drag-brace strut in the tip, the hand-hold member (Fig. 22) and also the diagonals which brace the aileron.

Cladding the Leading Edge

We now come to the ply-covering of the wing leading edge. Remember that once this is done, any twist or warp in the wing will be locked in and the wing will not be true. Bearing this in mind, you are advised to make up three "L" braces, each about 6ft. high with a 2ft. or 3ft. base, to support the wing at right angles with the leading edge uppermost.

Screw the "L" braces to the floor so that one will support the wing at the root end, one at the centre drag strut and one at the tip. Fix to the braces short rigid cross pieces to hold the wing under the front spar. Hang the wing on to these with the top surface of the wing facing outwards.

Pack if necessary under the spar to bring the front spar level. Using "G" clamps and clamping blocks, secure the spar to the braces. Also clamp at the rear spar, packing out as necessary. This arrangement is shown in Fig. 23.

Hang plumb bobs over the front spar at the centre and also at the root and measure the distance between the plumb line and the rear spar where the line passes it. This distance should be the same for both lines; if it is not, then carefully pack between the rear spar and the support and re-clamp. When the measurements coincide, the wing is true and free from twist. Until the leading edge is completely covered, it is inadvisable to move the wing.

Take a straight edge long enough to touch at least three ribs and, working along the leading edge one rib at a time, try to rock the straightedge. Any irregularities in the profile will be shown either as high spots

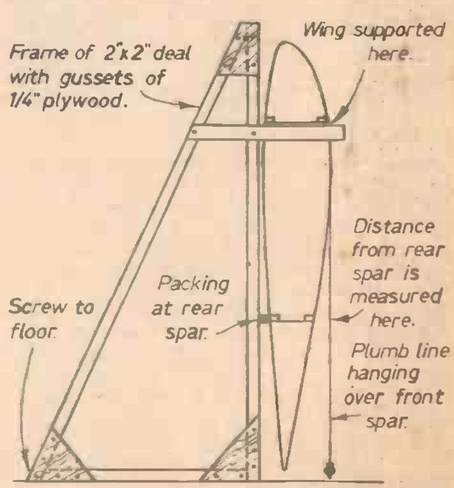


Fig. 23.—Brace the wing to the floor to check alignment before ply-covering the leading edge.

which can be pared away, or as low spots. These latter will require packing glued on and then shaping when dry.

This preparation of the front portion of the wing is very important as, if the ribs are slightly out of profile, the plywood covering will be lumpy. Not only would this be unsightly, but it would affect the performance of the finished aircraft.

Cover the leading edge in sections with separate pieces of plywood, scarfing them together on the job. Cut the plywood long-grained from 4ft. square sheets, half a sheet thus covering a 4ft. length of wing. Trim the sheet so that it can be scarfed on a rib and then pre-form the ply by folding it along the line of the leading edge, pouring boiling water over the outside and inside and clamping it between two planks of wood to the desired radius.

While this is drying, fit strips of packing to both sides of the front spar to support the plywood between the ribs (Fig. 19). Similarly, fit strips of packing on both sides of the rear spar over the aileron gap only. This is to support the fabric. Do not fit this packing to the rear spar over the main part of the wing.

Special clamps are available for pulling

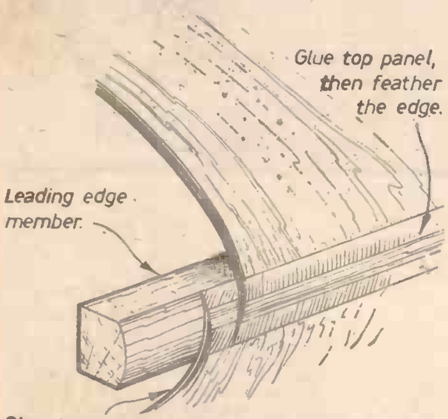


Fig. 24.—The joint between the top and bottom plywood panels covering the leading edge between ribs "C" and "D."

the plywood skin over the leading edge but, to save cost, it is quite sufficient to use webbing straps to apply pressure. You will need enough straps to pass over each rib which is to be covered with the ply panel being fitted. They will pass over the leading edge, round under the rear spar (which is padded with clean rag and scrap wood to prevent abrasion) and back up to the leading edge.

Starting from the under side of the wing, liberally glue the spar edge and the rib capstrips as far as the leading-edge member. Position the sheet of plywood and tack it to the spar edge with ½in. × 20 s.w.g. gimp pins, placed at intervals of about ¾in. Work up towards the leading edge along each rib progressively, tacking to the ribs with tacking strips. Now glue the ribs on the other (top) side and the spar edge.

Loop the webbing straps over the leading edge, keeping them as close to each rib as possible, and tension them. Slide battens of wood between the plywood and the straps at each rib and force the plywood into intimate contact with the rib. Take care not to ruck up the plywood or cause "bubbles" in it. If the wood sounds hollow when tapped with the hammer, then there is a bubble or pocket which must be worked out. With tacking strips, tack between the battens through to the rib.

When the first piece has been completed, leave it overnight to dry before slackening off the webbing straps and removing the tacking strips.

Cut a scarf on the outer rib plywood for the next panel using a bull-nosed plane, a file or a chisel. The next panel should be scarfed on the inside before pre-forming to mate the first one.

The tip, where the wing diminishes in depth, must be covered in smaller panels; the last rib A to the rib C is done in one piece; the portion between rib C and rib D is covered in two halves, scarfed on the leading edge (Fig. 24). The tip of the wing, from rib D to the mainspar is covered again in two halves while the remainder of the tip is covered with two panels, one on top and one beneath. The grain of all the plywood should be spanwise.

Now build in the transverse stringers between the root end rib and the first rib A and ply-cover the root, top and bottom, using 1/16in. plywood, spanwise grained.

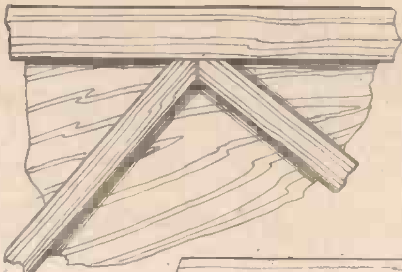
Carefully cut away the aileron and clean up the rib ends. No control cables are fitted yet.

The starboard wing is made in exactly the same way, but do not forget to glue the block into the mainspar which carries the pilot head. This and the anchor-unit plate must be fitted before the leading edge plywood is fitted.

Building the Fuselage

The method of building the fuselage which is described here is somewhat different to that shown on the plans. On these, the boxing up of the fuselage may present difficulties in aligning the two sides and bending in the bottom longerons at the nose.

The sequence of operations detailed herein has been adopted by Phoenix Aircraft Ltd. to eliminate these possible difficulties. The making of the necessary jigs for bending in the nose is strongly recommended as in the long run time and effort will be saved and a better job achieved.



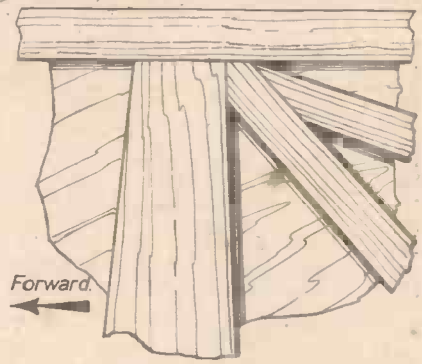


Fig. 26.—(Left) typical joint between bracing and longeron in fuselage sides and (below) joint of heavy under-carriage member and cockpit bracing struts in fuselage sides.

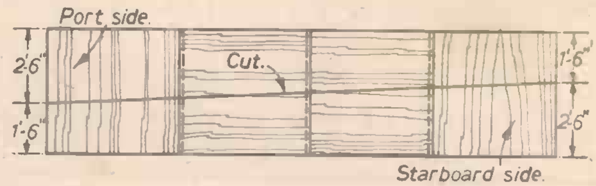


Fig. 27.—Scarfing plywood sheets for the sides: Note how both sides may be cut from four sheets of nominal 4ft. width. Direction of the grain is important.

Fuselage Side Jigs

The first step is to make a jig to locate the longerons and various members in the fuselage sides, both of which are built flat. As the two sides must be dimensionally the same, but opposite handed, we advise the constructor to make a jig for each side in the manner described here.

By making the two sides next to each other, time can be saved and measurements can be taken to both sides from one centre-line situated near the top longerons. This is clearly shown in Fig. 25.

Since the longerons at the nose end of the fuselage must be left at least 1ft. longer than will be required to aid bending, a clear space of about 17ft. × 4ft. 6in. will be needed. Ideally, use a level wooden floor and set out the jig as shown in Fig. 25. While wooden blocks must be used to locate the longerons, headless nails may be used to hold in place the various cross members. Do not bend up the bottom longerons in

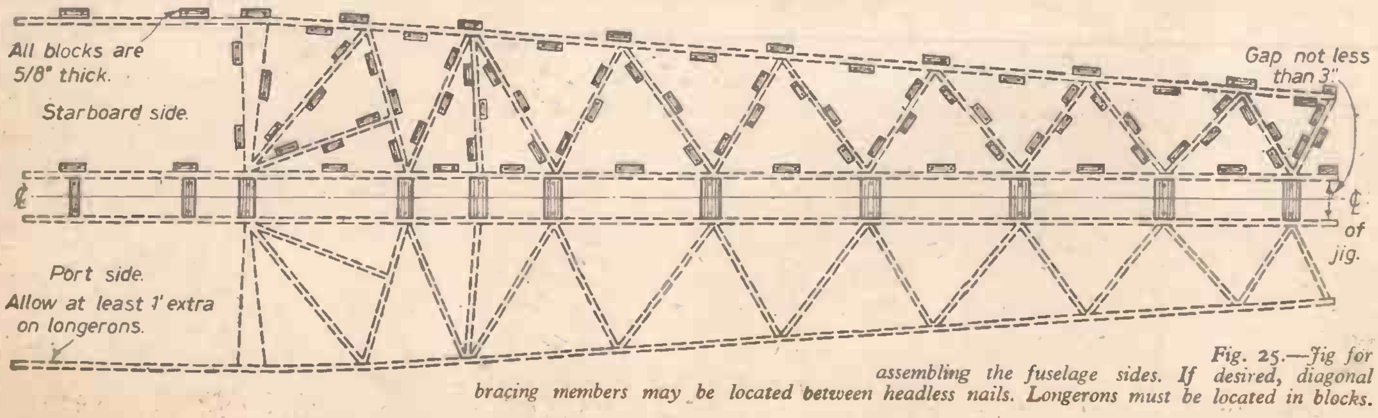


Fig. 25.—Jig for assembling the fuselage sides. If desired, diagonal bracing members may be located between headless nails. Longerons must be located in blocks.

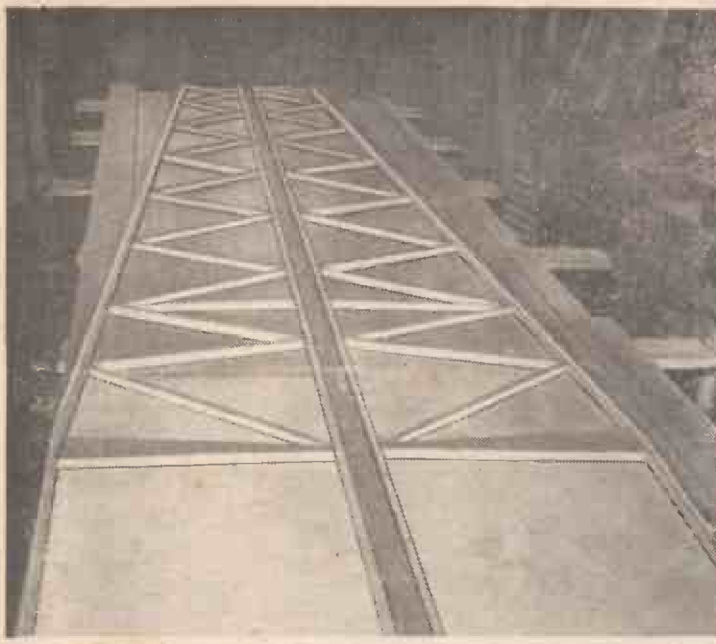


Fig. 28.—Photograph of the fuselage sides (picture by Mr. J. T Hayes, Lincoln).

brads and then pencil on the positions of the longerons and all members as a guide for stapling.

Remove the skins. Mix sufficient glue to glue up one side and remembering still not to glue anything forward of the heavy cockpit vertical member, apply glue liberally to the fuselage side frame. This is best done with a ¾in. wide paint brush. Do not forget to wash it out after use in plain warm water.

With a moistened sponge, evenly dampen the *top* surface of the ply skin before gluing so that the ply will expand slightly and, when dry after gluing, will contract to form an even, smooth skin in the fuselage.

It is a common eyesore with ply-covered aircraft that, after a time and especially in damp weather, the ply distorts between structural members. This is even more apparent with flat surfaces and this slight moistening before fixing will considerably retard this tendency.

Fitting the Skin

Enlist the help of an assistant and carefully position the ply skin on the frame. Starting at the top longeron by the heavy cockpit member, begin stapling the ply. Hold the stapling tool at an angle of about 45° to the centre-line of the member and staple at intervals of about ¾in. Work one bay at a time progressively aft.

To keep within the setting time of the glue, especially in warm temperatures, it may be necessary to glue only a 4ft. length at a time. If this is done, allow an overlap of the next glue application to avoid a possible gap. Repeat this procedure for the other fuselage side.

While the glue is setting, draw out on the floor the plan of the top of the fuselage from the stern-post as far forward as the cross member which is situated 119½in. from the stern post. Screw blocks of wood to the floor to locate each side of the longerons. The sides will be placed between these blocks inverted so that the fuselage is upside down for the next stage in assembly.

this jig, but just bring them parallel to the top ones as shown.

Cut and fit the longerons and spruce bracing struts, making sure that the joints are correctly formed as shown in Fig. 26.

Put a piece of polythene sheet or waxed paper under the joints and proceed to glue up each joint carefully and thoroughly. The farthest forward member to be glued at this stage is the heavy cockpit member which takes the undercarriage and lift strut fittings.

Plywood Side Skins

Now scarf up the ply sheets for the fuselage sides. Join the sheets as shown in Fig. 27. Scarf not less than 1 in 12 and, when set, well sand each side of the joints to remove any surplus glue. Cut the joined sheets as shown in Fig. 27 for the two sides. If desired, the sheets may be cut before scarfing to reduce the length of the scarf joints.

Place the long strip of ply skin over each fuselage side frame in the jig, allowing about ½in. overlap at the top longeron. Fix them temporarily in place with a few brads and then pencil on the positions of the longerons and all members as a guide for stapling.

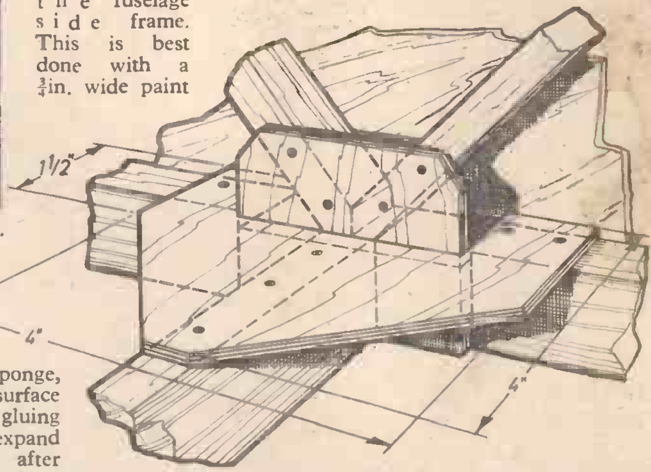


Fig. 30.—2in. wide x 2½in. high x ⅛in. thick ply gusset slotted over cross member and plate gusset recessed around it.

Remove the two sides from the assembly jig and plane off the surplus ply overlapping at the longerons. Do not as yet trim the excess from the unglued portion forward of the undercarriage member.

Filling Gaps

Examine carefully for any gaps in the gluing along the longerons and bracing. If construction has been done correctly, there should be no gaps but, should any be discovered, force glue under pressure into the gap with a polythene cake-icing syringe.

Check the two sides together and see that the top longerons are flush and free from lumps of dried glue. Sand each joint on the inside of each side. Ideally, use an orbital sanding tool but, if you use a rotary sanding disc in an electric drill, exercise caution as they cut quickly and can remove the base wood in addition to the dried glue.

Remove all the staples with the special tool described in Fig. 2 (October issue).

Fitting Cross Struts

Set the two sides upside down in the plan jig (Fig. 29).

Remember that you now have the fuselage upside down and mark on the positions of all the cross struts in the fuselage bottom (uppermost) as far as the one 109½in. from the stern post.

Clamp the rear fuselage sides to two straight-edged boards (Fig. 29) and cut and fit the cross members. To support and strengthen these butt-joints, make and fit ⅛in. plywood saddle gussets as shown in Fig. 30. The saddle gussets at the cross member which takes the 1/16in. ply bulkhead in the rear fuselage will not be fitted until this bulkhead has been installed as they will need to be shaped to suit. Do not screw the cross members to the longerons.

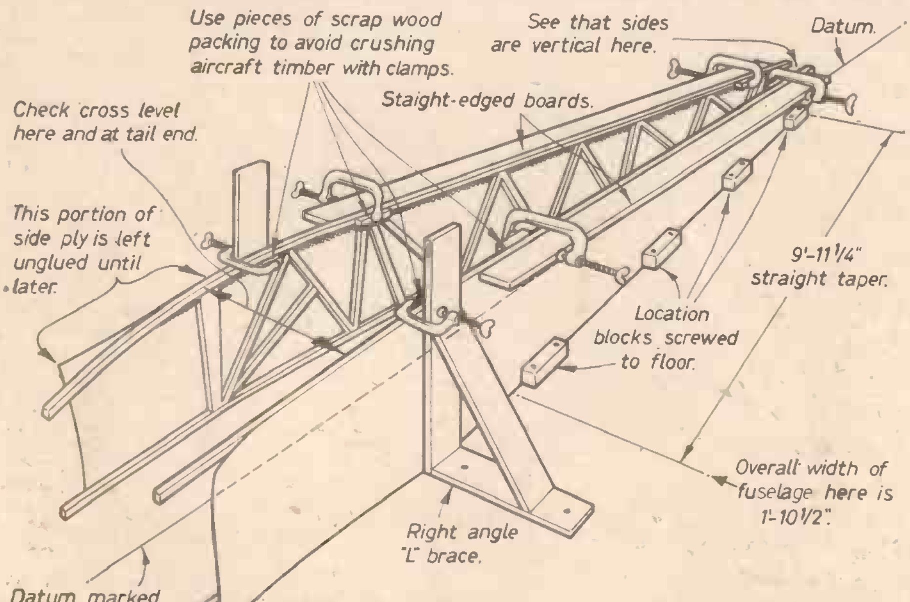
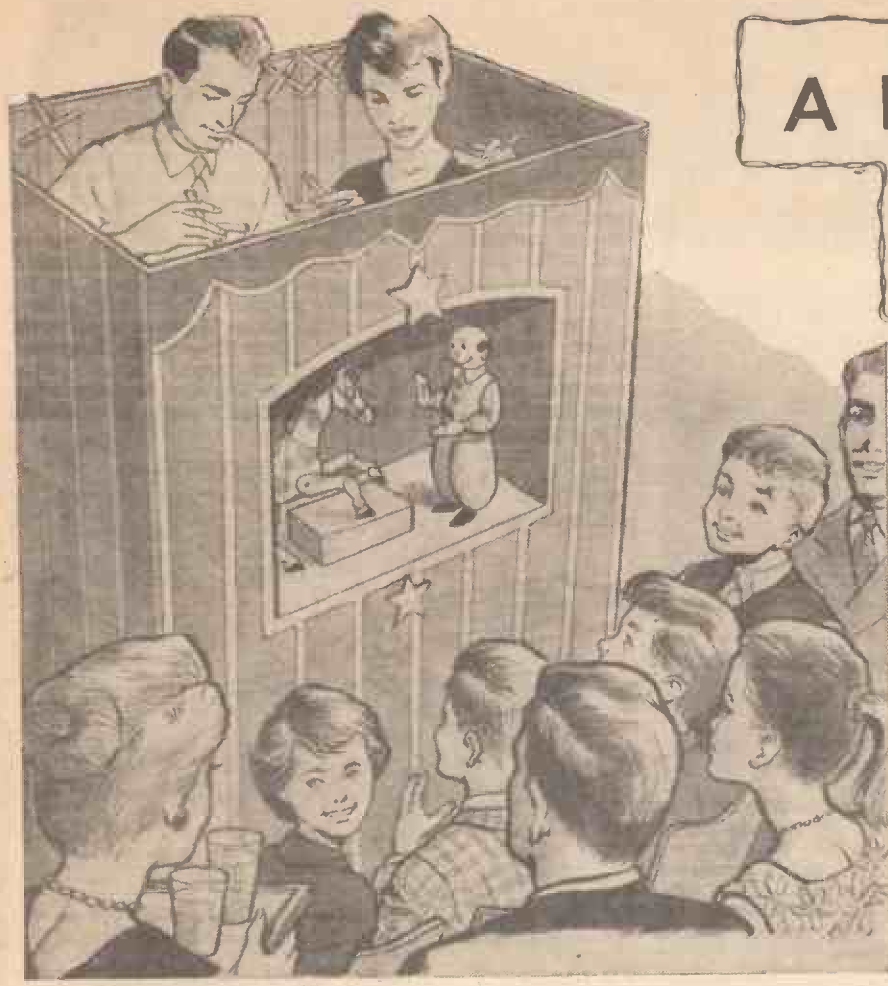


Fig. 29.—View of sides (inverted) clamped in straight-edges.

(To be continued)



A PORTABLE MARIO

SUITABLE FOR PROFESS

THE design of this portable marionette stage renders it suitable for the presentation of puppet entertainments using marionette figures of from 18 to 20in. high. This size figure is the one most commonly used by puppet showmen nowadays. Quite large audiences are able to see the show provided that due attention is given to the question of line of sight.

From Fig. 1 it will be apparent that the floor of the marionette theatre must be just over the heads of the front row of the audience if the auditorium has a flat floor.

Secondly, the proximity of the front row of the audience to the stage and the height of the proscenium opening are important. If too near, the front row will be able to see up under the proscenium and so get a view also of the operators, which is undesirable. The question of the height of the leaning rail is important too, as it must be of a convenient height for the comfort of the operators and must bear a relation to the length of the strings of the marionettes.

An interesting point to bear in mind, too, is the relation of the height of the puppet figures to the height of the proscenium opening. When the difference between the two heights is not great, an illusion of greater height is given to the puppets.

The height of the leaning rail is concerned mainly with the comfort of the operators who may have to work for an hour or so non-stop. Consequently this rail is adjusted conveniently for the fore-arms of the operator to rest upon it when holding the control stick of the marionette whilst the marionette itself is standing in a normal position upon the stage floor (Fig. 2).

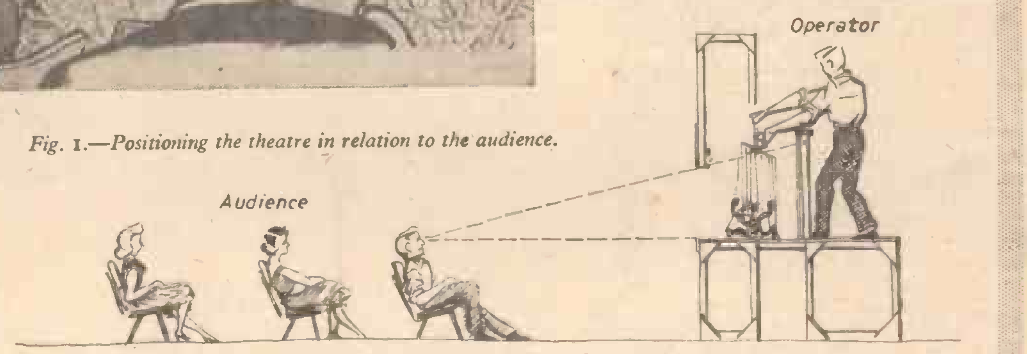


Fig. 1.—Positioning the theatre in relation to the audience.

In this design the height of the leaning rail is 3ft. 4in. above stage floor level. Except for specialised puppets, normal figures are strung to the control which is hung on a peg 4ft. 6in. from the floor with the feet of the puppet just resting on the floor.

From Fig. 5, it will be seen that the stage comprises two front towers and three shorter rear towers. The two front towers support the proscenium draperies and drop curtain, lighting bar, record player, etc. The back three towers support the floor upon which the operators walk, the leaning bar supports and a hanging bar protruding towards the rear upon which the puppets are hung when not in use (Fig. 4). The two floors of the stage are made from sheets of 3/8in. plywood, screwed to frameworks of 2in. × 1in. deal. Each floor is made in two parts which are hinged together so that they may be folded up when being transported.

Making the Support Towers

The towers are made throughout in 2in. × 1in. deal planed all round, so that the dimensions will be about 1/8in. under 2in. × 1in. The various frames are made with half-lap joints at the corners and these corners are further reinforced with triangular pieces of plywood 3/16in. thick glued and nailed in position. This construction will give great rigidity to the frames.

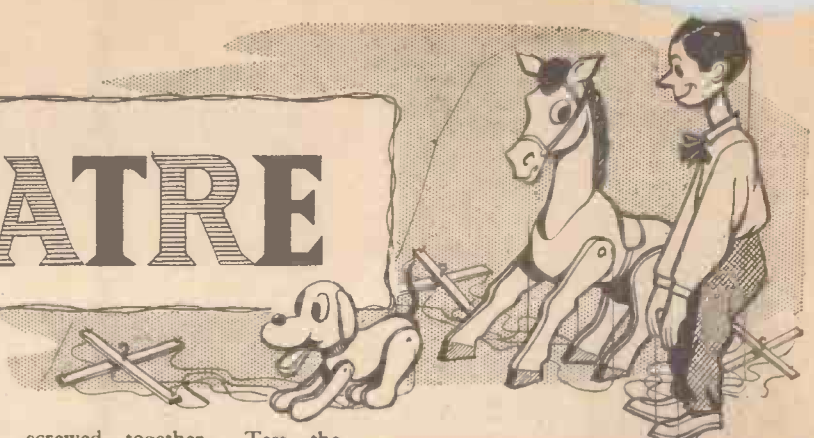
The frames are made to fold by the use of 1¼in. backflap hinges.

In the main the various parts of the stage are held together with 2in. × ¼in. Whitworth round-headed screws and wing nuts. A few other sizes are also required, as for example when fixing the lighting rail or leaning rail, but these will be described later.

Three of the shorter towers (Fig. 6) are required, each consisting of two wide and two narrow frames constructed to the dimensions given in Fig. 3. The corner joints are sawn as shown and are then glued and

Leaning rail and backcloth

NETTE-THEATRE



By [illegible] HOOK

SIONAL OR SEMI-PROFESSIONAL USE

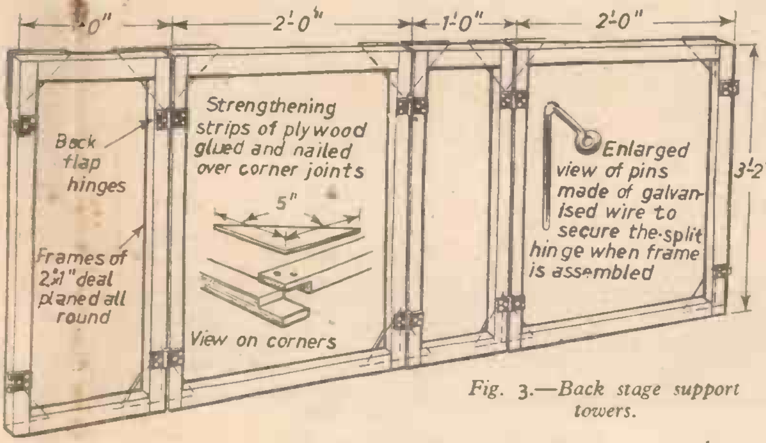


Fig. 3.—Back stage support towers.

screwed together. Test the frames for squareness by measuring across diagonally. These dimensions should be equal. After the frames have been made square the triangular corner pieces are glued and nailed over the corner joints. For all constructional work on the stage it is advisable to use a waterproof glue such as Aerolite, so that if the stage is stored in the damp the joints will not be affected.

When the glue is dry, clean up each frame with a smoothing plane.

Each set of four frames is joined together with $1\frac{1}{2}$in. backflap hinges. So that the frames may be opened out flat as shown in Fig. 3, one pair of hinges has the centre pin knocked out with a punch after one end of the pin has been filed off. When the frame is built up for use, the hinge thus parted is joined together with pins made from galvanised wire of suitable thickness as shown in Fig. 7.

Fig. 6.—A completed small rear tower.

The Front Support Towers

The front support towers are constructed in a similar way to those used at the back according to the dimensions given in Fig. 8. One difference is, of course, that a wide and narrow pair of frames when hinged together are hinged end to end with another pair of frames.

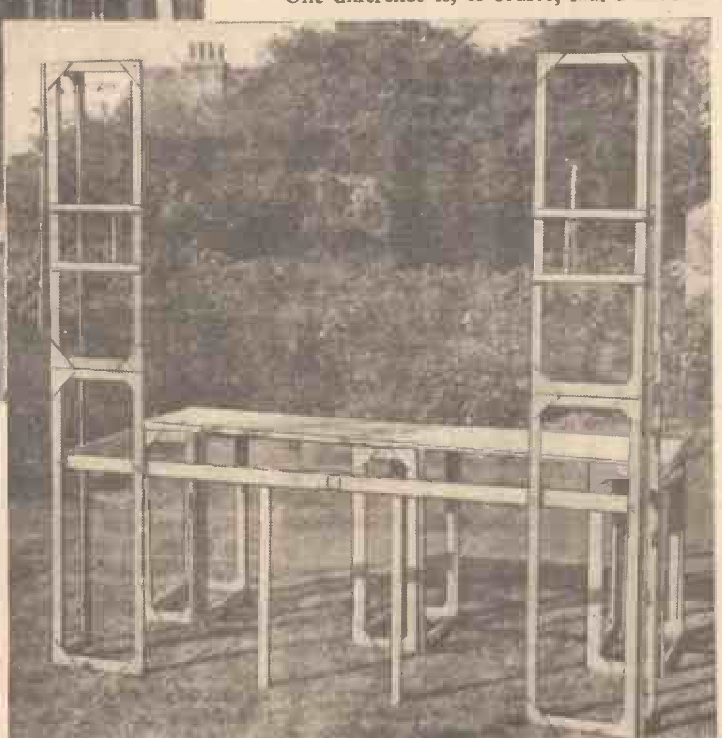
Open out the frames in a longitudinal direction and then fold at right angles when the frame will stand erect on a level surface. The longer width frame will be along the front of the stage and the shorter frame will return along the side of the stage. On the top of this return frame is bolted a batten 4ft. long and 2in. × 1in. which serves to hold the curtain draperies along the side of the stage and in the case of the left-hand frame will hold the pulley block used for drawing the proscenium curtain (Fig. 9).

To the top front frame of the assembly are bolted the pieces which serve to hold the light bar.

Fig. 4 (Above).—Back stage, showing puppet rail and puppeteer's platform.

Fig. 2 (Left).—Dimensions of the leaning rail.

Fig. 5 (Right).—The stage consists of two front towers and three shorter towers.



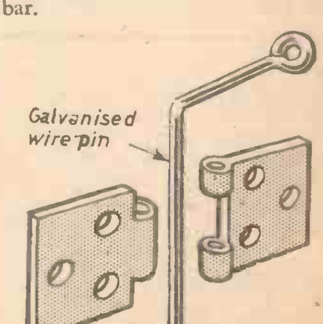


Fig. 7.—Backflap hinge modification.

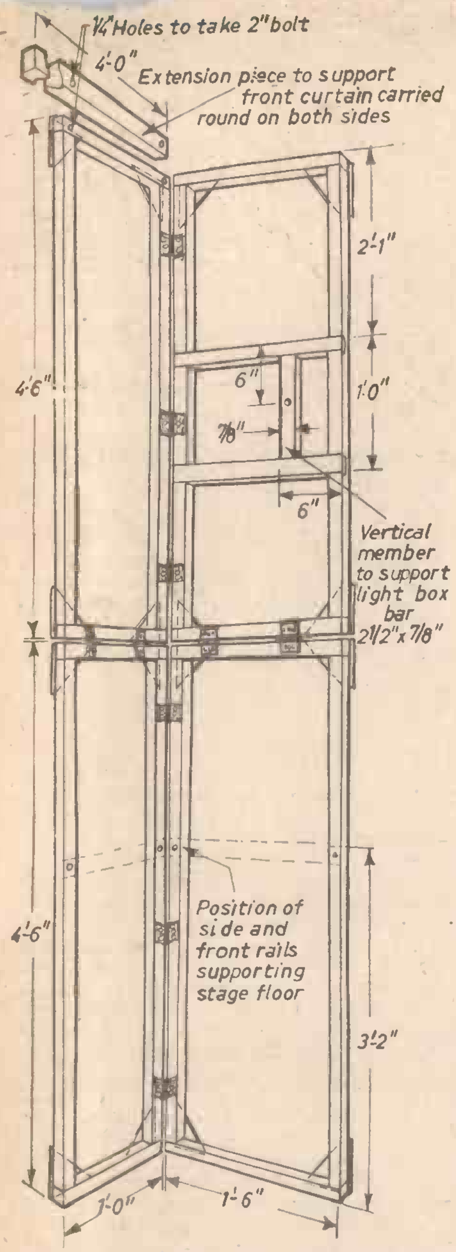


Fig. 8.—Details of left front tower.

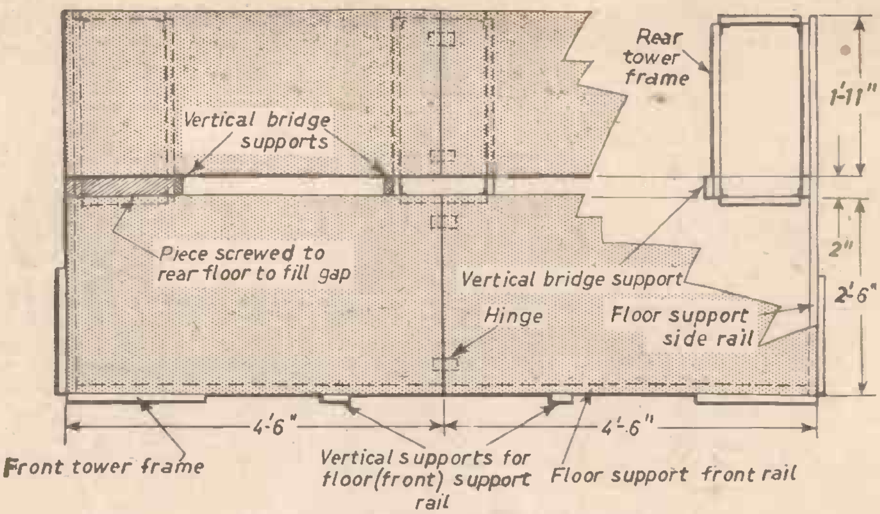


Fig. 10.—Dimensions for the floor of the stage.

On the lower of these frames are several holes which take the bolts which hold the battens joining the front and rear support towers and the front towers to each other whilst supporting the floor. Whilst these positions may be marked in pencil for the time being it is better to delay drilling until the battens have been prepared and are also ready for drilling.

The Side Support Bars

Each of these bars is 54in. long and 2½in. × ⅞in. finished size (Fig. 11). Cramp them in place joining the front tower to the rear tower so that they are on the outside of the rear tower and on the inside of the front tower. Butt the front end of the bar right into the angle of the front tower and place the rear end flush with the back edge of the frame of the rear tower.

The Front Floor Support Bar

This bar is made from two pieces of deal each 4ft. 4in. long and 2½in. × ⅞in. finished sizes. They are secured together with a single 2in. backflap hinge, as shown in Fig. 12.

At 12in. from the hinge joint, two vertical supports, each 38in. long, are bolted to the floor support. The support bar is then bolted on the inside of the front tower frames with the ends butting against the previously bolted up side door.

With the fitting of these floor support bars it is advisable to stand the towers on a level surface and to hold the bars in place with small G cramps before drilling the various members to ensure that everything is level and vertical.

Fig. 9.—The batten holding curtains along the side of the stage.

The Floor of the Stage

There are two parts to the floor of the stage—the front part upon which the puppet actors walk and the rear part upon which the puppet operators walk. Each of these floor sections is divided into two sections and held together with some 2in. backflap hinges so that they may fold back upon each other for purposes of easier transport.

The floors are made from ⅛in. thickness plywood screwed to frameworks of 2in. × 1in. battens. The dimensions of these frames are shown in Fig. 10. The corner points of the frames are halving joints.

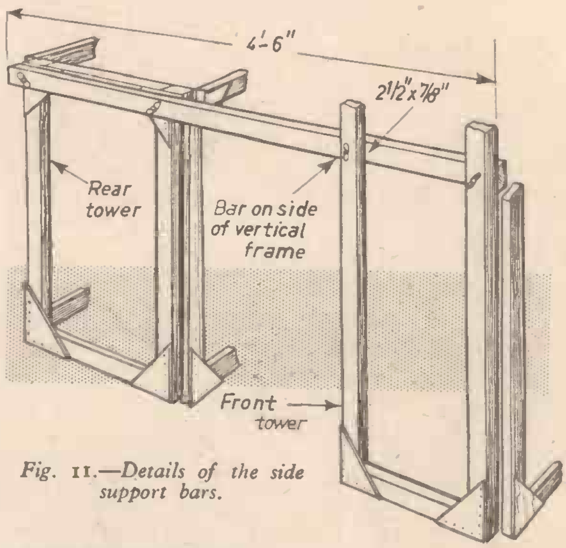


Fig. 11.—Details of the side support bars.

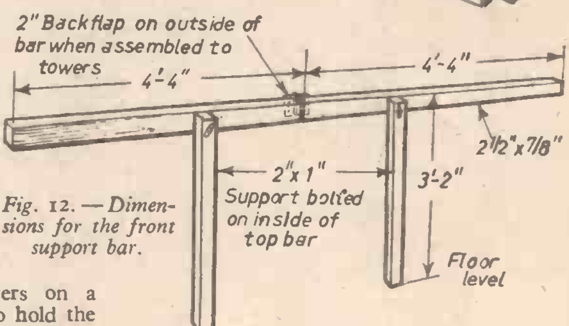


Fig. 12.—Dimensions for the front support bar.

When the floors are placed in position on the stage there is a space left between the two so that the bridge supports, which are bolted to the sides of the rear support towers, may protrude above the stage level. This leaves a gap of about 2in. in between the floors which can be inconvenient to the operators when adjusting things in the wings. Because of this two pieces of deal 15in. × 2in. × 1in. are screwed to the front edge of the rear floor frames. This is shown in Fig. 10.

(To be continued in next month's issue.)

A Garden Spray and Car Washer

By J. Waller

A Versatile Pump for You to Make

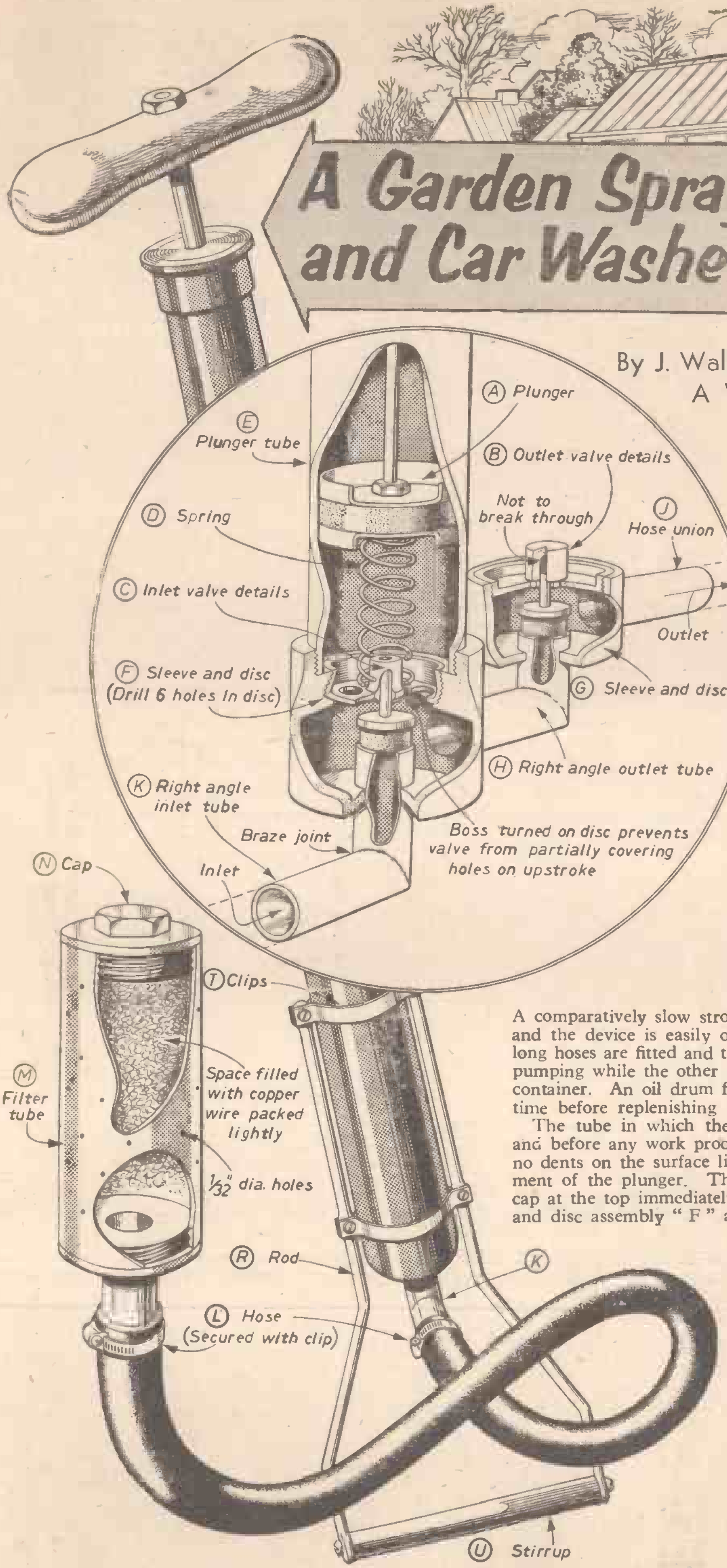


Fig. 1.—The completed pump with (inset) a cutaway view of the lower end. Part of the filter casing has also been removed.

THIS design of pump played an important rôle during the last war, when it was found to be an efficient method of spraying water on to an almost inaccessible fire. Its present uses are in the spraying of fruit trees and car washing and the emptying of tanks. Boilers and sumps are other instances where the simple pumping action can remove liquid via a long length of tube to a drain. Thus, this design is not new, but is an interesting constructional job, it being possible to make it either from odd pieces of scrap material or by altering an existing hand pump.

Construction

Fig. 1 shows (inset) the lower end of the unit with the casing cut away. The plunger "A" is pushed down to the bottom of the tube and an upward stroke is just about to commence—a situation that causes the outlet valve "B" to shut and also opens the inlet valve "C"; in this case the latter is still seated as the plunger has not risen sufficiently to release the pressure imparted by the spring "D." This lifting action causes water or other liquid to enter the inlet valve and to fill the plunger tube "E," and the reversal of the stroke direction then shuts the inlet valve and immediately lifts the outlet member allowing the liquid to flow unrestricted to the jet or spray fitted to the rubber or plastic tube at that position. A comparatively slow stroke is required, especially when spraying fruit trees, and the device is easily operated by a single person at ground level,, but if long hoses are fitted and the work proceeds from tree to tree, then one person pumping while the other sprays is preferable as this also means using a large container. An oil drum fitted to a simple trolley can be used to increase the time before replenishing the liquid becomes necessary.

The tube in which the plunger operates is a piece of thin wall material, and before any work proceeds on it, a check is essential to see that there are no dents on the surface likely to distort the bore and impede the easy movement of the plunger. The ends are threaded in the usual way to receive a cap at the top immediately beneath the pumping handle, and a similar sleeve and disc assembly "F" at the bottom. The latter is bored to create a box where the valve is fitted and drilled to receive the right-angle tube "K." A built-up assembly is possible from pieces of tube, but a detail machined from a solid piece of brass bar is perhaps made much more quickly if a lathe is available. Holes drilled through the disc allow the water to run from the filter into the box and then to the plunger tube. To facilitate replacement of the valve—a standard water tap fitment—a threaded disc is made and the holes themselves act as tightening or slackening members when it becomes necessary to make a change. Another hole is drilled to receive the second right-angle tube "H," which forms part of the outlet valve assembly.

This member at "G" is constructed in much the same manner as the previous sleeve, but on this occasion no holes are provided as a tightening medium. Instead a short length of hexagonal bar is brazed into a hole in the disc and this allows the use of a small spanner when it becomes essential to remove the disc and replace the washer. The hole in which the shank of this washer slides is not drilled completely through otherwise water will leak at this point. Again the bottom and side wall is drilled for the right-angled tubes, and these also are preferably brazed in position as this prevents the parts turning on the threads when in use—an action that will certainly take place if the tubes are screwed into the sleeves at this point. Incidentally, the question of whether to use the usual Jubilee type of clip for the hose or to utilise a screwed coupling is a matter of choice. The latter are readily obtainable from ironmongers and allow a quick uncoupling of the hose and the instalment of another in a matter of seconds.

The coiled spring "D" is made large enough to pass over the extension piece machined on the disc. There is no need to restrict this clearance because the plunger, on moving up and down, will take the spring with it and thus pass over the extension at every stroke. The spring is closed and the nut on the piston holds it to that member because it makes a more secure hold than attempting to attach it to the disc extension. The piston follows orthodox practice adopted for these details and suitable cup washers are obtainable from ironmongers to fit the bores of most tubes. Failing this source of supply, it does not take long to make a piston from some fairly soft rubber with a pair of washers each side similar to those depicted in the drawing.

The Filter

A filter is essential unless it is proposed to pump only perfectly clean water, but as the general usefulness of this equipment is appreciated, many other tasks are likely to be undertaken which make the installation of a filter unit an essential feature of the design.

Construction is shown in Fig. 1. Again a length of thin wall tube is used, threaded internally at each end for the hose union and cap with a host of small 1/32in. holes drilled through the walls. The union must fit tightly or, alternatively, if the threads are slack, the flange fixed to prevent it unscrewing by making two or three centre pops round the joint where the two parts meet. The cap is shown with a hexagon, but this is optional. A nut brazed to the turned detail is one way of making it, but a square filed to provide a spanner hold is also satisfactory.

Fill this tube with wire wool—the copper or brass variety is obtainable for approximately 1s., and does not rust. The steel pot scourer is useless for this purpose because after a short period it will disintegrate. Pack the wool loosely, replace the cap and then the filter is ready for use. It will not, of course, stop every minute fragment in the water, but as pieces of straw can pass through the 1/32in. holes it will stop such material from eventually passing on to the valves.

The Stirrup

The stirrup is made from simple bent rods with either a wood or brass lower piece for the foot, and these are adjusted according to the height of the person most likely to use the pump. The stirrup is arranged at right-angles to the hoses, as shown.

Variable Hose Size

While most readers are content to supply and fit a single size of hose and inlet and delivery connections, this is not always a wise method to adopt because it does restrict to a large degree the usefulness of this equipment. For instance, the emptying of a car sump where the plug was so battered that it was impossible to again apply a spanner meant that the sump required dismantling from the cylinder block for the removal of this dirty oil. To overcome the problem of the car being out of action at that time, a long piece of clear plastic hose was attached to the pump and fed down the filler tube, whereupon it was a simple matter to dispose of the oil in a suitable bucket. While this was not, of course, an ideal solution to the normal oil draining procedure, it did mean that fresh oil was supplied until it became possible to take off the sump and drill out the offending member. Therefore, make adaptors to fit a large and small hose.

Using The Pump

Spraying trees has already been mentioned and a thorough clean with fresh water from the bucket will prevent any corrosion. The pump will obviously empty water butts or tanks, despite the fact they are covered with slime, and again a wash will remove all the dirt the filter will pick up. Similarly the pump will spray a garden fence with creosote, and a wash in petrol leaves it clean and ready for the next task, or it can remove all the water from a fish pond much better than the bucket method because the inlet hose can reach the inaccessible corners which normally require a mopping up operation before the pond is considered dry. A similar arrangement to the oil pumping procedure previously mentioned, but this time reversed, can fill the crankcase, gearbox or rear axle, and as the latter is situated in an awkward position, the careful pumping from a can is much better than endeavouring to run the lubricant from a tin after that item has been filled from the larger can.

Practically all liquids (with the exception of acids which naturally have a corrosive effect on the parts) are easily pumped with this accessory and the design is so arranged that cleaning is comparatively easy. Whether the spraying of whitewash or distemper could be undertaken is a matter of conjecture, but there appears no reason why this is not possible if the liquid is not too thick.

Space Fuel of the Future?

PLANS exist at present for increasing the efficiency of sources of power already in use, i.e., liquid and solid propellants and nuclear energy and electricity, but it has also been suggested that use be made of the plasma or energy belts which exist in space. At present this is merely an imaginative idea, but successful utilisation of this energy would mean that space craft could travel almost indefinitely, obtaining their fuel as they go.

Our Latest Radar

SO much information is collected so quickly by modern radar that data processing equipment (electronic brain) is necessary to sort it out and present an up-to-the-minute picture of the tactical air situation. A long-range warning, as well as range, bearing and height data, is given.

Undersea Research Vessel

A SUCCESSOR to the Bathyscaphe, based on the same principles but of entirely different shape, is being designed in America. In appearance it will resemble a submarine, rather than a sphere. It will be 9ft. in diameter and will weigh 83 tons. A pressure resistant sphere at the forward end will house the crew of three and all the control, navigation and recording equipment. A similar sphere aft will contain all the batteries and automatic equipment. Between the two will be situated a ballast tank and a compartment to house the equipment used to obtain and store samples from the sea bed.

Model Van de Graaff Electrostatic Generator

DESIGNED for school laboratories and capable of producing nearly half a million volts, this model Van de Graaff electrostatic generator can be bought for only £46. It is produced by Messrs. W. B. Nicolson (Scientific Instruments) Ltd.

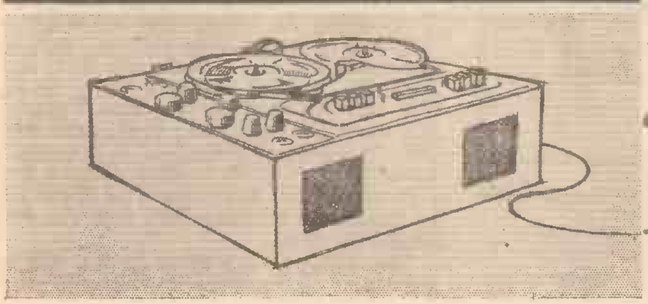
Re-entry Problem

ONE of the problems scientists have to face when designing a manned space vehicle is protecting the occupants from the searing heat which will result when the space ship re-enters the earth's atmosphere. Heat shields have been constructed and are in process of being tested. One is a 3in. thick 6ft. diameter sheet of beryllium—a material capable of absorbing vast quantities of heat and the other is of the ablating type. These materials, as they grow hot, melt vaporise or flake off, thus dispersing heat.

The Fairey Rotodyne, the world's first vertical take-off airliner in flight at Farnborough recently.

Building a Tape Recorder

PART 3
Continued from the November Issue



By S. A. KNIGHT

This Month's Instalment Deals Mainly With Wiring

THE top panel carries the control knobs and some of the actual controls, in addition to the input and output jacks, and the magic-eye level indicator. The specially engraved panel which has been designed for this recorder should be obtained from the supplier given in the components list in the October issue, and the metal panel marked out from this; in this way all drillings will be correct. No dimensions are given therefore in the panel sketch of Fig. 14, apart from those of overall size and fixing points.

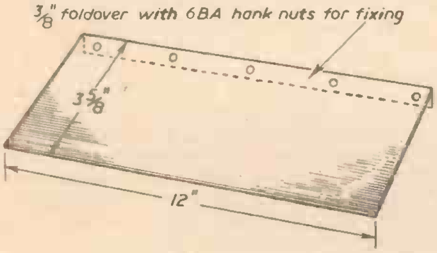


Fig. 14.—Main dimensions of the metal panel.

Wiring

The following order of separate sub-chassis is best followed for wiring; the final assembly and interconnections are then quite simple.

Wiring the Panel

After the panel has been bent and drilled, using the engraved bakelite top as a templet, the following components should be mounted: the three input jacks, switch S1, the monitor and amp. jacks, three bushes for ¼in. spindles, the bass potentiometer VR5, the output speaker jack, and the magic-eye. This latter is mounted horizontally on a simple bracket which in turn is clamped under the fourth bush through which the ¼in. spindle to the treble control later passes. The panel is then part wired, as shown in the photograph Fig. 15, and the wiring diagram, Fig. 16. Resistors R1 to R6 inclusive, and condenser C1 are neatly grouped around the three input jacks and switch S1; the components associated with the magic-eye are similarly wired at its valve base, these being R24, R25 and R26, condensers C17, C18 and crystal X1. Leads for H.T., heaters, and input from R23 are fed out and for the time being left long, as shown. R48 is wired at the speaker jack. The photograph does not show R31, R32, C21 and C22, but these should be wired in. A small tag strip is used to support the components associated with the magic-eye indicator.

The wiring is not critical, but the leads associated with the input jacks and resistors should be kept to an absolute minimum length. Care should also be taken to ensure that when the various components are wired

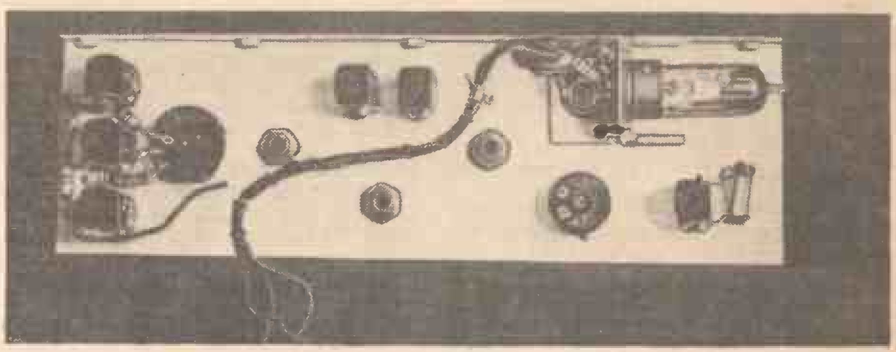


Fig. 15.—Components mounted and wired on the panel.

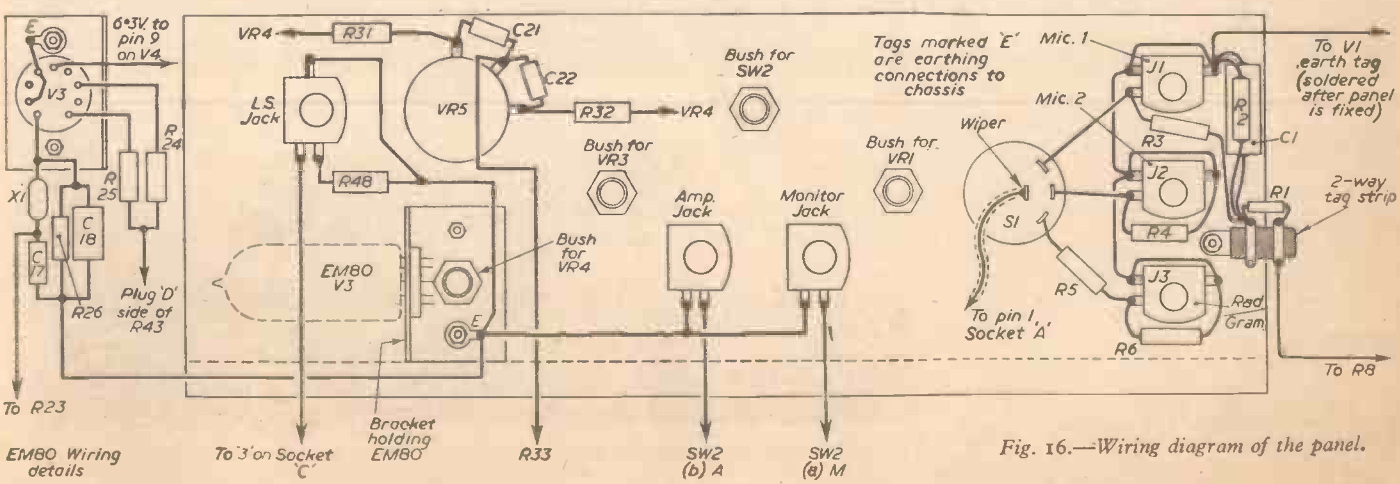


Fig. 16.—Wiring diagram of the panel.

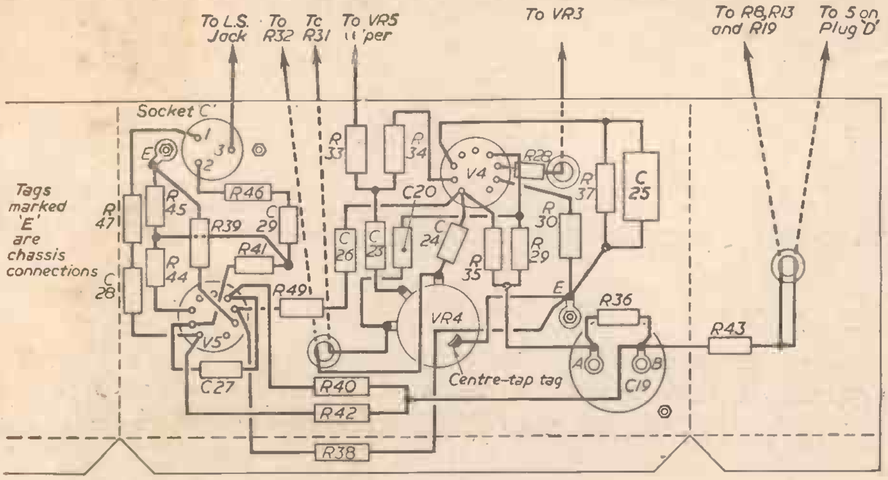


Fig. 17.—Mid-amplifier wiring.

to the holder pins of the magic-eye that a clearance is left in line with the holding bush as a ¼in. spindle has later to pass through this. To be safe from short circuit risk, it is as well to use a length of ¼in. insulated rod (such as paxolin) for the spindle.

The "Mid-amplifier" Chassis

This is best wired next as the wiring here is again not critical. This chassis carries the valve stages V4 and V5, the input point being derived from the slider of the gain control VR3, and the output terminating in socket "C." Fig. 17 gives the wiring. Condenser C19 (8 + 16 μF) is dropped through the chassis so that it does not foul the small strip carrying VR3 and S2 above, and the positioning of VR4 on the chassis must be beneath the appropriate panel hole bush when this latter is mounted (treble gain). Tag boards and strips may be used as necessary under the chassis, particularly for holding the larger condensers C20, C24, C28 and C29. The heater and H.T. leads are brought out at the end to a tag strip which is clearly seen in the photograph (Fig.11). They should not be soldered just yet as other leads have to be wired here later. The slider input from VR3 comes down to V4A grid through a short piece of screened lead, also seen; this can be free for the time being, of course. The leads up to VR5 are run up similarly (three unscreened) and condensers C21, C22, R31 and R32 are wired across the actual control. Two further leads (one earth) run up to the speaker output jack. All these leads are left long at present for later soldering to the panel when this is fixed.

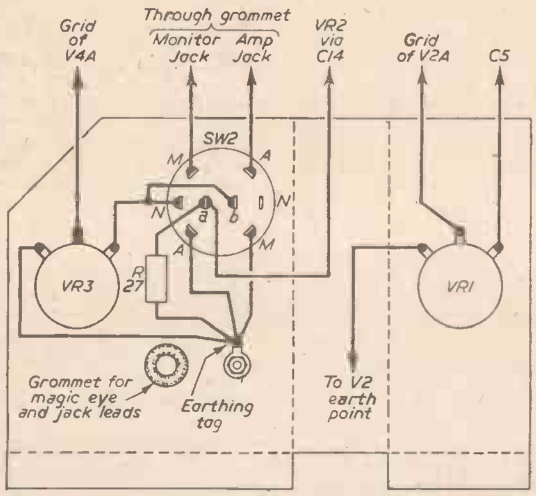


Fig. 18.—A point-to-point wiring diagram of the control strip.

The Two Smaller Sections

These are the sections holding controls VR1, VR3, R27 and switch S2 (see Fig. 18) and the bracket for condenser C10. The condenser is dropped through slightly so that it clears the bracket above.

The sections as so far wired up may now be assembled and the interwiring completed. This covers the wiring from S2 across to VR3 and to the monitor and amp. jacks on the panel, the heater leads and H.T. lead from the magic-eye brought down to the side strip on the "mid-amplifier" chassis, and connections completed to the other controls concerned on the panel. It is essential when fitting VR1 in position, that its tags face outwards; if this is not done it will not be possible to wire this later from the pre-amplifier section.

The wiring of this latter section will be given next, as the wiring is critical in parts and so additional care is necessary.

Wiring the Pre-amplifier

The wiring of the pre-amplifier strip is rather more critical than the units already described, and some care should be exercised to follow the wiring diagram of Fig. 19 as closely as possible.

The majority of the components are mounted on paxolin boards of about 1/16in. thickness, and self-riveting type tags are used, being punched into the panels as the figure indicates. Alternatively, in the absence of such tags, ordinary double-ended solder tags may be used, secured by 8 or 6 B.A. bolts. In this latter case, care should be taken to use countersunk screws, so that there can be no possibility of the underside shorting out to the metal chassis when the boards are positioned. In this respect, of course, the spacing from the chassis should be at least ⅛in., the actual positions of the fixing screws being immaterial so long as there is no possibility of shorting. Note particularly that the preset control VR2 is mounted on the larger paxolin board, the spindle only protruding through the metalwork of the chassis.

Next month's instalment will give valve base and heater run details, describe assembly and an alternative output and also deal with testing.

ANSWERS TO READERS' QUERIES ABOUT THIS DESIGN :—

1.—The Collaro Deck is obtainable from most radio dealers. Messrs. Lasky's Radio, 370, Harrow Road, Paddington, W.2, can supply.

2.—Wire the recorder in normal 22 s.w.g. single P.V.C. insulated wire, with stranded 22/0076 for the heater leads.

3.—Messrs. T.R.S., Ltd., 70, Brigstock Road, Thornton Heath, who supply the special mains transformer, can also supply a complete resistor and condenser kit, also the valves. Messrs. Osmor Radio Products, Ltd., can also supply kits. Their address is 418, Brighton Road, Croydon, Surrey.

4.—Total cost of the recorder should be about £40, including the deck.

5.—Readers should design and make their own cabinet, but a model suitable for modification might be obtained from Premier Radio, 207, Edgware Road, London, W.2.

6.—We regret that in the components list one of the 25 μF electrolytics has become changed over with one of the .25 μF paper, but the main circuit diagram is correct.

7.—The value of C1 in Fig. 1 should be .25 μF. This is not in the components list, and in addition seven more .05 μF condensers should be included. C1 is a 0.25 μF paper condenser and the 150 v. condensers are C1, C18 and C35.

8.—R49 is not given in the circuit, but will be mentioned later in the series.

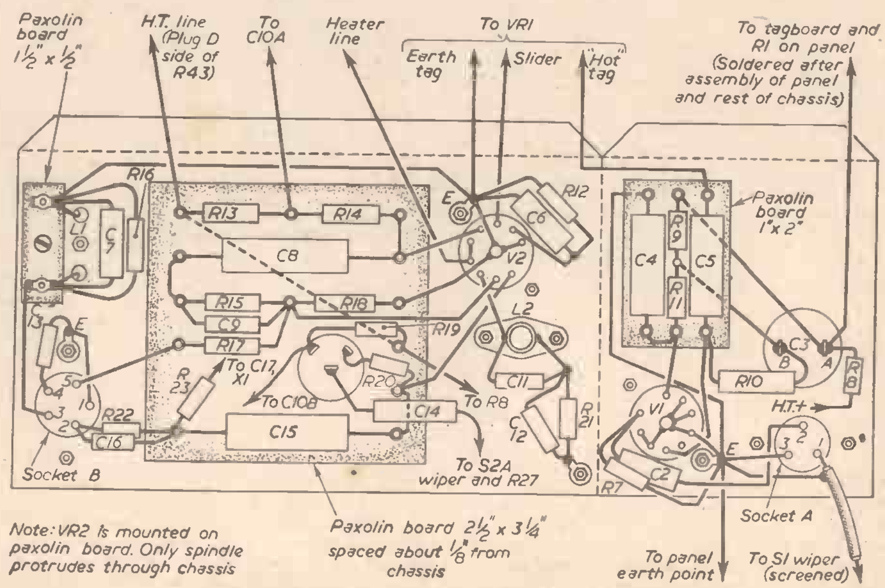
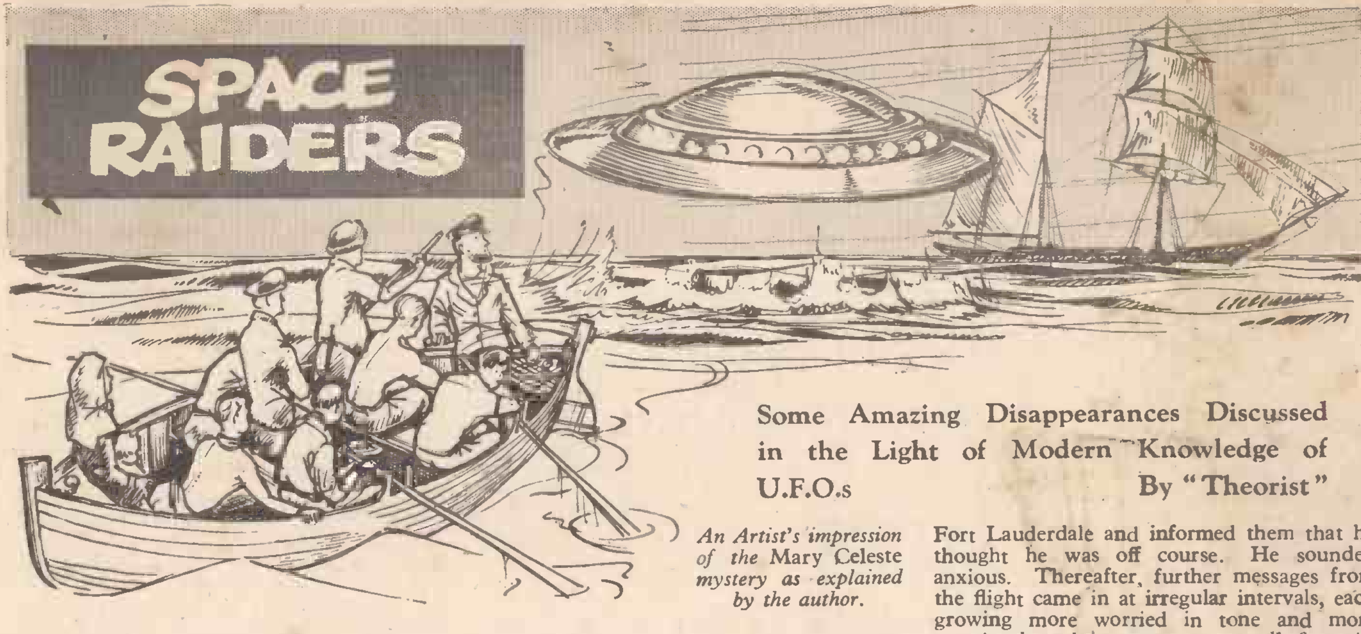


Fig. 19.—Wiring details of the pre-amplifier.



Some Amazing Disappearances Discussed in the Light of Modern Knowledge of U.F.O.s

By "Theorist"

An Artist's impression of the Mary Celeste *mystery as explained by the author.*

IN January, 1957, at a Press conference in Washington, Rear-Admiral Delmar Farrney, former head of the U.S. Navy's guided missiles programme, declared quite emphatically that unidentified objects were frequenting the earth's atmosphere. He said that there were signs that these objects or machines were under *intelligent control*. He was also sure that no agency either in the U.S.A. or in the U.S.S.R. could be capable of duplicating the speeds and accelerations which radar and observers indicated these flying objects as being able to achieve.

Evidence which supports the Admiral in each and every particular has accumulated enormously recently and one is led inevitably into speculation about these remarkable phenomena. In the past there have been some amazing happenings which indicate that reasoning beings of extra-terrestrial origin may well visit our planet from time to time. The present intention, however, is to touch on deeper issues involving these strange visitors. These concern the sudden and very mysterious vanishings of men and machines; vanishings which to this day are totally unexplainable in terms of the hazards and dangers inherent in our earthbound wanderings. An analysis is attempted only in the final episode related, for those which precede it appear to speak for themselves in no uncertain manner. The questions asked are: "were these people kidnapped?" If so, were they carried off by beings from another planet?

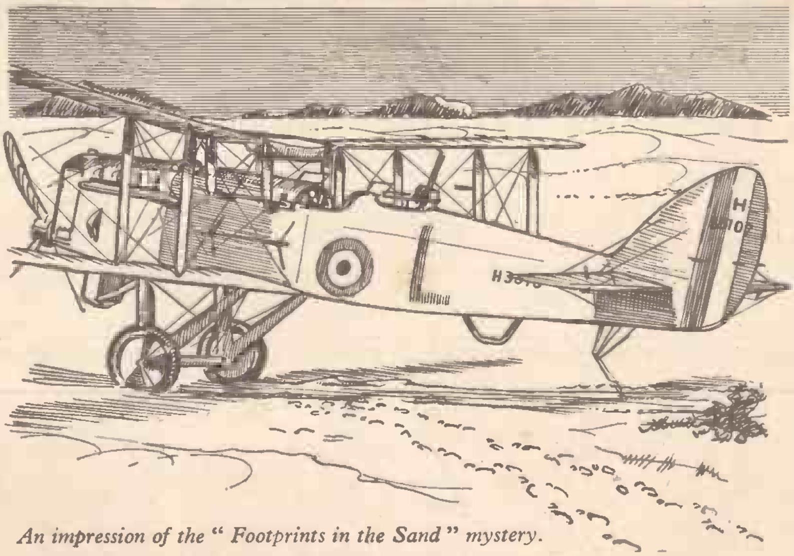
Footprints in the Sand

On a day in 1924, two experienced flyers, Flight Lieutenant W. T. Day and Pilot Officer D. R. Stewart, took off in a biplane from a base in desert monopolised Iraq, presumably on routine patrol. Some hours later anxiety was expressed back at the base, for the plane had failed to return. If the flyers had been forced down in a desolate region by engine failure, their plight could quickly become serious, especially if one or both happened to be injured in landing. A search party was organised at once to discover the missing plane and succour the two airmen.

Eventually the plane was found in a typical desert zone and the eager rescuers made haste towards it. They were mystified by what they discovered on arrival. Careful examination of the aircraft revealed that mechanically it was intact and flyable. The two officers were not to be found from that day to this. What the searchers did find apart from the machine, however, was visible evidence which has continued to intrigue the imagination ever since. They discovered that two distinct sets of footprints—side by side—were impressed in the sand from the aircraft to a point some fifty yards away from it. Beyond this point the footprints ceased abruptly, the ground from then on presenting a smooth and quite undisturbed sandy surface. No second sets of steps were found leading back to the plane.

A Mass Disappearance

On December 5th, 1945, five Avenger bombers of the U.S. Air Force took off from their base at Fort Lauderdale in Florida. They were on a practice flight. It was a routine operation which would entail them covering a distance of scarcely more than 400 miles before landing back at their departure base. Just over an hour after take-off, the leader of the flight (each Avenger carries a crew of three) contacted Fort Lauderdale and informed them that he thought he was off course. He sounded anxious. Thereafter, further messages from the flight came in at irregular intervals, each growing more worried in tone and more certain that the compasses on *all five aircraft* were not functioning normally. An approximation of their position was ultimately received from the flight some two hours after take-off. They thought they were a little more than 200 miles north-east of the home base. Immediately a Martin Mariner manned by a crew of twelve or thirteen took off in an attempt to intercept the Avenger flight and guide it home. No further contact could be made with the five Avengers, and when shortly after take-off the huge rescue plane was called for a position check—it, too, failed to respond. All six planes offered a curtain of silence and disappeared utterly and completely from the eyes of man.



An impression of the " Footprints in the Sand " mystery.

A Jet Aircraft Kidnapped

Late one afternoon in March, 1955, U.S. Air Force pilot Eugene Metcalfe was flying over Illinois. The sky was very clear and he had no difficulty in defining a jet aircraft which was approaching him on a parallel course. Suddenly, he was amazed to see a huge saucer-form machine loom up behind the oncoming 'plane. A large aperture was visible in the rim of the saucer-form and the ill-fated jet and its crew were instantly engulfed by the intruder. The giant access door closed and the huge machine zoomed out of sight at a fantastic speed. No trace of the jet 'plane has ever been found. This laconic report by an experienced flyer and the ultimate statement that a jet 'plane had failed to return to base, must surely be accepted as proof that indeed strange things *do* happen in our atmosphere; and that amongst those strange phenomena we must admit the presence of extra-terrestrial machines manned by sentient beings.

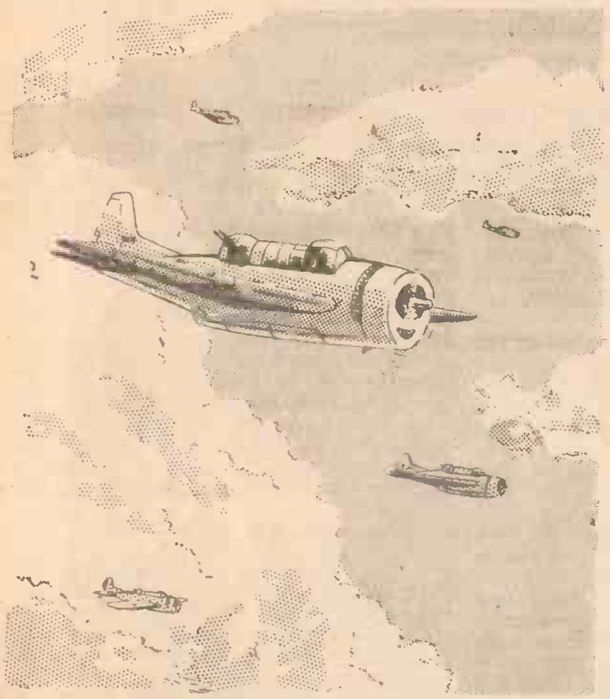
Visitors from Space

Whether one accepts or refuses the past statements that beings from other planets have been interviewed by people on earth, the possibility of such a meeting cannot be logically ruled out if it is agreed that extra-terrestrial machines frequent our atmosphere. An interesting point which emerges from these alleged meetings is the repetition of a confession by the strangers that they indulge in a certain amount of scientific collecting. This practice when applied to human beings is, of course, nothing less than kidnapping.

One more case involving the complete disappearance of human beings is cited below and a reasoned explanation attempted.

The Mary Celeste

On December 5th, 1872, the barque *Dei Gratia* was situated in the Atlantic about 300 miles from Gibraltar, her destination. In fair weather at mid-afternoon her crew sighted a brig or brigantine with her sails partially set. With only a light breeze blowing, this circumstance was rather odd and, added to this, the ship was swinging about as though not under proper control. Becoming curious, the Captain of the *Dei Gratia* brought his ship closer, and it was then seen that in fact no one was at the helm of the strange ship. Realising that something was definitely amiss, a boat was lowered from the *Dei Gratia* and the Captain and three of his crew set off to investigate the mystery. Coming alongside the vessel they saw that she was a brigantine named the *Mary Celeste* (not *Marie Celeste* as is usually and wrongly quoted). They boarded her.



These aircraft are Avenger bombers of the type which featured in "Mass Disappearance."

Everything on deck appeared to be in order, except that the ship's boats were missing. Going below, the investigators searched the ship from stem to stern without discovering anybody aboard her. That there had been people present quite recently, was confirmed in various ways. On a table in the captain's cabin a meal was set. Two or three cups of tea had scarcely been touched and a boiled egg with the top removed stood in an egg-cup. There was also a watch hanging on a hook—it was still ticking. The stove in the galley was still warm although it had been cleaned out, and in the forecastle, seamen's clothes and personal belongings were quite undisturbed. The only occupant of the ship the investigators found was a cat which was asleep and apparently in good condition. Everything pointed to a sudden desertion of the ship, but there was no sign of violence. Apart from the absence of the ship's boats, the only other inanimate thing which was missing was significantly enough the ship's chronometer. The *Mary Celeste* herself was in good shape and showed no signs of having encountered heavy seas. Strange marks, however, were discovered on the bows a foot or so above the waterline. They were long, narrow grooves as though gouged by a pair of enormous pincers in attempting to seize the ship at the forward end.

It was eventually established that the *Mary Celeste* sailed from New York with Captain Briggs in command. He was a man of unquestioned integrity. Accompanying him were his wife, his small daughter and a crew of seven. It also came to light that the ship sailed with but one of its usual two boats, the other having been damaged beyond repair whilst the ship was lying at anchor in New York harbour.

Various Explanations

Many ingenious explanations have been put forward over the years in attempting to solve the mystery of the *Mary Celeste*, but each one appears to fall down on some vital point. The dominating factors are the absence of disorder on board the ship and the complete disappearance of the ship's boat. The warm stove strongly indicates that at least one person had only recently left the ship. As it was a perfectly clear day and almost calm, with the ship making only modest headway; it would seem unlikely that a heavily loaded boat could have gone unobserved by the *Dei Gratia* or other craft in the area. Piracy must be ruled out as obviously the greatest material prize was the *Mary Celeste* and her cargo, both of which were left intact. Besides, it is unlikely that the ship could have been boarded without some skirmish taking place, with resulting disorder above deck. Nothing of this sort was found.

That the desertion of the ship was a purely voluntary action is equally untenable as an explanation. If one can imagine the Captain and the rest of the ship's complement leaving the ship in one small boat, on some trivial pretext, then why should the chronometer have been taken? The missing chronometer indicates that the abandonment was intended to be permanent.

It has been suggested that homicidal madness roamed the decks of the *Mary Celeste*. This is inconceivable, however, when we ask how a person so afflicted could, without hindrance, despatch all his victims and leave no single clue of violence? Even if this unlikely massacre did occur, then how did he dispose of his victims? If he disposed of them in the sea, how was it that no trace of them could be found—not even a trace of clothing? Further, if the deranged person thereafter left in the ship's boat, it is not very likely in his state of mind that he would remember the chronometer. If he suffered remorse and jumped overboard, he would neither require the ship's boat nor the choronometer in his act of self destruction.

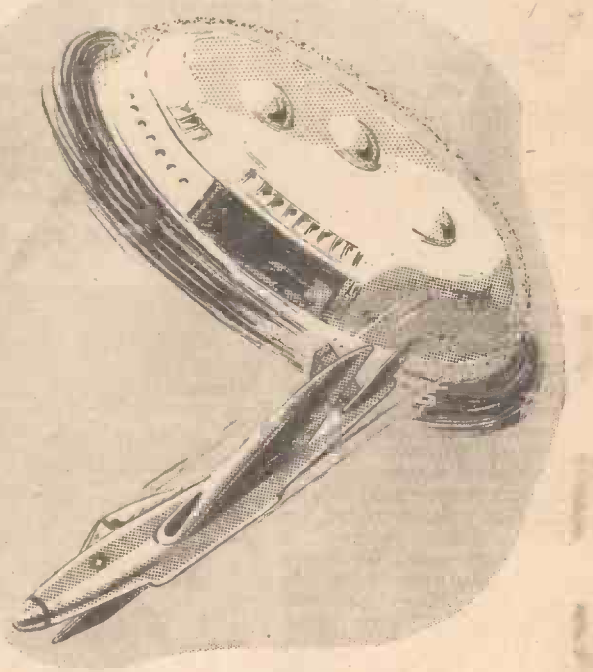
Mutiny Eliminated

Mutiny is not reconcilable with the casual and peaceful atmosphere which apparently prevailed aboard the *Mary Celeste* immediately prior to the desertion. If the Captain and his family succumbed to the treachery of mutineers, there appears to be no reason why the latter should not have sailed away their ill-gotten prize.

Any theory which purports to explain the mystery of the derelict and which infers the liaison of Captain Briggs with members of any other ship, is fundamentally weak. For apart from the high reputation of the Captain, he also possessed a substantial share in his ship's cargo.

A Marine Monster

Another suggestion is that the ship was attacked by a marine monster, which at first seized hold of the bows of the *Mary Celeste* thereby creating the strange grooves previously mentioned. Being unable to draw the ship down, the creature suddenly transferred its attentions to the persons aboard and annihilated them as they appeared on deck. For the argument to be initially tenable it would seem that a certain amount of superstructural damage to the ship could be expected. Evidence of such damage was not present, however. The *coup de grace* for this idea of a sea monster is easily discerned in the absence of the ship's boat. In such circumstances there would be very little future in launching the boat—it would be jumping out of the frying-pan into the fire.



The kidnapping of an American jet aircraft.

An Aerial Raider

Many of the difficulties encountered in

(*Concluded on page* 133)

When you use a Screw! use a Rawlplug too

With Rawlplugs you get a stronghold for every size of screw in any masonry—brick, concrete, stone, slate, tile, etc., etc. It is so simple to drill the hole with the appropriate Rawltool or Metalide drill, insert the Rawlplug and drive home the screw, that you will soon become an enthusiastic Rawlplug user—and all your fixtures will be safe. You can start with the simple POPULAR OUTFIT which costs only 3s. 0d. and when you become proficient the larger outfits are available for your skill.

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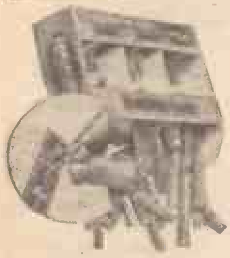
HANDY BOXES

Handy shilling boxes of Rawlplugs. Assorted sizes of Nos. 8, 10, 12 and 14 are packed for easy storage and selection.



50 RAWLPLUGS FOR 2/3

This divided window box holds 50 Rawlplugs assorted over Nos. 8, 10 and 12 gauges in three different lengths of each size. Incorporated in the lid of the box is a useful gauge to help you to select the right size screw for the Rawlplug.

RAWLPLUG METALIDE for masonry drilling *the easy way*

REGISTERED TRADE MARK

Here is a cheap reliable masonry drill for the household handyman. Four sizes are made for use in a hand brace or suitable electric drill. Just what you need for that occasional domestic fixing job.

No. 8 (3/16") Green Wallet	No. 10 (7/32") Blue Wallet	No. 12 (1/4") Brown Wallet	No. 14 (9/32") Grey Wallet
5/6	6/-	6/6	7/-

Each Metalide drill is packed with an instruction leaflet in a strong plastic wallet with transparent window.

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FREE RE-SHARPENING

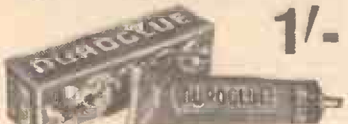
The most efficient, precision made, long lasting masonry drill is the Rawlplug DURIUM (with the free re-sharpening service). We strongly advise this drill for continuous drilling (such as industrial operation) 17 Sizes from No. 6 ($\frac{5}{32}$") to No. 30 (1") and a long series for drilling right through walls. Prices are from 9/6 each. For drilling glass use the special DURIUM GLASS DRILL. Made in nine sizes from $\frac{1}{8}$" to $\frac{1}{2}$" at 6/6 to 10/6 each. **Free Re-sharpening Voucher with each drill.**

1/- & 1/6

All Purpose Adhesive. Clear. Waterproof. Heatproof. Insulating. Handy tube 1/-, Large tubes 1/6d. DUROFIX is undoubtedly the finest value for money today. It has such a wide range of applications from simple woodwork repairs to fine china, porcelain and glassware that no home should be without a tube. **Commercial tubes 5/-; $\frac{1}{4}$-lb. tins 2/3; 1-lb. tins 10/6.**

1/-

Real Wood in Putty Form. In dexterous fingers surprising things can be done with Rawlplug PLASTIC WOOD. Models can be made and coloured, intricate mouldings rebuilt, splits in wood made good and, what is more it will stick firmly to any non greasy surface—metal, glass, vulcanite, plastic, earthenware, etc. Can be cut, planed and sanded to glass smooth finish. Colours:—Natural, Oak, Mahogany, Walnut. **$\frac{1}{4}$-lb. tins 2/3; $\frac{1}{2}$-lb. tins 3/9; 1-lb. tins 6/6.**



1/-

Animal glue of tremendous strength. This popular ready to use DUROGLUE is the handyman's friend. It can be used for that immediate need and replaced in the toolbox for another day. It is strong, reliable and for woodwork an ever ready aid to fixing and repairs. It is also suitable for many other materials but not for those washed in hot water. **$\frac{1}{2}$-lb. tins 2/6; 1-lb. tins 4/9.**

$10\frac{1}{2}$D

For quick easy repairs to Metalware. This scientific preparation in paste form can be applied in a few seconds and dries in a few minutes. Metal utensils in the house, garage or garden can be put into good condition again by the intelligent use of Rawlplug PLASTIC METAL without heat or soldering iron. Not suitable for wireless or electrical connections.

Rawlplug

DO-IT-YOURSELF OUTFIT

12/6

The handiest of handy outfits for the handyman

Here is the latest innovation from the Rawlplug Company. Seven popular Rawlplug products packed into one attractively printed box.

One handy box of No. 8 assorted Rawlplugs. One No. 8 Metalide Masonry drill in plastic container. One 1/6 tube Durofix. One tube Natural Plastic Wood. One tube Duroglue. One card Fuse Wire. Six No. 316 Rawlnuts (for making vibration-proof fixings to thin and hollow materials). One 64-page Rawlplug instructional handbook.

This assortment of Rawlplug products will find many uses in the home. Selling at 12/6 it makes an ideal present for the wife to buy for her husband or the handyman to buy for himself.

Rawlplug Do-it-Yourself Outfits are now in the shops, why not call in to your local Rawlplug dealer and ask to see one now?

1/9D

Non Slump Sealing Compound. For keeping water out of wood and glass joints; packing metal pipe joints, for sealing together articles subjected to vibration and excesses of heat and cold, etc., this Rawlplug DUROLASTIC has everything. It sticks; it sets into a rubbery compound that will not crumble, crack or decay, it can be painted. For outdoor jobs it is incomparable.

RAWLPLUGS WALL PLUGS

THE RAWLPLUG COMPANY LIMITED, CROMWELL ROAD, LONDON, S.W.7

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(*Continued from page* 130)

trying to provide a rational explanation of this great sea mystery are overcome if an aerial raider is postulated. If such a raider did appear it must have been of extra-terrestrial origin, as the year was 1872. No aircraft built on earth ranged over the vast Atlantic at that time. The sequence of reasoning in such a theory is simple but convincing as it adequately covers the suggestion of complete surprise, alarm, and almost instant desertion of the ship. Let us reconstruct the drama in terms of this theory.

The Threat of Curiosity

It is daytime and the Captain and his wife and child are in his cabin. A light meal has been prepared. In the galley the cook has sometime previously prepared and served the main meal of the day and is just now tidying up the galley, having cleared the stove out in preparation for the efficient re-laying of the fire for the next day's operations. The rest of the crew members are about their duties above deck. The setting is peaceful, and no threat to the tranquillity of routine tasks exists—at least those ten souls riding the lonely ocean are utterly unaware of any such threat.

Suddenly, commotion breaks out on deck. A seaman comes scrambling down the rigging from his task of correcting some fault of the ship's sails. With terrified gestures he draws the attention of his colleagues to a disc or sphere, which hovers a few hundred feet above but slightly to one side of the *Mary Celeste*. The water directly beneath the disc is extremely turbulent. The strange machine is about 40ft. in diameter, and an eerie blue light shimmers over its surface as it turns in the afternoon sunlight, with an insatiable curiosity peering through its numerous portholes. Almost as weird and demoralising is the loud humming sound which the machine emits—similar to the drone of some mighty organ.

In a few moments all aboard are present, gazing with acute apprehension at the strange entity. Captain Briggs, accustomed though he is to handling sudden emergencies, is on this occasion disconcerted and inwardly alarmed. The object is neither bird nor beast. It is obviously threatening them, as it refuses to leave the vicinity of the ship. Perhaps this terrific form will bring about the destruction of the ship. These thoughts flash through the mind of Captain Briggs as he tries vainly to reassure his wife and child.

Now the disc is moving in closer to the ship and the rest of the crew have become panic-stricken. This panic is understandable as none of these seamen had ever witnessed any form of aerial machine. Hastily the ship's boat is manned. The Captain's wife implores her husband to abandon ship, and he, excusably under the circumstances, agrees to accompany them. If the ship is to be inevitably destroyed, then it is obviously his duty to try and defend his family and crew. There is little time to collect anything, but the Captain even in this apparently dire situation, manages to secure the chronometer before joining them in the boat.

The Ship is Lost

Slowly they draw away from the *Mary Celeste*, as the cause of their departure hovers menacingly around the ship. Precious minutes slip by, then, to the immense relief of all in the boat, the disc starts to ascend. Higher and higher it rises until it vanishes into the blue of the stratosphere. Immediately Captain Briggs orders the boat to be put about and returned to the ship. Soon it is apparent, however, that their chance of regaining the brigantine is remote. She has sailed out of range of the heavily loaded boat.

Into Space

We could leave the theory at this point, but the non-discovery of the ship's company, boat or even oars, suggests a startling climax.

If the disc was a scoutship, it would certainly report the presence of living beings to its parent ship. As it was an oceanic setting where the incident occurred, the circumstances would allow the parent ship to descend and gather the boat and its occupants. An attempt may have been made to capture the *Mary Celeste*, as indicated by the strange marks on the bows of the ship. Either the intruders decided that she was too large to collect as a specimen of earthly conveyance; or they were interrupted in their task. A quick warning from a scoutship of the approach of other surface vessels, would be sufficient to send the vast parent spaceship into the rarified air of the upper atmosphere . . . and beyond.

Summing Up

An argument which may be advanced against this aerial raider theory is that other ships have been known to vanish completely along with their personnel. In some instances no trace of humanity or wreckage has been found. Why not attribute the same fate to the *Mary Celeste*?

The argument is sound, provided we admit a storm or similar phenomenon of sufficient intensity to act as the annihilating agent. However, once more the good condition of the brigantine contradicts the probability of such a happening. One just cannot imagine all members of the ship voluntarily leaving in the boat, to row themselves into extinction. In the *absence* of an aerial raider, and in the fair conditions prevailing over the area at the critical time; no matter why they left the ship, the boat and its occupants had a certain chance of surviving and being discovered at an early date. Instead, they utterly vanished, leaving the *Mary Celeste* to go sailing into history as the most remarkable derelict of all time.

PUZZLE CORNER

1.—Water, Water Everywhere! submitted by D. Ewins.

A SHIP-WRECKED dinghy has enough water to last 13 days if each man has 1 quart per day. After 5 days a certain amount is spilt and on the same day a man dies. If the water lasts out as long as had been first expected how much was spilt?

2.—Beat the Clock.

A MAN'S watch loses 10 secs. per day and his clock gains 10 secs. per day. If he synchronizes them on June 1st at noon, when will they next show the same time?

3.—Sum-it Meeting.

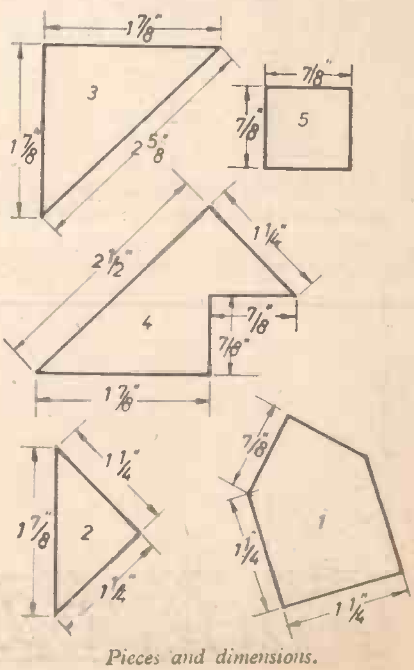
OUT of 6 Americans and 7 Russians, 3 of each were to be chosen to attend a conference. One American fell ill, however. By what proportion was the number of combinations for the meeting reduced?

A PUZZLE YOU CAN MAKE

4.—" The 5 Piece Square," submitted by Ian Still.

A TWO-AND-THREE-QUARTER inch square has to be completed, using all the 5 pieces shown on the right. If you want to try it yourself, draw the pieces shown in Fig. 1 on to thin card. When you have solved it you can make a stronger job to try out on your friends by using plywood or plastic. Cut out accurately from a 2¾in. square with a fret saw leaving sharp edges and corners. Clean up with fine glasspaper. To prevent anyone tracing out the lines of the grain in the wood and solving the puzzle easily, cover with two coats of thin lacquer paint of a suitable colour.

Answers are given on page 137.



Pieces and dimensions.

Letters to the Editor

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

A LUTON MINOR TESTIMONIAL

SIR,—I have been most interested in the series of articles about the construction of the Phoenix Luton Minor Aircraft, which you are printing in your most excellent journal.

Since I have recently had the opportunity to fly a home-made Minor which the owner wished to sell, I thought that perhaps the impressions of a colleague and myself might be of interest to your readers.

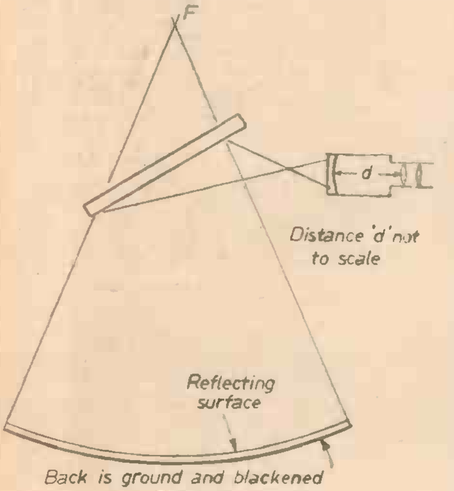
It was with some trepidation that we set out to try the Minor, which we rather expected to be disappointing and probably under-powered with its two-cylinder J.A.P. engine. However, we were most agreeably surprised to find that it is so easy and simple to fly and that the engine is more than adequate.

In the Minor you feel that the aeroplane is part of you, and its quick, light controls make it a delight to fly. My first landing was far from perfect, but I found that the undercarriage was very forgiving and I did not bounce at all. I then found that by looking over the side I could easily see the wheel and judge my height to the inch, and several perfect landings seemed almost too simple to be true.

After less than half an hour each in the Minor, both my colleague and I had completely fallen for it, and our opinions were confirmed when we watched a Phoenix pilot put the Minor through its paces. Its turning circle beats anything that I have seen fly, and its manœuvrability in the hands of an expert is quite amazing. I am in no way connected with Phoenix Aircraft Ltd.—FRAZER MUSGROVE (Welwyn).

TWO SIMPLE TELESCOPES

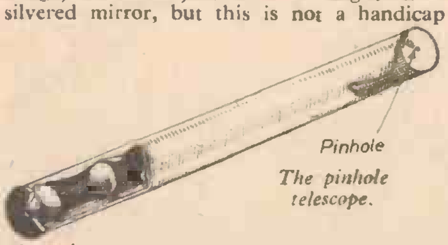
SIR,—I read your recent articles on building a reflecting telescope and found them very interesting. However, I cannot, at the moment, afford to make



A simplified telescope.

such an instrument; but I have made a simplified telescope which some readers may find interesting.

The mirror is made from the glass face of a broken alarm clock. I noticed that this had a focal length of 5in., but as there were two images—one from the back and one from the front of the glass, I roughened the back (to make it ground-glass) with emery cloth then painted this side with black printers' ink and then oil paint. The image, of course, is not as bright as a silvered mirror, but this is not a handicap



The pinhole telescope.

when the moon and the brighter planets are observed.

When the focal length is increased by using a concave lens, as in the Barlow lens, it is possible to achieve a magnification of up to 100x.

If the glass is toughened-glass then it is liable to break easily once the surface has been roughened, and a wooden shape should be cut to support it. As the edge of the glass in most clocks is a slightly different shape to the rest—although this is rarely more than ¼in.—a piece of black card may be cut to the shape of the edge and stuck on.

Another simple telescope, which is ideal for observing the sun, is a pinhole telescope. After all, we have pinhole cameras so why not pinhole telescopes, too? The focal length of the pinhole will be exactly its distance from the eyepiece assembly. The pinhole can be made with a No. 10 sewing needle into a piece of tinfoil stuck to thin cardboard.—JAMES SAUNDERS (Cardiff).

CAN MAN DEFINE NOTHING?

SIR,—Referring to the human ability to understand nothing (A. M. Coppins' letter in the September issue), it seems to me that the root of the matter lies in our conceptions of substantiality and ultimate causes.

The whole of man's understanding is absolutely derived from the world of physical things and, briefly speaking, any entity not physical cannot be accepted by our senses and is so barred from the mental picture of the outside world. In trying to understand such entities as God, resource must be had to physical comparisons to give the conception of God any meaning, therefore man's most noble attributes are used to describe God.

In the case of the "nothing" of empty space we can only recognise this as a substance-lacking void, any [illegible]ture it may have being of a nature we [illegible] physically unable to prove.

This brings us to query the reality of matter itself. Whereas we can understand substance as being composed of molecules, atoms and ultimately of energy, we cannot ascribe any physical character to energy to enable us to understand it because it is the basis of all matter. It is therefore an

(Continued at top of col. 3)

unknowable entity, and yet we understand it well and accept it as a commonplace thing purely by its interactions.

Briefly speaking then, we may say that anything which cannot be described by, or compared with, anything physical must be for ever beyond our understanding although we may quite comfortably accept its existence.

In this way the ultimate creation of energy must be a thing we can never understand and only when this established energy begins to form into electrons, protons, neutrons, etc., and these into atoms, can we begin to build a mental picture.

We can therefore only comprehend "nothing" as being the absence of anything physical.—R. B. TAYLOR (Kent).

Temperature Indicating Paints

SIR,—I should like to enlarge the answer given to J. G. Huggins in the September "Your Queries Answered," regarding the tempering of tools.

Paints have been developed in Germany which change colour when a critical temperature is reached. When they are cold they are painted or sprayed on to the metal. They contain temperature sensitive pigments and accuracy to within plus or minus 9°F is claimed, thus avoiding the necessity for a continuous watch on thermometers. They can also be used in crayon form to give a quick check on an already hot surface.—F. W. WOODWARD (Wallasey).

Clock Designer and Builder

SIR,—You may be interested to hear details of two clocks which I have designed and built at home. The mechanism of one of these, a chiming clock, is shown below. When the clock needs rewinding the clock face door swings open and remains open for 3/4 minutes and then closes. During the late afternoon and evening the face and figures are automatically lit while striking. The clock strikes from 10 a.m. to 9.30 p.m. It was built in 1922.

My other timepiece is a calendar clock and was built in 1939. This indicates the time, the date, month and year and reminds the user of Leap year and when the clock needs winding. Both of the clocks were built from scrap materials and both have been running now for many years.—GEORGE WHITTLE (Penally).

Mr. Whittle's chiming clock.

READERS' SALES AND WANTS

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

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AIR COMPRESSORS. single cylinder, two stage, 21/2 cu. ft. min. at up to 450 p.s.i.: suitable for spraying. etc.; condition as new but slightly store soiled: cost over £10; bargain at 35/- each. Air Lines. 40ft., new. 30/-. Cooper. 10, Fowler Street. Nechells, Birmingham, 8.

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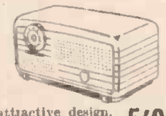

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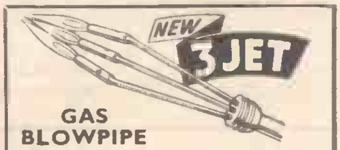
4¼IN. Planing and Rebating Machines, 30in. overall, adjustable cut, heavy ballraces, £6/10/-. Also 5in., 6in. and 8in. Planers at low prices. Combined 5in. Planer and 8in. Circular Saw (a really useful machine), £10/5/-. Heavy duty combination Woodworking Lathes from £10/15/-. Build your own Circular Saw cheaply; Circular Saw Spindles from 45/-. Full range for saws up to 30in. diameter. All machines fully guaranteed. Send 6d. for full lists and save pounds. Ortan Lathes. Falcon Works, Costessey, Norwich, Dept. P.M.



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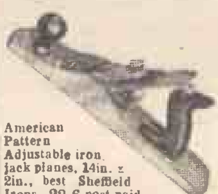

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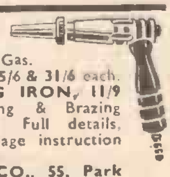

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PHOTOGRAPHY

2IN. X 2IN. Projector and Enlarger Castings, Bellows, etc. S.A.E. for details. V. J. Cottle. 84a. Chaplin Road, Easton, Bristol, 5.

BELLOWS, Camera, Enlarger. Process. Industrial Collapsible Machine Guards. Beers. 4. St. Cuthbert's Road, Derby. (Tel.: 41263.)

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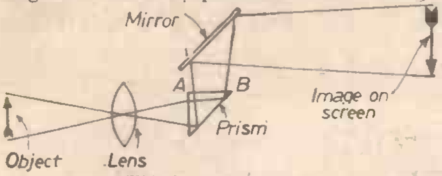
Continued overleaf

EPISCOPE PRINCIPLES

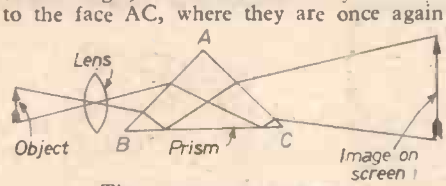
SIR,—Re the query on the episcope principle in the "Your Queries Answered" section of the October issue of PRACTICAL MECHANICS the arrangement shown in the diagram would not produce an erect image.



The incorrect set-up.

As shown above, the image would be inverted by the lens then the rays would be only slightly refracted by the prism, causing the angle of divergence to be decreased: then, at the sloping face of the prism, they would be totally internally reflected exactly as though a mirror were used. Finally, at the face AB the rays would be refracted outwards slightly, thus increasing the angle of divergence to the same angle as that before the light entered the prism, thus a mirror could be substituted making no difference in the result. As you have correctly stated this will not effect a vertical reversal of the image. The correct set-up is shown by my diagram below.

As can be seen, only one prism is required. At the face AB the rays of light are refracted slightly downwards. They strike the face BC at an angle greater than the critical angle, are totally internally reflected to the face AC, where they are once again

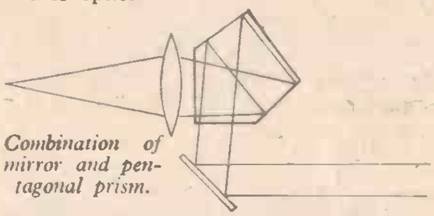


The correct arrangement.

refracted to travel along their original course but having been vertically reversed in the process, thus giving an erect image. This image is, however, still laterally inverted, i.e., the left-hand side of the object appears at the right-hand side of the screen and *vice versa*, thus, if this is undesirable, a second prism may be inserted but turned through 90 deg. so that it will reverse the image laterally instead of vertically.

Another method would be to simply use another lens to reverse the image produced by the first lens.—ROY MCALLISTER (Bury St. Edmunds).

SIR,—Re your reply to F. Miller, "Episcope Principles," the diagram is wrong in one important particular—the right-angled prism as illustrated would act as a mirror giving total internal reflection on the hypotenuse surface with no displacement of image by the right-angled surfaces. The tracing of the rays as given follows no known laws of optics.



Combination of mirror and pentagonal prism.

Your correspondent can get what he wants by a combination of mirror and pentagon prism in both the vertical and horizontal directions, but this would be very complicated and quite expensive.

A much simpler method is to have two lenses, the front one focusing on the aerial image of the rear. This front lens reverses laterally and vertically in one optical operation. Again, owing to the size of lenses and the corrections needed in each the price would be high.

I think F. Miller would be well advised to be satisfied with his reversed image.—H. F. STENSON (Birmingham, 20).

A simplified set-up.

WARNING TO HOME JEWELLERY MAKERS

SIR,—Concerning the home jewellery-making article in your October issue, readers should note that if they *sell* any of the pieces they make, they may be liable to be registered with H.M. Customs and Excise and to pay purchase tax. The usual £500 per annum exemption limit does not apply to certain classes of goods, of which jewellery is one. Anyone who contemplates selling home-made jewellery would be well advised to consult his local Officer of Customs and Excise first.—PRESS AND INFORMATION OFFICER (H.M. Customs and Excise).

ANSWERS TO PUZZLE CORNER

1. Two gallons, i.e., the dead man's ration for the remaining eight days.

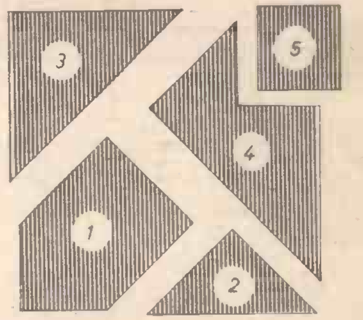
2. They are 8 mins. farther apart every day.

∴ After 90 days they are 12 hours apart, i.e., they read the same time. So that occurs on August 30th of the same year.

3. Total ways initially = 2,800.
Total ways finally = 1,400.

∴ The number was reduced by 50 per cent.

4. The five pieces fit together as shown below.



PERSONAL TRANSPORT OF THE FUTURE

SIR,—Will the roads of the future be in the air? In my opinion they will not, at least not in the foreseeable future. However, they should be and will be ultimately.

I base this opinion on the "negative thinking" of the powers-that-be to road problems.

It was patently clear to all after the war that chaos would result and the opportunity existed then to encourage private flying, yet the policy was to discourage it as much as possible.

As an ex-wartime and peacetime pilot I have a certain amount of sympathy and understanding of the potential dangers to airline planes if even one per cent. of private motorists were to take to the air as a serious means of transport and not just as a sport, but at the same time I do believe that the problems and dangers could be overcome by suitable design of the machine and stringent regulations.

As regard suitability of design I believe that there is already in existence a machine ideally suited to the purpose, it is, I believe, of American origin and the principle roughly is as follows:

It is circular in shape and may be considered as an ordinary aerofoil section wing bent to form a circle—leading edge cut like a doughnut.

An ordinary engine-powered air blower sucks air over the aerofoil section to provide the main lift aided by jet action of expelled air downward giving vertical lift. At suitable altitude, forward thrust from a small propeller air jet gives forward propulsion when the machine flies upon the more usual aerodynamic principle.

Such a machine has, therefore, every desirable feature. Vertical take-off, forward and backward flight, and none of the dangers of the helicopter design, i.e., rotating wing.

In the absence of a true weightless or gravitation resisting machine, the above mentioned would appear to be the most practical proposition which could be manufactured in numbers to sell at certainly no more and possibly less than the average family motor-car.

I believe that the realisation of popular air transport leading to the end of the big road chaos lies upon the authorities giving "blessing" to the scheme. At the moment the exact opposite is the case, and until there is a reversal of this attitude my answer to the leading question is a definite *No*.—P. HANCOCK (Middlesex).

A Hydrometer

SIR,—In your September issue you were advising a correspondent on how to make an alcohol test for home-made wine. I have an instrument for this purpose which works satisfactorily, which I purchased from Messrs. Loftus, of Tottenham Court Road, London, price 7s. 6d. This instrument is made entirely of glass and is, therefore, easily kept clean. An advantage over the one which you suggested is that no distillation is needed. —J. H. PENZER (Stourbridge).

Use Your Camera for Enlarging

(*Continued from page 118*)

of the carrier, and each has an aperture cut centrally and about ¼in. larger all round than the negative size (Fig. 5). Two pieces of wood, about 7/32in. thick × ½in. wide and 6in. long, act as spacers and are glued between the pieces of ply. The precise thickness of the spacers will, of course, depend upon the glass used. The entire wooden part of the carrier is screwed to the track with No. 4 × 1½in. long countersunk head wood screws, after being packed up in the same way as the lamphouse. The glass section of the carrier should be able to slide freely in the slot without excessive sideplay.

A sleeve of black cloth is attached around the edges of the negative carrier, using upholsterers' tacks, and the other end is fitted with an elastic band so that it grips the camera body firmly. If the camera back does not come off completely it can generally be swung well clear.

The enlarger is now ready for use, and detailed instructions on the actual technique can be obtained from any of a wide range of standard textbooks. In the present case the enlarging paper is pinned or taped to a vertically positioned board or a wall and the size of the image adjusted by moving the entire enlarger nearer to or further away from the paper. Sharp focus is obtained by sliding the camera carriage along the track.

TRADE NOTES

A REVIEW OF NEW TOOLS, EQUIPMENT, ETC.

Combined Arc Welding and Brazing Set

MARKETED by Taylor Bros. (Yorkshire) Ltd., 32, Baker Street, Middlesbrough, the F.M. 65 combined arc welding and brazing set is the smallest model of a range of industrial welding equipment made by Ferrous Transformers, Ltd. Designed for industrial use, the machine is more robust than the usual amateur equipment and is capable of undertaking a wide range of welding brazing and silver soldering work. It will give a full output of 65 amps. from a 15 amp. domestic power point and using one all-purpose 14 s.w.g. electrode ensures that welding becomes a simple operation under conditions not usually possible. The portability of the equipment makes it especially suitable for carrying out welding repairs *in situ*. A special low voltage tapping giving 250 amps. makes brazing hard surfacing and silver soldering practicable. The set, complete with accessories and instructions, costs £25.

The combined arc welding and brazing set in use.

The "Supersander".

New Wolf Accessories

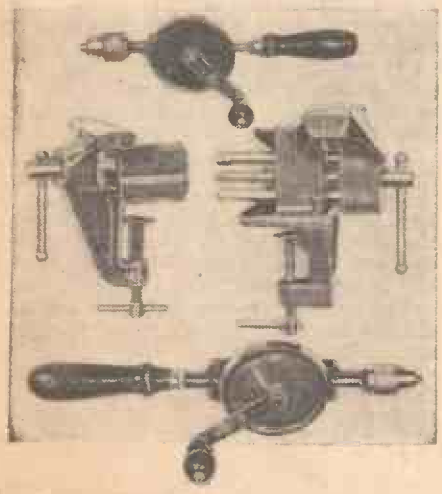
TWO new accessories are now available for use with Wolf power units, they are a speed reducer unit, known as the "Lo-Speed" and an orbital sander, the "Supersander," shown in the photograph.

The speed reducer unit is easily attached and incorporates two trains of spur gears to give a ratio of 4:1 and speeds between 600 r.p.m. and 350 r.p.m. according to the power unit used. It costs 42s. 6d.

The orbital sander can be fitted with new sander sheets very easily by placing them against a hexagon roller and tightening a screw. To eliminate vibration, the drive is transmitted through a vulcanised rubber disc which forms a cushion between the working head and power unit. Price is £5 17s. 6d., including six sanding sheets and a sponge rubber pad. A range of accessories is available as extras.

Fabrex Tool Range

THE tools shown in the photograph below are the first of a new range to be marketed by Fabrex Tools Ltd., a new company formed by the makers of "Record" tools, C. & J. Hampton Ltd. The smaller drill, priced at 14s. 6d., takes up to ¼in. drills and the larger double pinion model up to 5/16in. drills. The price of the latter is 23s. 6d. The table vices have jaws of 2½in. and 3in. and are priced at 13s. 6d. and 24s. 6d. respectively.



The Fabrex tool range.

Bridges 6in. Super Saw Kit

TO introduce their new 6in. Super Saw Kit, Bridges are offering the kit at £19 2s. 3d. This represents a price saving of £1 if the contents, listed below, were purchased individually.

A 5/16in. MK IV "Neonic" safety drill.
A NuRip protable saw with 6in. Nu-Rip saw blade.
A Multi-Purpose saw table.
A 6in. Combination saw blade.
A booklet "Let's Get Started."

Powered by the latest Bridges "Neonic" drill, this new kit has been designed to cover every sawing operation likely to be needed by the home workshop enthusiast—it also has much to offer the industrial user with a small joinery shop. Each item in the kit is already well established in the Bridges range.

D.I.Y. Printed Circuits

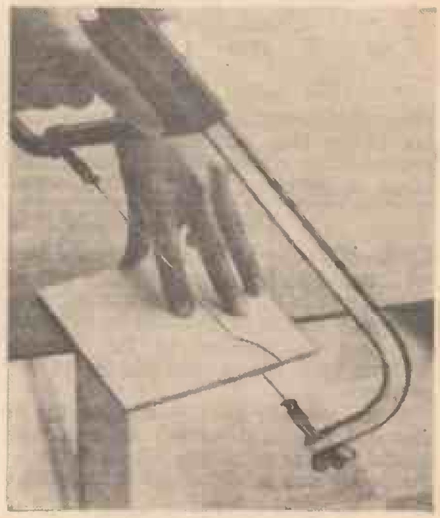
THE production of a kit by Messrs. Proops Bros. Ltd., 52, Tottenham Court Road, London, W.1, has now made it possible for amateur radio and television enthusiasts to make their own printed circuitry. The kit, which costs 19s. 6d., or 21s. by post from Proops Bros., contains everything necessary, including three sheets of laminate, four bottles of chemicals, i.e., etchant, resist, solvent and cleanser. The case which contains the kit is used as the etching bath, the lid forms a working drip tray and the final items included are a brush, a suction cup handling tool and a set of instructions. This latter, in addition to giving comprehensive step-by-step instructions, includes sections on circuit design. Apart from its obvious utilitarian advantages this kit should provide the enthusiast with a fascinating extension to his normal range of interests.

Plaster Hardener

MESSRS. VINATEX LTD., Devonshire Road, Carshalton, Surrey, have just developed a new product, namely Vinatex Plaster Hardener SP10, which is ideally suited for hardening plaster. It also increases its break and bending strength, reduces the porosity of the plaster, enabling painting to be done almost immediately and reduces surface defects, such as small air holes. The price is 25s. per half gallon can, or 35s. for one gallon.

Tile Saw

DAFILES LTD. are now marketing a blade which will profile-cut glazed ceramic wall tiles up to ¼in. thick.



The tile saw in action.

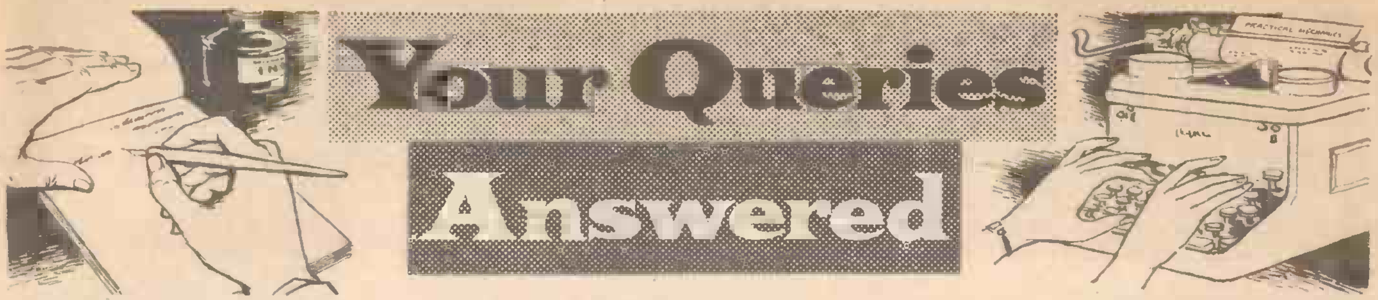
This blade, known as the New Formula "Tilefile," fits any standard 10in. hacksaw frame and, as with all Dafile products, has teeth all round, thus enabling any shape to be cut.

The tiles to be cut can be marked out, using a china-clay pencil, and the line followed with the "Tilefile" blade.

Broken tiles are very rare with careful use of the "Tilefile," thus its cost (3s. 10d. retail, including frame adaptors) is very promptly compensated.

Change of Address

MESSRS. LIGHT SOLDERING DEVELOPMENTS LTD. have now removed to 28, Sydenham Road, Croydon, Surrey. The existing telephone number remains the same.



Christmas Tree Novelty

THIS Christmas I am going to install a Christmas tree with the usual decorations, lights, etc., and would like to illuminate the tree from the bottom, with a beam of light, which would change colours in rotation, so as to give the impression of movement. Can you suggest a method of carrying out this project?—J. M. Green (Co. Donegal).

AN arrangement similar to that used in some electric fires, where hot air rising from a bulb rotates a fan, would be suitable. The fan could be cut from thin metal, and be about 3in. in diameter, being pivoted on a thin wire or pointed rod so that it turns easily. The bulb would be directly below, and a cylinder some 4in. long or so can be attached to the fan, to enclose the bulb. Openings are cut in this cylinder opposite the bulb, and covered with transparent coloured material. As the coloured light has to be directed upwards a mirror at 45 deg. should be fixed near the cylinder. Unnecessary light can be trapped by enclosing the equipment in a three-sided box with top.

Making Insecticide

PLEASE tell me how to prepare a fly spray solution, containing either D.D.T. or some other suitable insecticide.—G. T. Evans (Staffs).

ASSUMING that you have D.D.T. (dichlordiphenyltrichloroethane) in powder form, all that is necessary is to make a liquid suspension in kerosene.

An alternative insecticide could be:

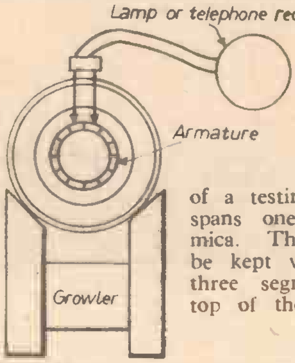
Benzene hexacholide obtainable from: B. D. H. Ltd., Graham Street, London, E.C.1.

Testing Electric Motors

I WISH to carry out small motor repairs but have only A.C. current. Could you tell me the best way to drop test armatures for shorts, etc., and field coils for resistance.—Philip McEnroe (Newcastle-on-Tyne).

FOR the testing of armatures you could use a "growler" fed from the single-phase A.C. supply. In order to test a small armature this is placed on the poles of the growler as indicated. A short-circuited armature coil will be indicated by a steel feeler gauge vibrating when the feeler bridges the armature slot. The feeler should be applied to the top armature slot, the armature being turned round to test the slots in turn. In order to determine whether a short circuit is in a coil, or between the commutator segments, a knife may be used to bridge the commutator segments. If a spark is noticed when the knife blade then breaks contact with one segment the short circuit is in the coil. If no spark is noticed the short circuit is between the commutator segments.

In order to locate reversed leads and open circuits as well as short circuits the armature is rotated on the poles with a low voltage lamp connected to two points of a testing fork which spans one intersegment mica. The fork should be kept within two or three segments of the top of the commutator, while the armature is revolved a step at a time. A change of light from the lamp indicates a defective coil.



Using a growler for testing a motor.

In order to test the resistance of field coils you could use a resistance test set in which a hand-driven generator and ohmmeter are incorporated. Messrs. Evershed and Vignole supply a useful set which can be used for resistance of insulation resistance measurements. In order to carry out volt drop tests in field coils we suggest that the best way would be to obtain a D.C. supply from a transformer and metal rectifier with smoothing capacitor, or to use an A.C. to D.C. motor generator set or converter. Volt drop tests on armatures could be carried out with D.C. obtained from a 12 or 24 volt accumulator, which could be trickle charged from the A.C. mains.

3-D Projection

PLEASE tell me the principle of operation of a 3-D projector.—W. Mitchell (Cardiff).

THE usual method is to project right and left pictures through vertical and horizontal polarising screens, viewing the combined image with spectacles having one vertical and one horizontally polarised glass, so that each eye can see only the correct image. The polarising screens cannot be made at home. It is also necessary to have the projector lenses and systems very well matched so that both images coincide exactly except for the normal stereo displacement.

Equipment for building up such a system, such as screens, etc., may be obtained from large suppliers of photographic equipment, such as Wallace Heaton, 127, New Bond Street, W.1, or R. F. Hunter Ltd., 51/53, Gray's Inn Road, W.C.1. The cost for equipment giving a satisfactory result is not low.

Mirroring Perspex

PLEASE tell me how I can mirror the inside of a blue Perspex bowl.—L. Lewis (Northampton).

THE following preliminary stages must be carried out with vigorous scouring out with clean water after each stage, except where indicated.

1. Scour thoroughly with a proprietary kitchen scouring powder on a cotton-wool pad.
2. Degrease with carbon tetrachloride.
3. Fill completely with 10 per cent. solution of potassium cyanide (very poisonous).
4. Fill completely with acid potassium dichromate and keep this solution in the bowl for one hour.
5. Wash out thoroughly with clean, cold water. This must be done after each stage described above.
6. Fill bowl with a saturated solution of stannous chloride and wash with water once only, so that there remains a molecular film of stannous chloride on the surface of the perspex.

Silver solution:

A. Silver nitrate, 100 gms. per litre; potassium hydroxide, 50 gms. per litre.

RULES

Our Panel of Experts will answer your Query only if you comply with the Rules given below

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.

Make up these two solutions in separate beakers and when the salts in each are dissolved, add the potassium hydroxide solution slowly, with stirring, to the silver nitrate solution. A brown precipitate will form. Now add 10 per cent. ammonia in water to the mixture until the brown precipitate just disappears. Put the whole bulk into a clean bottle and label "A."

B. Rochelle salt, 1.7 gms. per litre; nitrate, 2.0 gms. per litre.

Put this into a separate bottle and label "B."

The preparation of these solutions, "A" and "B" must be done before the process of cleaning described in the first part of these notes is started.

Silvering Perspex:

Immediately upon reaching stage 6 of the preparation, i.e., after once rinsing out the stannous chloride, pour simultaneously and as nearly as possible equal proportions of "A" and "B" into the bowl to whatever level you wish to silver and leave undisturbed for about 10 minutes to 20 minutes.

At the end of 10 minutes tip the bowl to see how the deposition of silver is behaving and if it appears satisfactory tip the solution away and wash out the bowl with cold water; distilled water is preferable.

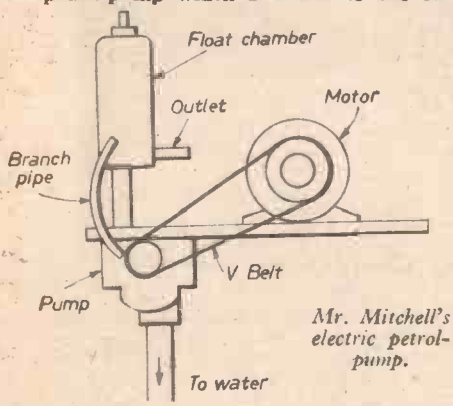
Note: Use distilled water when making up solutions "A" and "B."

If the first attempt is not successful dissolve the silver in strong nitric acid, wash bowl thoroughly and start again.

A warning should be given here about the highly explosive nature of ammoniated silver solutions and their residues. While the solutions "A" and "B" are perfectly safe for storing, the process of ammoniating should not be allowed to take up too much time. It should not be done at a temperature higher than 65 deg. F. and ammoniated solution "A" should under no circumstances be kept. Further, all unused and spent ammoniated "A" and "A" + "B" solutions should be swilled away with copious amounts of water, and all utensils thoroughly rinsed to avoid the retention of dried material which will almost certainly contain silver azide.

Self Priming a Pump

I HAVE acquired a second-hand electric petrol-pump which I intend to use for



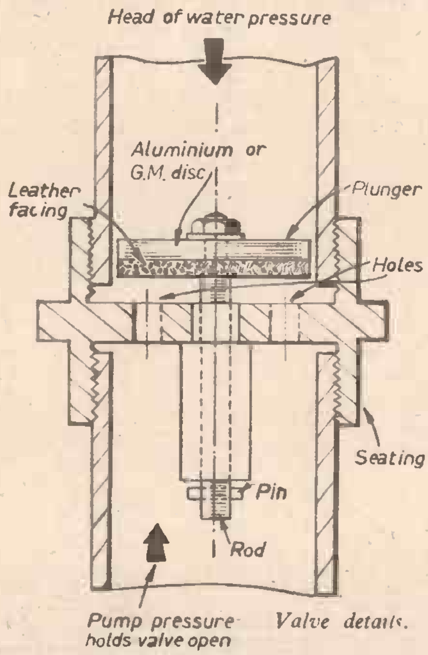
Mr. Mitchell's electric petrol-pump.

pumping water from a well to a header tank on the hill behind my house. Unfortunately I cannot get this pump to prime itself, and wonder if you can supply me with a working diagram. The pump was originally used for dispensing petrol at a garage and I know it should be self priming. The well is about 25ft. to water level and there is 15ft. of water. I have fitted a foot valve. It does pump quite well once it is going.—A. L. Mitchell (Wolverhampton).

IN order to overcome this problem you must install a valve on the delivery side of the pump which will close automatically when pumping ceases and "hold" a head of water and prevent it flowing back through the pump unit into the well.

The sketch below shows how to arrange this valve. If you possess the facilities, the manufacture is a simple matter, but any firm of pump suppliers should be able to provide one from their stock.

A ring with a series of holes or apertures as the seating and a plunger which is lifted by the water pressure are the two main items



Valve details.

of this assembly. This plunger remains in the open position all the time the pump is lifting water from the well, but immediately the latter is turned off the water in the long pipe to the top of the hill exerts pressure simply by gravity and holds the plunger down on the seating. It is, of course, necessary to retain the plunger in the seating otherwise the pressure will cause it to leave the bore in that member, but this arrangement while depending on the design you adopt, can be a simple pin driven across the shaft. We suggest that you make the plunger head of aluminium or gunmetal which has been machined away as much as possible in an endeavour to lighten it, and a plain disc of leather or similar material will ensure there is no leakage from the apertures. If possible, fit this valve as a separate unit as this simplifies replacement.

Soda Water Syphon

WOULD you please tell me how the ordinary siphon soda water bottle functions?—H. Heaton (Salford).

ALTHOUGH the soda water holder is known as a siphon it does not work on a siphon principle. The glass outlet tube is only taken to the bottom of the bottle to ensure collecting the whole of the liquid. It is the pressure contained in the soda water (by injection) that causes it to be forced out when the valve is opened. The soda water is blown out and is not siphoned.

Connecting Fluorescent Tubes

MY petrol electric plant has an output of 2 amp. at 230V A.C. (actually 500-watt) and it is desired to run 10 20-watt fluorescent tubes with, if possible, current to spare for a radiogram (taking some 100 watts). The light fittings that I have contain a choke (ballast) and starter switch only (no P.F. condenser). The tubes are 20-watt.—F. Hossell (Seychelles).

IF the lamps are designed to start on 110/115 volts you could connect two lamps in series with each other and in series with a 40-watt ballast choke. A 115-volt starting switch should then be connected across each tube. In order to improve the power factor you could connect a capacitor across each pair of lamps. A capacitor or capacitors will be neccessary to enable high power factor operation to be obtained.

Reflecting Telescope

I AM thinking of building your 6in. Astro reflecting telescope, but would like to know if each different diameter mirror has its own standard focal length.—J. Sydenham (Leicester).

THERE is no specific focal length for each diameter of mirror. A 6in. diameter mirror can be figured to give a focal length of 42in.

$$f/7\left(\frac{42}{6}\right) \text{ or } 48\text{in. } f/8\left(\frac{48}{6}\right) \text{ or } f/9$$

focal length 54in. It depends on what is wanted.

It is better to keep to f/7, 42in. focal length so that the tube length is short.

Speedboat Construction

I AM building a 12ft. speedboat and would like to know if ordinary aluminium sheet can be protected successfully against sea water corrosion. Also would a Ford 8 h.p. engine be big and fast enough to drive the boat at a good speed?—B. Palmer (Swansea).

PURE aluminium sheet can be treated to resist sea water by merely ensuring it is properly painted. Alloys of aluminium would be better and harder and anodised sheets would be ideal.

For amateur use we strongly recommend the use of marine ply before aluminium sheet.

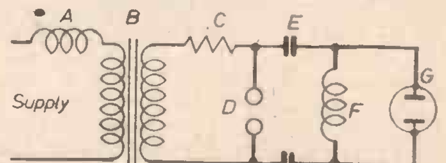
An 8 h.p. Ford engine would be satisfactory for an inboard engine. It is presumed this query is raised because such an engine is available cheaply, otherwise an outboard motor has many advantages for a small speedboat, not the least of which is the simplicity of installation.

Pulsating Lamp

I WISH to make a variable pulsating-lamp to produce a stroboscopic effect for the inspection of "running machinery."

Please suggest a suitable circuit.—B. E. McCanking (Sheffield).

YOU could use the circuit shown below. A large inductance A is connected in



Circuit for a pulsating lamp.

series with the primary windings of the transformer B. This transformer may have a step-up ratio of about 60 : 1 and is designed so that its core is saturated during the greater part of the magnetic cycle when the primary current is low. The secondary winding is connected through the 2MΩ resistor C to the spark gap D, one side of which is earthed. The neon lamp G is fed through the two capacitors E with a small inductance F across the lamp. Variable frequency of flashing is obtainable by using a variable resistor at C. The secondary voltage charges the capacitors E until their potential difference is sufficient to break down the spark gap D. When this occurs an impulse is generated which causes the lamp to light with a bright flash.

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Vol. XXVIII No. 447

COMMENTS OF THE MONTH

The Future of Herne Hill

A NEW lease of life has been granted to London's Herne Hill track, which has been steadily losing money over the past few years for its lessees, the B.C.F., formerly the N.C.U. This comes about as a direct result of the London County Council taking over the track from the B.C.F. The buildings are somewhat dilapidated and about £5,000 would be needed to restore them. The B.C.F. has decided that it can no longer afford to carry such a liability. Disposal of the lease might have meant that the track would no longer be available to the general public, so the L.C.C. is to take it over under the Physical Training and Recreation Act of 1937.

The terms of the transfer are that the lease will be relinquished without a premium, but the estimated £5,000 liability for making good defects in buildings, etc., will also be accepted by the L.C.C. The original lease has 25 years to run, but a special extended lease of 42 years has been arranged at £600 per year. More money—about £7,000—is to be spent on improvements to the track, the stands and the refreshment building; the athletics track is to be resurfaced and its use revived.

The present system of letting to clubs, etc., is to continue and until specifically announced, the B.C.F. will continue with the administration as at present.

Audible Warning—is it Necessary?

Anyone who uses the roads, particularly the main roads, regularly must have at some time wondered what the purpose of audible warning is. Its prime purpose, i.e., that of giving a polite warning of approach, seems to have been lost and instead loud blasts are used to express the annoyance of drivers delayed for a few moments, or alternatively to frighten other road users out of the way by sheer volume of sound. Surely this is misuse of something originally intended to serve a purpose far less violent!

When one considers that so many drivers only use their horns in this way, the thought arises, "Is audible warning necessary at all?" It has been abolished in Gibraltar for some years now and there is no reason to believe that the accident rate has risen as a result. It is true that drivers there, particularly taxi drivers, have evolved their own method of audible warning by banging with the flat of the hand on the outside of their vehicle's door, but this is preferable to the raucous and discordant din produced by modern motor horns. Paris, too, has more recently forbidden the use of audible warning.

An alternative, perhaps, to abolition—a word which is always an anathema to a freedom loving people—is to fit only horns tuned to one key. Think how much more pleasant is would be to receive warning of a vehicle's approach by the sound of a pure note like that of a trumpet, instead of a raucous and brassy belch of the type now so common; but this must remain a pipe dream for the modern motor horn is not designed with beauty in mind but instead strident urgency is the theme. There is one point in its favour, however, it prevents a tendency to stop to listen to a pleasant sound instead of jumping for one's life!

Our New Minister of Transport

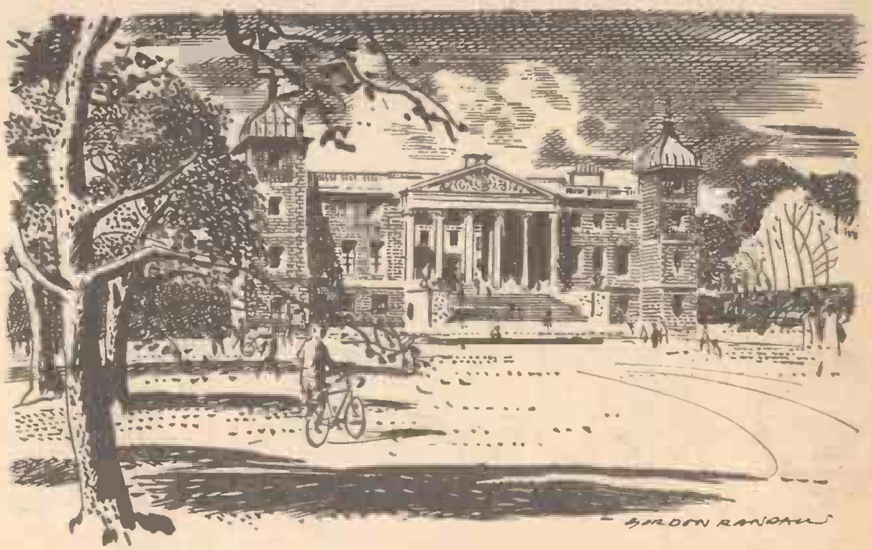
There cannot ever have been many cycling M.P.'s and fewer still with Cabinet rank. It must therefore be a very rare occasion when me have a cycling Transport Minister, as we now have. Mr. Ernest Marples, M.P., is a very enthusiastic cyclist and has been for many years. He started cycling as a boy and still cycles both for business and pleasure. He rides round London to business appointments and his bicycle also carries him to the House of Commons. He usually spends his holidays abroad in company with his wife—and their bicycles!

Minister of Transport is not an enviable post at the present time and Mr. Marples has inherited a number of problems which will be very difficult to solve. The twin problems of inadequate roads and too much road traffic will provide headache No. 1 and the ever growing road casualty figures will provide another. Perhaps, however, as Mr. Marples' road experience has been gained from a different viewpoint to that of his predecessors, he will have a new approach to the problems.

It is unlikely that Mr. Marples will bring about any sweeping changes which will particularly affect cyclists, but it is certain that any legislation affecting cyclists will be assured of at least one sympathetic and understanding ear. Perhaps, too, he will be able to do something to clarify the position with regard to racing on the open road.

1960 Tour of Britain

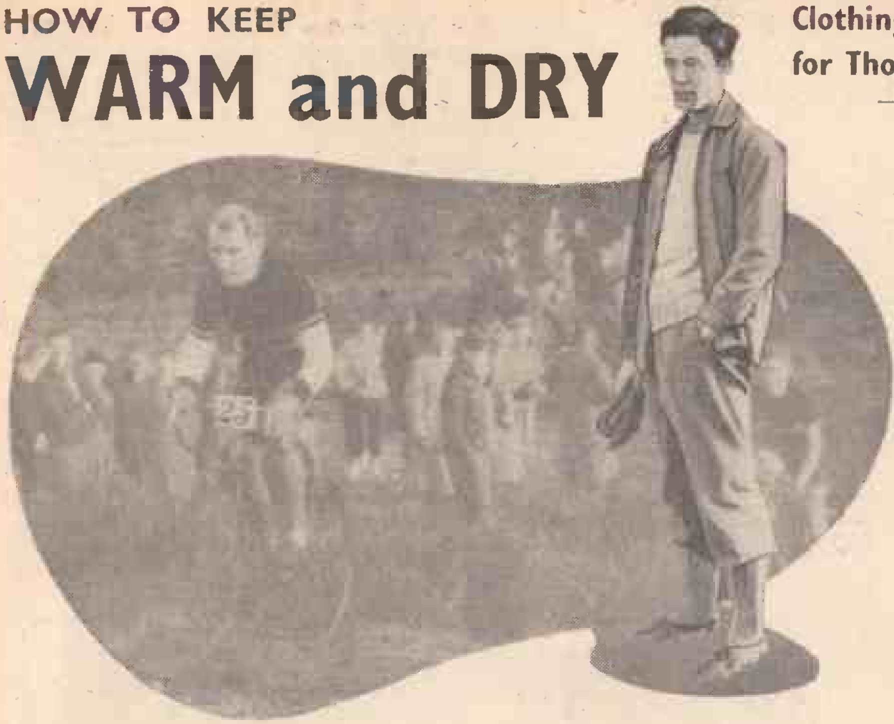
Next year this event is again to be sponsored by the Milk Marketing Board and together with the B.C.F. who will promote it, they have decided to restrict entries to amateurs only. There will be teams to represent England, Scotland, Northern Ireland and Wales. There will be regional teams representing the South, the North, London, the East Midlands and the North West. Teams from the Army and the R.A.F. will also take part and invitations have been sent to Belgium, Holland, Sweden, Russia and East Germany. The race will be run from 6th to 18th June, starting and finishing in Blackpool.



This lovely house with its lakes and glorious parkland is at Osterley, Middlesex.

HOW TO KEEP WARM and DRY

Clothing and Protection are Discussed for Those Who Cycle All the Year Round



THERE is no reason to let cold winds and winter weather prevent you from cycling all the year round. It is possible to keep warm on a bicycle and at the same time look smart, particularly now when manufacturers are producing many lines specially for the cyclist. Clothing has been standardised to a certain extent among clubmen to produce what is almost a uniform; but, in the author's opinion, they have discovered the best clothing formula for cycling. The cyclist in the heading photograph is wearing it.

Obviously, when riding a cycle, the legs are the only part of the body which move to any great extent. This means that heavier clothing will be required for the upper half of the body.

Warmth is best provided by a woollen jersey over the normal shirt, etc., but to keep the heat in, a windproof covering of some sort should be worn. One of the many types of showerproofed zip jackets is best for this. Not only are they proof against wind and light rain, but they are extremely smart in appearance. Always buy one of these jackets hip length, as waist length garments are inclined to ride up the back, due to the rider's position on a sports machine. This, of course, applies equally to the jersey or sweater worn underneath. Perhaps even more efficient for protection against the weather is the Anarak type of jacket. Originally designed for climbers, these do not open down the front but are pulled over the head and zipped up tight round the neck. Draw cords are fitted at the waist and in the hood, enabling this to be fitted tightly round the face. They are hip length and the waist and cuffs are elasticated to keep out the wind. They are perhaps not as smart in appearance as many of the tailored jackets, but they are extremely efficient and comfortable.

Nether Garments

At one time, standard winter equipment for the cyclist always included plus fours, but few riders wear these today. The snags were that the bulky folds of material were inclined to get mixed up with the chain, and in wet weather they held an excessive amount of water, picked up from the front wheel. Much more suitable is the modern substitute of "plus two's" which retain all the advantages of plus fours, i.e., large reinforced seat, ample room for leg movement and absolute freedom at the ankles.

Jeans are worn a great deal by the modern cyclist; they have the advantages of no loose flapping folds of material and of being substantially windproof. Not every rider, however, can obtain enough freedom of movement in them, and extracting and replacing a handkerchief while riding demands manoeuvres worthy of a trick cycling contortionist. Corduroys are bulky and not really windproof. Better than these are whipcord or Bedford cord trousers which are reasonably windproof and extremely hardwearing. Trousers specially for the cyclist are being made on the lines of plus fours, but closer fitting, with reinforced seats and elasticated waists. These are perhaps the best answer of all. Freedom of movement and a reasonable degree of windproofing are the main requirements.

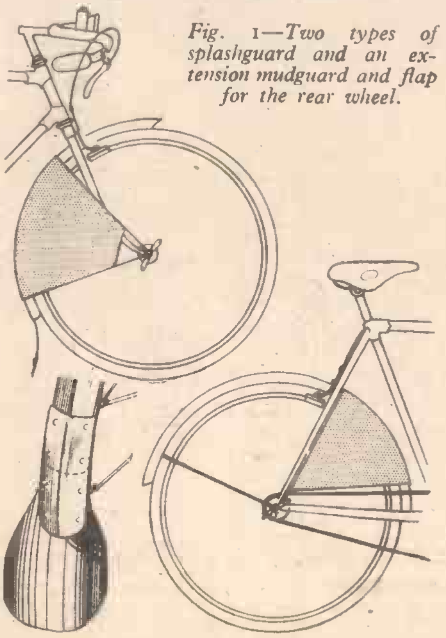


Fig. 1—Two types of splashguard and an extension mudguard and flap for the rear wheel.

Socks and Shoes

If there has been invented a satisfactory way of keeping the feet warm on a bicycle, the author for one would be very glad to hear about it. However, a fairly heavy pair of long wool, or wool and nylon socks is a help and a pair of cycling shoes heavier and more roomy than usual, may help even more. Choose cycling shoes without flaps as these serve only to get tangled up with the toe-clips. Relaxing the pressure of toeclips and straps may help to keep the feet warm. If it is possible to move the toes, circulation will be improved.

Gloves

A certain amount of flexibility of hand movement must be maintained so that brake levers may be handled quickly and effectively and therefore gloves of fairly thin texture are advisable. Gauntlets are not necessary, although they should be long enough to prevent the wind from passing up the sleeves. Mitts with four fingers in one portion and the thumb separate are satisfactory and probably warmer than ordinary gloves.

Headwear

This again is a matter of choice. Many men wear the modern style of "County" cap while others favour a beret of one style or another. Some take the opportunity of wearing something unconventional. The beret and the time-honoured "peasant" scarf are popular among the ladies.

Keeping Dry

This, as distinct from keeping warm is the other problem facing the winter cyclist.

The main necessity, of course, is a good cape. The modern style of waterproof is made in plastic, although good quality oilskin capes are still popular. The things to look for when buying a cape are: ample skirt size, thumb tapes and waist tapes, ventilation in the back and a good strong zip or press studs.

For keeping the head dry, there are few things better than a sou'wester, either of plastic or oilskin. Some riders claim that a cap is better because it keeps rain off the face and out of the eyes, but the sou'wester stops it dripping down the back of the neck.

Opinion is divided on the wearing of leggings. Some riders maintain that there is little advantage as condensation causes as much dampness as the rain would if they were not worn. However, of the many types available the most comfortable and those giving the most freedom are the type which cover the foot and fit close to the leg to just above knee height. These will keep shoes, socks and trousers dry and condensation can be kept to a minimum by travelling slower and not getting too hot. For the more leisurely rider heavier and more capacious leggings are available.

Mudflaps and Wheelguards

Preventing water from being splashed up from the tyres is half the battle in keeping dry on a bicycle. Good wide mudguards, fitted as close as possible to the wheels and a large mudflap on the front guard will do a great deal to help. A splashguard added to this as shown in Fig. 1 will reduce the water splashed up even more. A splashguard will help on the rear wheel as well and, if riding in company with others, a rear mudguard extension and a mudflap on the back wheel will be appreciated by those riding behind (see Fig. 1).

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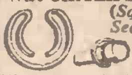

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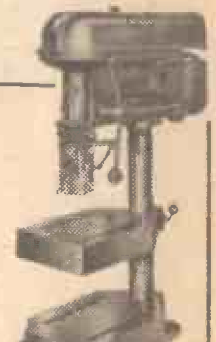

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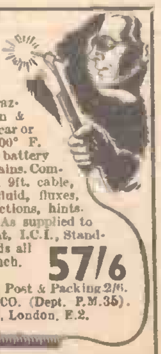

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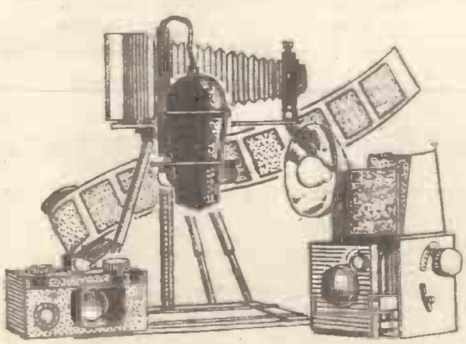

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