PRACTICAL MECHANICS

1/3

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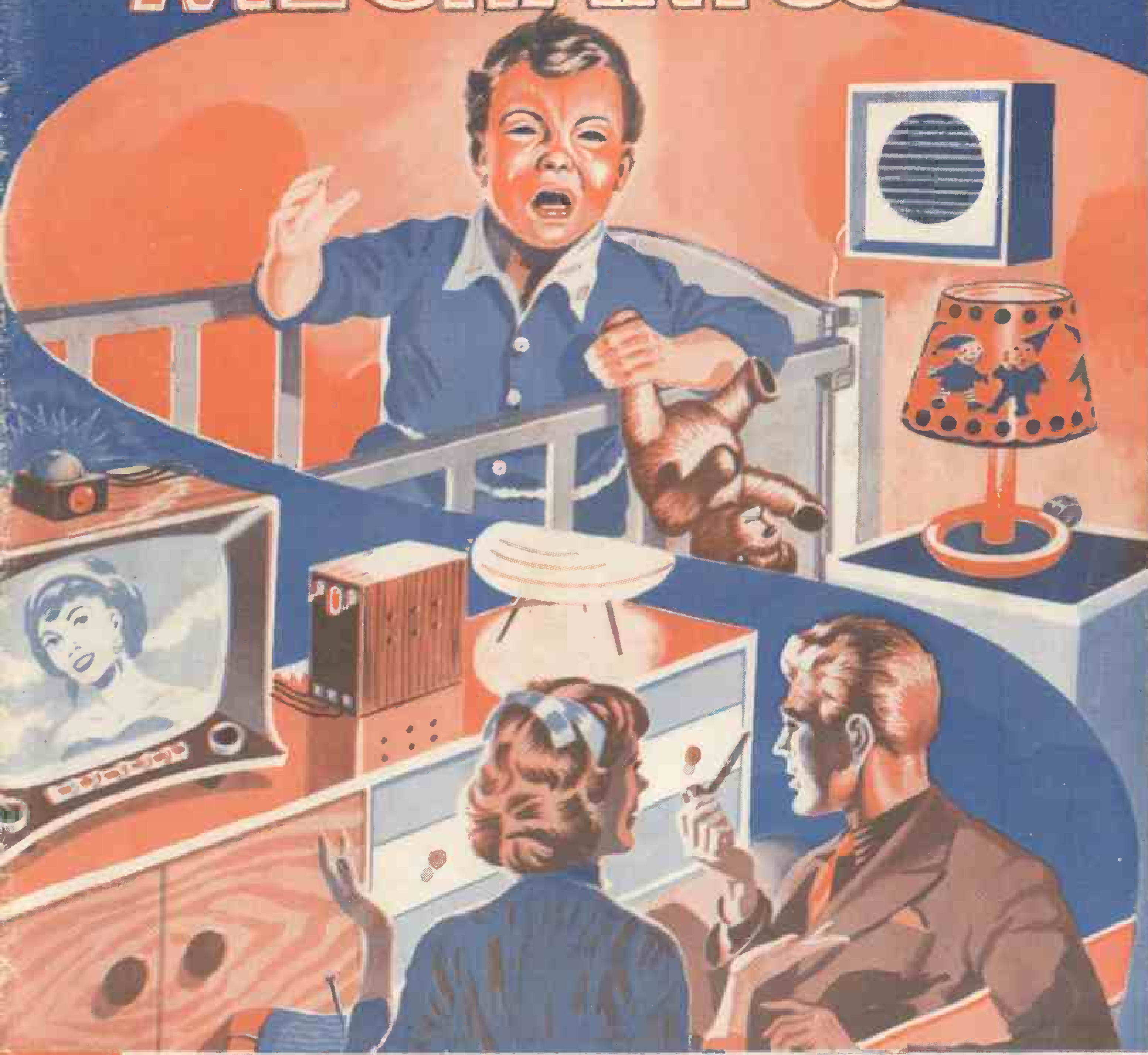

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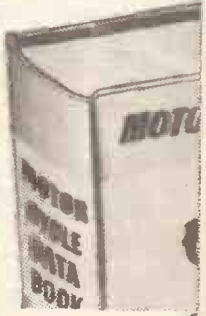

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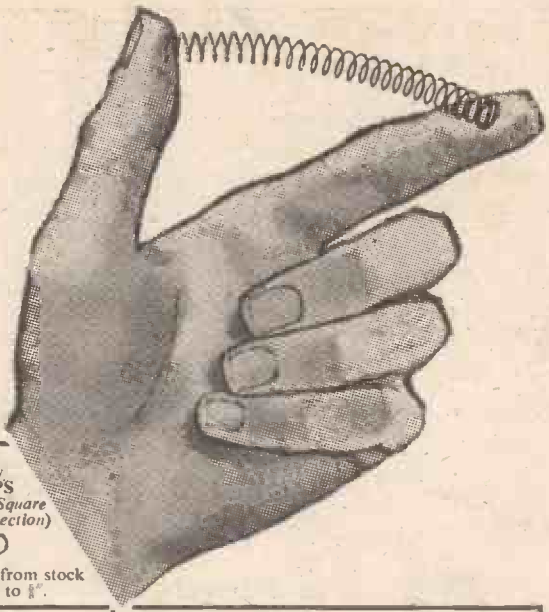

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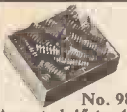

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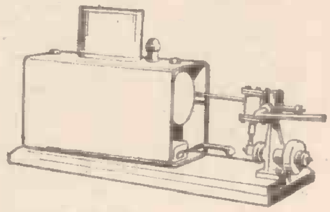

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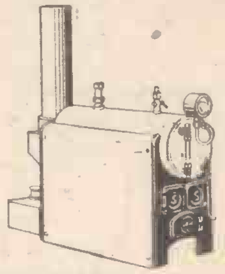

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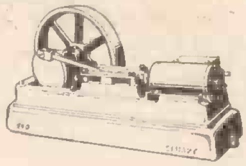

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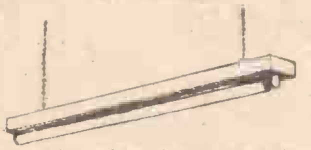

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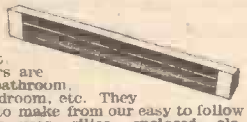

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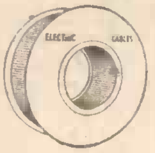

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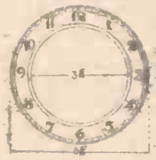

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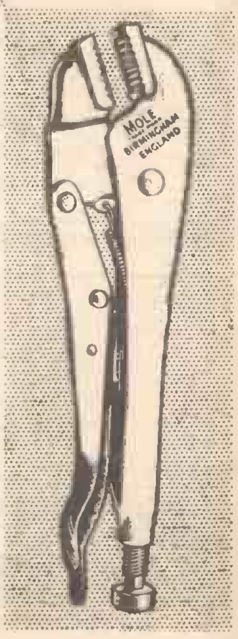

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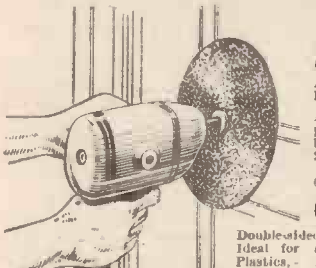

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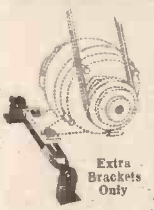

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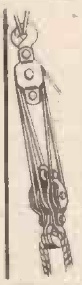

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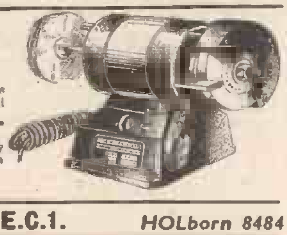

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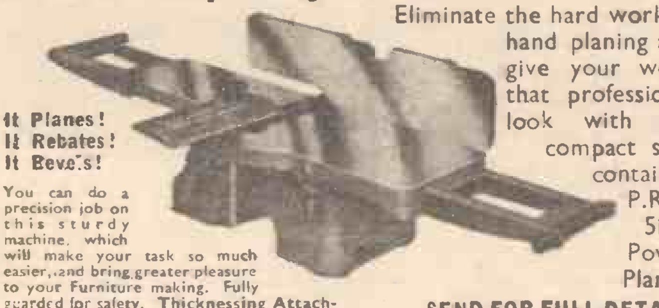

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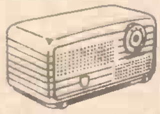

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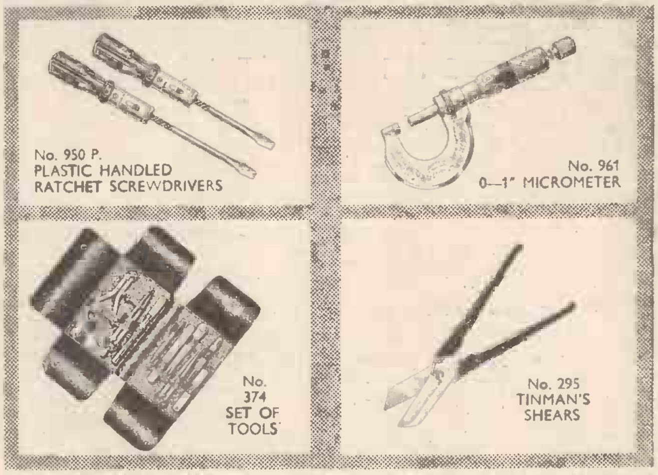

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MARCH, 1960

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THE CYCLIST SECTION

CONTRIBUTIONS

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FAIR COMMENT

NEW SOURCES OF ELECTRICITY

IN many parts of the world scientists are carrying out experiments to find new ways of producing electricity. Several different processes are being worked on at the same time but the end in every case is the same—to replace the dynamo and the battery. The dynamo is an extremely efficient piece of apparatus and it produces electricity very satisfactorily, but driving it adds complications and expense. Hydro-electric power requires the construction of immensely expensive dams, and to drive the normal power station coal is burnt to provide steam, which drives a turbine, this in turn driving the generator. The atomic power plant merely substitutes a new fuel. What is aimed at then in all this research is to produce electricity more efficiently.

One of the methods being experimented with independently by several scientists in America is based on the principle of converting heat to electricity by means of a thermocouple. Wires of two different metals are joined, one end is heated and the other cooled, and electricity flows—that is the principle of the thermocouple. An efficient method of keeping the two ends at different temperatures is by keeping part of the thermocouple in a vacuum, i.e. the diode valve. When modified this device can produce electricity from heat.

The new semi-conductors are being used to produce electricity in very much the same way. The crystal, when heated, gives up electrons to a new position where their surplus energy can be used as electricity. It is believed that the efficiency of these methods will be able to compare favourably with the conventional power plant within very few years. At the moment they produce electricity with about 10 per cent. efficiency. Where heat normally wasted is available, even this relatively low efficiency can be very useful indeed. For example, the Russians are believed to have used this method in their Sputniks, the heat being provided by the sun.

Another revolutionary method of producing electricity is the use of the chemical battery or fuel cell. The normal battery can be used until its chemicals are exhausted and then has to be changed or electrically recharged. The new "battery" receives its chemicals from outside the cell and so long as they are provided it will generate electricity; its efficiency in theory could be nearly 100 per cent.

The device is constructed similar to a battery. The cell contains potassium hydroxide—the electrolyte—in which are immersed two electrodes. Hydrogen is fed to one and oxygen to the other. In the ensuing chemical reaction water is formed and negatively charged electrons collect on the hydrogen-fed electrode. If an electric motor is connected electricity flows from the hydrogen electrode through the motor and back to the oxygen electrode. Power is increased by linking cells in series. Extensive research is at present in progress on other chemicals for these cells, including oil, and some 20 firms in the U.S. are working on practical applications for them. Scientists predict that the fuel cell may soon be powering a new gearless, silent motorcar and eventually other forms of transport as well. It is of interest to note that the first practical demonstration of the cell was given by a British engineer, Francis T. Bacon.

"PRACTICAL HOUSEHOLDER" AT OLYMPIA

THE Ideal Home Exhibition opens at Olympia in a few days' time and all practical mechanics and home handymen are recommended to pay a visit to the bungalow erected by New Ideal Homesteads Ltd. in the Model Village. This lovely home has been furnished and equipped by "Practical Householder" with a special eye to the do-it-yourself enthusiast. All you home owners, we are sure, will find a great many practical and attractive ideas to take home with you.

The bungalow itself is particularly interesting because of its practical layout and design which aim to help the owner by necessitating minimum maintenance. The dream kitchen can be built by the amateur, as can much of the furniture; other do-it-yourself aspects include tiling and lighting.

The April, 1960, issue will be published on March 31st. Order it now!

A TABLE SLIDE VIEWER

Make It And See Your Transparencies At Their Best !

By P. R. Chapman

ALTHOUGH the most satisfactory method of viewing colour slides is undoubtedly a projector, the latter is expensive and needs special setting up. A much cheaper alternative is the table viewer, shown in Figs. 1, 2 and 3.

The light source is a 15 watt "pygmy" lamp, diffused by an opal glass screen in front of which the transparency is placed and viewed by a suitable lens.

The exact dimensions are not important, the ones given being those of the instrument constructed which was made to view $2\frac{3}{4}$in. × $2\frac{3}{4}$in. slides in addition to 35 mm.

Base and Lens Carrier

The base consists of a piece of $\frac{3}{8}$in. plywood, $7\frac{3}{4}$in. long × 4in. wide. To one end of this is fitted the lens carrier. This is made up from three pieces of $\frac{1}{4}$in. plywood, $2\frac{1}{2}$in. wide, and is marked A in Fig. 1. The viewing lenses are two double convex lenses of $3\frac{1}{2}$in. dia. and each of about 4in. focal length, fitted into a cardboard tube (B). This latter can be made either by rolling up wide gummed paper strip or by using a piece of cardboard, bent and glued. The lenses are fixed in by glued cardboard strips. If they are cleaned on their inner surfaces before fixing, the lenses will remain clean, since they will be completely sealed. The tube with its lens assembly is then glued into the lens carrier, using cardboard spacers, if necessary, to centre it. Finally, a piece of $\frac{1}{8}$in. plywood with a square hole in it, C, is cut and screwed over the viewing side of the lenses. The hole should be of such a size that the edge of the nearer lens is just not visible at the corners.

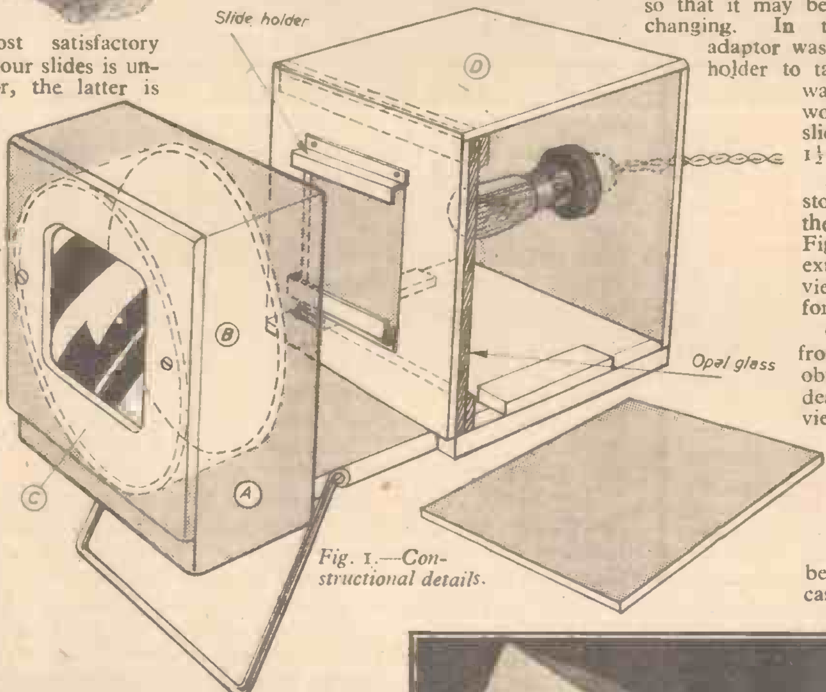


Fig. 1.—Constructional details.

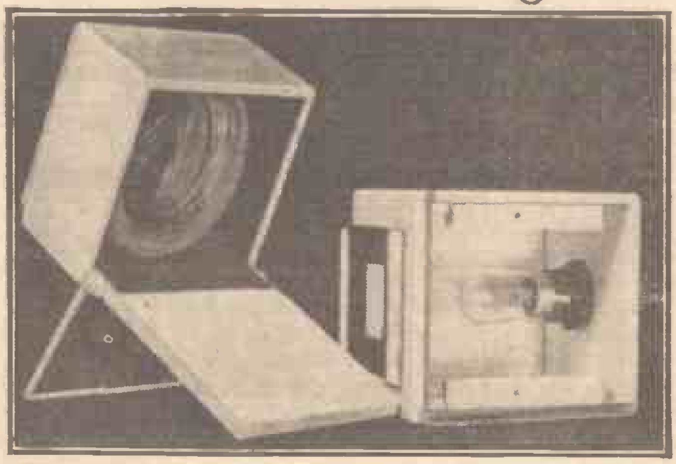
The Lamphouse

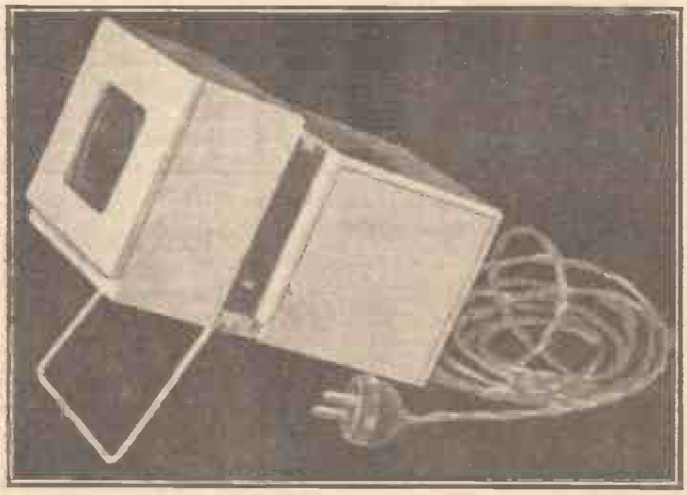
The lamphouse is also made from $\frac{1}{4}$in. plywood, being 4in. high, 4in. long and 4in. wide (D). It is left open at the front and bottom, the back being bored to take a standard bayonet lampholder. The front is closed by a piece of wood with a hole $2\frac{1}{4}$in. × $2\frac{1}{4}$in. sq. On the inside of this, two strips of wood are glued to hold the opal glass in position, and on the outside two metal or wood guides to take the slides. These should be slightly more than $2\frac{3}{4}$in. apart or 2in. apart if only 35 mm. slides are to be viewed. The lamphouse is painted matt white inside. It is held to the base by means of two screws, so that it may be easily removed for lamp changing. In the original model, an adaptor was made to fit into the slide holder to take 35 mm. slides. This was simply a piece of $\frac{1}{8}$in. wood the size of a larger slide, with a hole 1in. × $1\frac{1}{2}$in. and guides 2in. apart.

A folding leg made of stout iron wire is screwed to the baseboard as shown in Figs. 1, 2 and 3. When extended this holds the viewer at a suitable angle for use.

Opal glass is better than frosted glass and may be obtained from photographic dealers. Finally, the whole viewer may be painted a suitable colour.

The lens-to-slide distance depends upon the actual lenses used (probably from a magnifying glass) and may have to be varied in individual cases.





Figs. 2 and 3 are two photographs of the original viewer.

A Foldaway Bench

If Space is Restricted in Your Home this Design will Interest You

BASICALLY the foldaway bench is a very narrow wall-side cabinet with a front which drops down making a useful bench and convenient tool cabinet, as shown in Figs. 4 and 5.

Begin with the two side pieces, which should be of wood 4ft. 7¼in. long, 6in. wide and ¾in. thick. Make sure the ends are square and mark the top edge for identification purposes. Prepare the top 3ft. 6in. long × 6in. wide and ¾in. thick and the bottom 3ft. 4½in. × 6in. and ¾in. thick. No complicated joints are necessary as the top is laid on the sides and glued and screwed to them and the bottom is also glued and screwed to the sides at a distance of 1ft. 11¾in. from the top edge. Next fix the rail to hold the bottom of the sides rigid.

The back of the cabinet, on to which hooks, etc., may be fastened to hold your tools, can be made of either pegboard or 3/16in. plywood and is fastened in place by means of small strips of wood about ¾in. × 1in. glued and nailed or screwed around the back edge of the sides, top and bottom. When these are set, the back is glued and nailed on to them. This means that the back is set forward from the wall by ¾in. which will allow room for the protrusion of hooks if pegboard has been used. If plywood is to be used for the back the strips could be somewhat smaller, say, ½in. square. The fixing of the back in the main frame will give the whole structure rigidity (see Figs. 2 and 3).

Cut and fit the front which when open forms the bench. It should be made from ¾in. block board which is easy to work and will provide a joint-free surface. Its size is 3ft. 6in. long × 2ft. wide, and it should be joined to the bottom by two 2in. flap hinges. To fasten it in the closed

YOU NEED
Deal or, Medium Hardwood:
2 pieces 4ft. 7¼in. × 6in. × ¾in. (sides).
1 piece 3ft. 6in. × 6in. × ¾in. (top).
1 piece 3ft. 4½in. × 6in. × ¾in. (bottom).
1 piece 3ft. 4½in. × 2in. × 1in. (rail).
12ft. 1in. × ¾in. (back beading stops).
1 piece of blockboard 3ft. 6in. × 2ft. (bench).
4 pieces 2ft. 7¾in. × 2in. × 1in. (uprights).
4 pieces 1ft. 6in. × 2in. × 1in. (rails).
2 pieces 2ft. 8in. × 2in. × 1in. (brace).
Hardboard:
1 piece (pegboard) 1ft. 11¾in. × 3ft. 4½in. (back).
2 pieces 2ft. 7in. × 1ft. 8in. (leg covers).
Miscellaneous:
1 piece batten 2ft. 7in. × 1in. × ⅜in., six 2in. flap hinges, two small handles, glue, screws, paint, fittings as required.

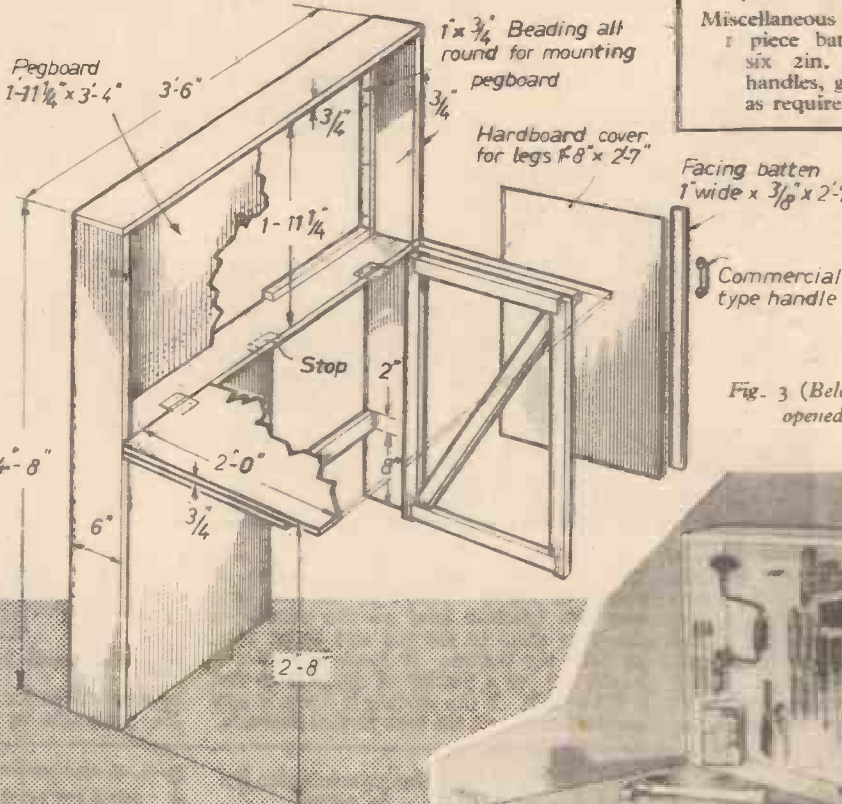
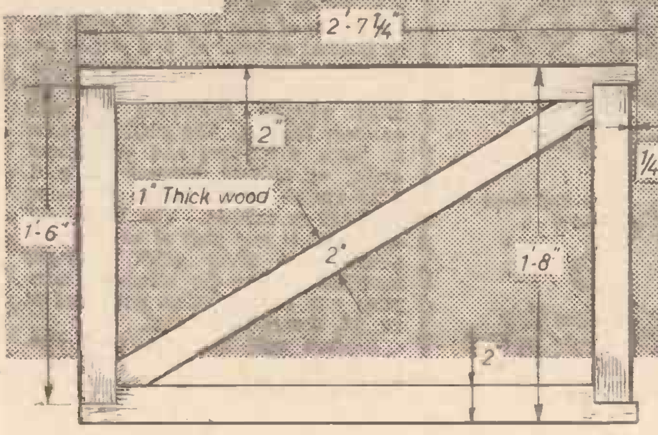


Fig. 2 (Left).—Fixing the back in the main frame and general details.

Fig. 3 (Below).—The completed bench opened out ready for use.

Fig. 1 (Below).—The legs consist of two uprights, two rails and one brace.



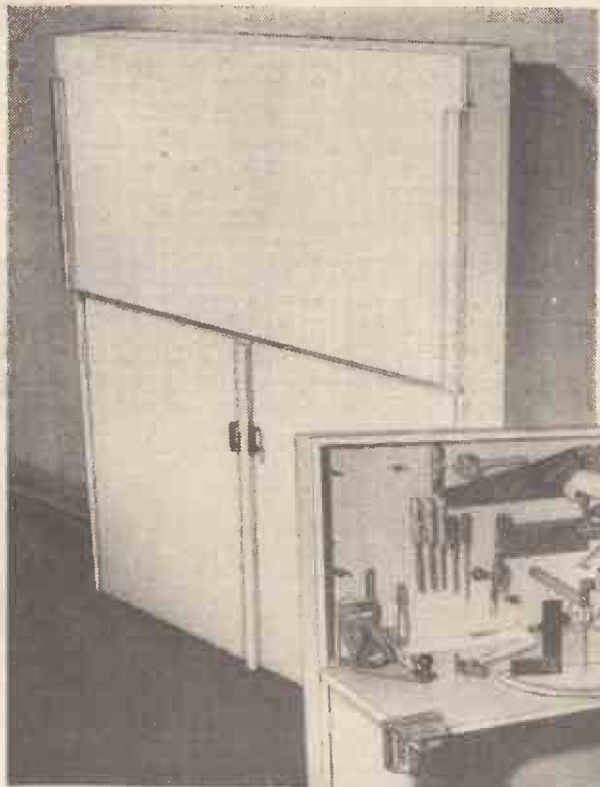


Fig. 4 (Above).—The bench with legs fitting flush to the front.

Fig. 5 (Right).—The completed bench in use.

position, two small hooks and eyes may be used or if desired a padlock and hasp.

All that remains now is to make the legs, each of which consists of two uprights and two rails and one brace—see Fig. 1. Glue and screw the rails on to the uprights and then glue and screw the brace into position from the bottom hinge to the corner. If the two uprights are cut to the correct length first, then the remaining ends may be finished off after assembly. Cover the leg with a sheet of ⅛in. hardboard. The legs are then hinged on to the sides, so that when closed they are flush with the front edges (see Fig. 4). A small stop about 4in. long and 1in. × ¾in. section is then fitted under the bottom to stop the legs closing too far. Glue and screw the facing batten in place to cover the door joint. Fit two small handles to the legs.

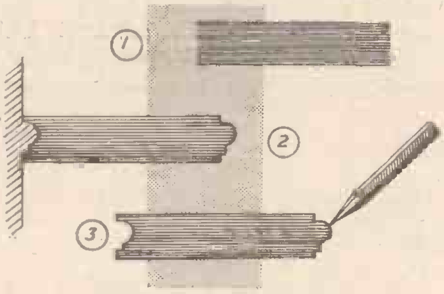
The whole job can now be finished as desired either with paint or clear varnish and then it is ready for fixing in position. It should be firmly fastened to the wall with four 4in. brackets fixed on the outside of the sides close to the top and about 18in. up from the bottom. If there is a skirting board, cut out a portion of the side so that it fits over it. If the skirting is thick, it may be necessary to set the back farther forward.

Hints and Tips

By L. J. Sidney

Transferring the Profile of a Moulding With a Pack of Cards

ALTHOUGH fuse-wire, tape solder, and plasticine have been used for this purpose, still one of the easiest ways is to

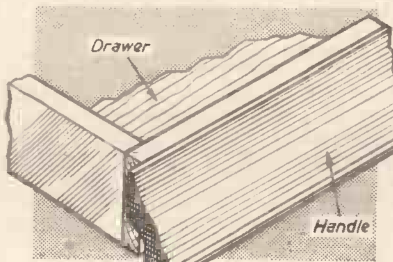


Transferring the profile.

use a pack of cards. Simply push the pack of cards, as shown above, over the moulding so that the edge of the pack assumes the shape of the moulding, transfer it to the wood and draw round it.

Louvred Drawer Handles the Easy Way

LOUVRED drawer handles can be easily made from a wall-type banister rail of the cross-section shown above. It should



The handle has a neat appearance.

be screwed to the front of the drawer with ½in. projecting at each end to act as stops.

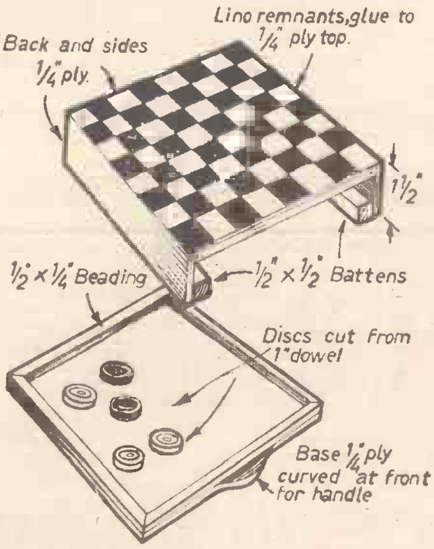
Draught Board with Slide-away Drawer

THIS draught board has a slide-away drawer fitted underneath for keeping the counters in and it can be made quite easily from scrap materials.

Make the top first. Cut a piece of ¼in. plywood measuring 13½in. square and divide this up into 1½in. squares, using a pencil. Down the long edges of this top, on the underside, pin and glue strips of ¼in. plywood 1¼in. wide, 13½in. long. Check for squareness and fix the back piece in position which is 1¼in. wide, 13in. long. Then pin the ½in. square battens along the bottom edges of the sides as indicated.

Make the checkerboard pattern with 1½in. squares of linoleum, plastic, or wood veneer fixed in place with impact adhesive. Cut the sliding drawer from ¼in. plywood, measuring 13in. × 13¼in. and bead the edges with strips of ½in. × ¼in. hardwood, on edge.

Cut your draughtsmen from 1in. dowel and paint in two contrasting colours.



Dimensions for the draught board and counter drawer.

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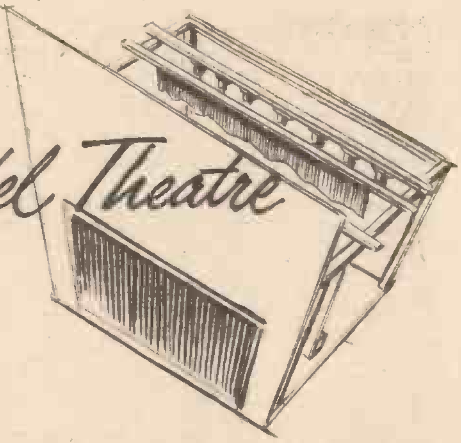


* AMATEUR STAGECRAFT

1 Making and Using a Model Theatre

Use It to Plan Your Productions

By C. C. Somerville

A MODEL stage is an asset to any dramatic society. Both the producer and scenic designer will find such a model invaluable in planning their effects, and many technical snags and difficulties can be eliminated in advance and so avoid the usual dress rehearsal panic.

The construction of a model stage can be elaborate or simple according to your talents. I have seen a quite efficient one produced from a cardboard dress box by children in a craft lesson. The one described here, however, is built in wood and will prove robust and effective for all normal requirements.

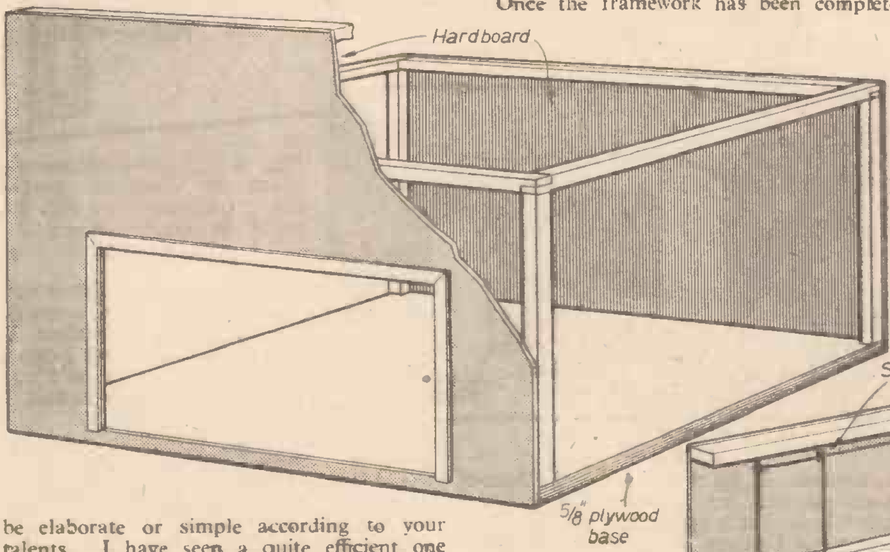


Fig. 1.—The framework of the model stage and the proscenium.

Framework

Fig. 1 shows the basic construction of this stage which is built upon a ⅝in. plywood base measuring 16in. × 12in. On to this a framework of ½in. strip is erected to support the proscenium and backdrop. These are cut from hardboard, the backdrop measuring 16in. × 9⅝in. and the proscenium 16in. × 14⅝in. The actual proscenium opening or window is 12in. long × 6in. high and surrounded by an ornamental beading as indicated.

Curtain

Once the framework has been completed the front curtain can be tackled. A rear view of the mechanism involved can be seen at Fig. 2. The curtain was cut from a sheet of corrugated card with a wooden batten glued along the top and bottom. When painted a deep blue it resembled a rich, pleated velvet drop. A point to note is that the curtain must be ½in. greater all round than the actual proscenium opening.

Lighting

The lighting for this miniature theatre consists of battens, floods and spotlights, all made with 2.5 volt flashlight bulbs. These can be worked from a battery, but as a large number will be required it is far better to power them from the mains using a step-down bell transformer. The different types of light fittings are illustrated in Fig. 5. The flood and the spotlight are made in either tinplate or card lined with aluminium foil. The wire leads can be soldered on to the bulbs themselves, or alternatively the bulbs can be mounted in tiny holders, obtainable from a well-known chain store.

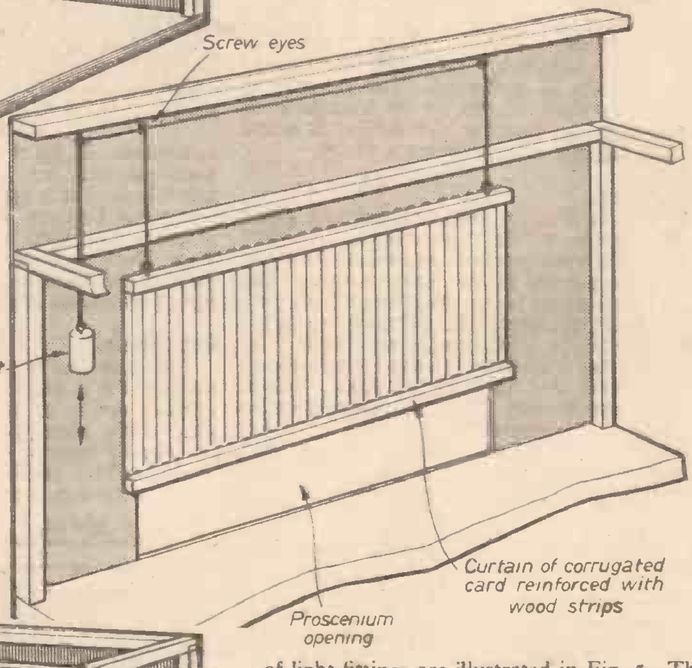


Fig. 2 (Right).—Rear view of the proscenium showing curtain mechanism.

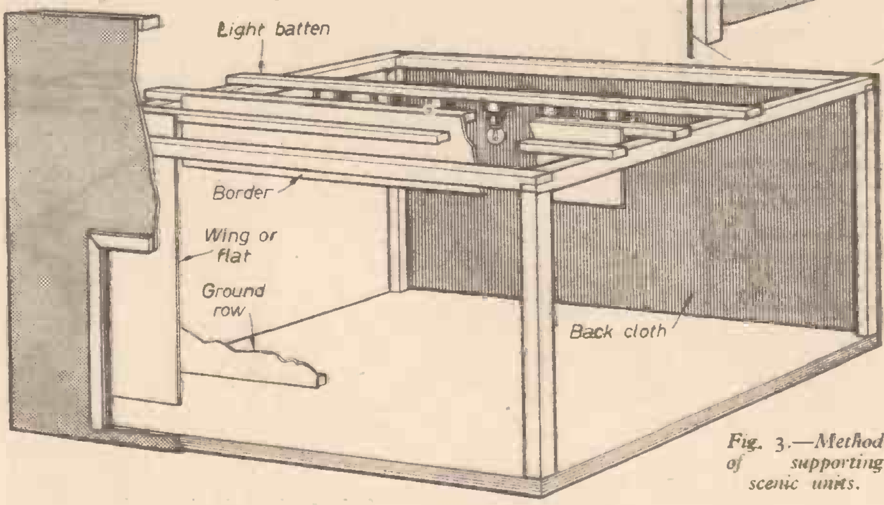


Fig. 3.—Method of supporting scenic units.

Coloured Lighting

A batten of footlights is best sunk into a trough at the front of the stage. The floodlight boxes are grooved to take coloured gelatines, but this is impractical with the batten lamps as it is so much simpler to colour the lamps themselves, using a "dip" made by mixing powdered dyes with methylated spirit. The colours needed are amber, red and blue with an occasional green. Each set of coloured lamps is operated by one switch and is known as a circuit. The colours on the battens should, of course, be evenly distributed and not all clustered together.

A useful innovation for your theatre would be to have each block of lights on a dimmer. Wireless rheostats can be used effectively for this purpose and a simple circuit diagram is shown in Fig. 4.

This circuit uses three battens, each having a three-colour combination. Two of these battens are overhead battens, and the other is the footlight batten. Two floods are used, one at each side of the stage. Fig. 4 also shows the layout for a simple switchboard used in conjunction with the circuit.

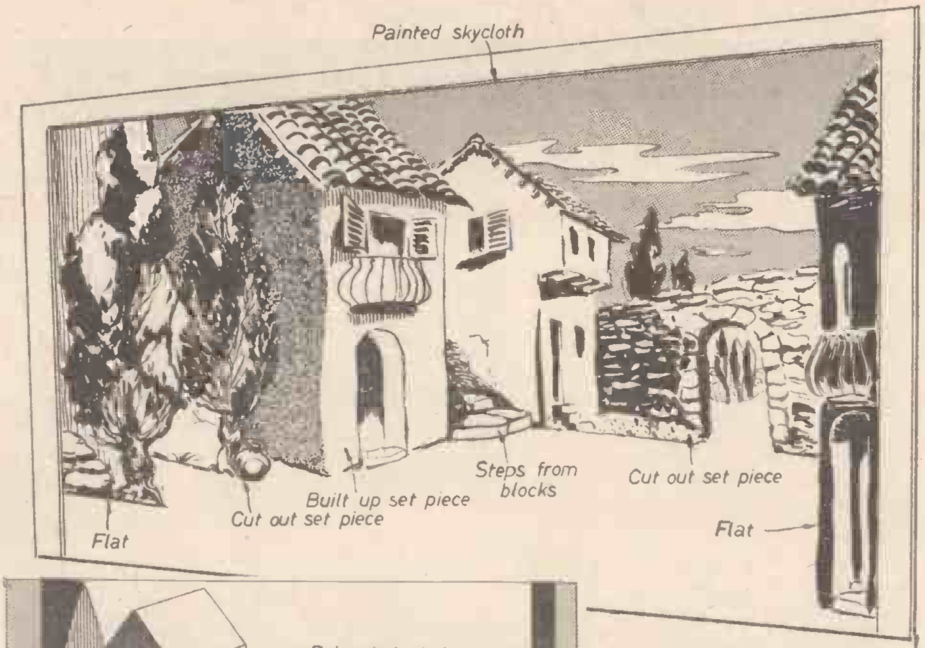
The Scenery

The next step is the planning of the scenery. Curtains or traverses can be arranged by running them on wire, the ends being twisted round the side struts. These traverses can be moved backwards or forwards as required. Scenery is best painted on paper and subsequently mounted on stout cardboard, reinforced if necessary with wooden battens or plywood. The backscenes and "flats" or wing pieces are glued on to strips of wood 18in. long and these hang across the side struts of the stage, as do the lighting battens. Fig. 3 will make this clear. Borders—the strips which hang down at the top to prevent the audience seeing the lights —are mounted on battens in the same way. Ground rows, similar to borders but running along the stage floor, are sometimes necessary. They are made to stand up by sticking their backs to blocks of wood. Flat cut out furniture and similar properties are made to stand in the same way.

Built-up or "solid" sets are always effective and not nearly so difficult to make as might be imagined. They can be produced successfully in cardboard. The secret is to make as much of the set as possible from one piece, by bending and cutting it rather than making it from separate pieces.

Painting

This is done in poster colours and is not the same for a "flat" scene as for a "solid" set. The latter produces its own shadows and may be painted in flat, even colours. But for flat scenery heavy shadows and perspective must be introduced. All the scene painting should be bold; avoid fussy detail. The aim of the scene is to represent the locale of the action and indicate the mood, but it must not intrude. It must always keep its place as background. When considering colours take into account the lighting which you intend to use. It is a waste of time to paint a scene in one colour and then light it in another. At the same time weird effects of transformation are possible by painting a scene in deep reds and greens, and switching alternately between two lamps of the same colours. Red light turns the greens of the scene black and the reds become invisible. Exactly the opposite happens when a green light is shone on the scene.



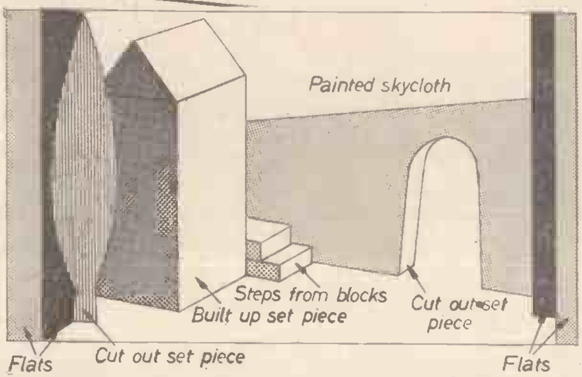


Fig. 6 (Left).—Preliminary sketch for composite scene. Fig. 7 (Above).—How Fig. 6 might be interpreted on a full-size stage.

Set Pieces

Furniture and set pieces will have to be made and it is useful to have on hand a few abstract solids, cubes, rectangles, cylinders, etc., which, when lit artistically, can be used to suggest modern expressionistic settings. Simple effects can be formed by grouping these in various ways and with a little rearrangement of the same units a complete change of scene can be achieved. A modern set using several different forms of scenery is illustrated at Fig. 6. A different interpretation is shown in Fig. 7.

The "Actors"

Cardboard figures, or even chessmen, may be used to represent the actors, and prior to working with his company the wise producer will experiment on his own. Crowd scenes or elaborate groupings are not always easy to visualise, but with a model, mistakes can be rectified without having to confuse the cast with countermanded orders.

Producers working in cramped circumstances, with scanty storage space for scenery, will find interchangeable scenic units invaluable as they can be used time and again in different positions to give different effects. These will, of course, be the result of experimentation on the model.

There is no end to the uses to which the model theatre can be put.

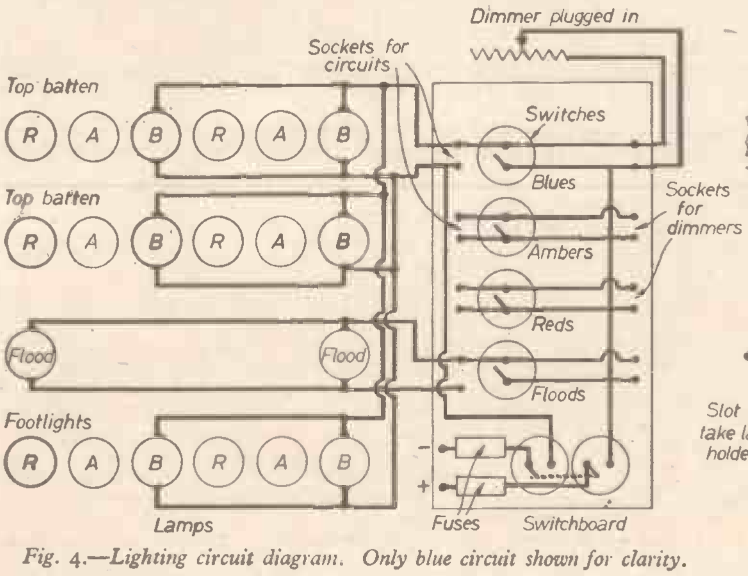


Fig. 4.—Lighting circuit diagram. Only blue circuit shown for clarity.

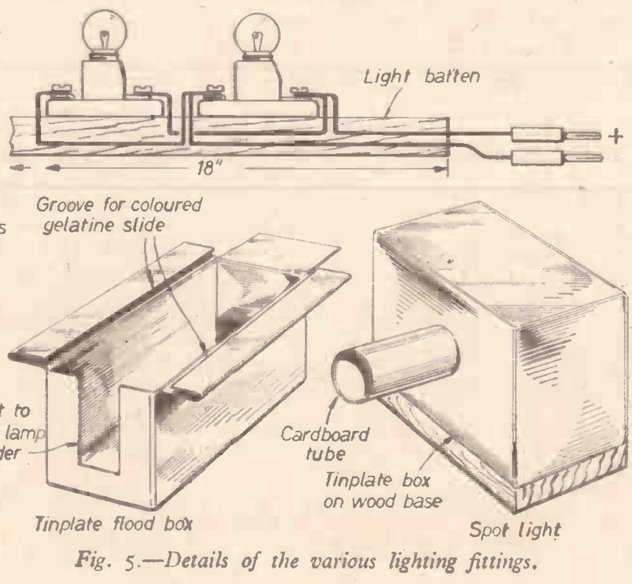


Fig. 5.—Details of the various lighting fittings.

Building the 'Luton Minor'

Part 7.—Wing Pylons; Wheel Brakes; Control Cables, etc.

Wing Support Pylons

THESE are ¾in. dia. 17 s.w.g. with bolted attachment plates at the top. The front spar undersurface is 24in. above the top fuselage longerons. Make up the front pylon first. This consists of three tubes—the two side ones being identical in length. Time can be saved if the lower ends of the front and rear side pylon struts are completed first with the "U" piece welded in.

Set up the fuselage with the top longerons level fore and aft and also level at right-angles to the fuselage centre-line at the cockpit. This is known as the "rigging position." All rigging and measurements will be taken with the aircraft trestled in this manner.

Take a pair of 3ft. wide trestles and screw and clamp extension pieces to them to support one wing (either will do) in its correct position and connect the front spar fitting to the front pylon (Fig. 46).

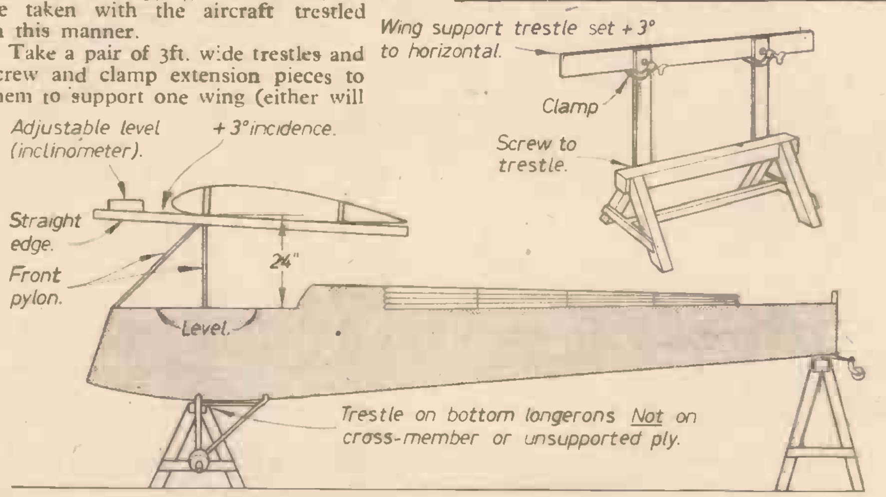
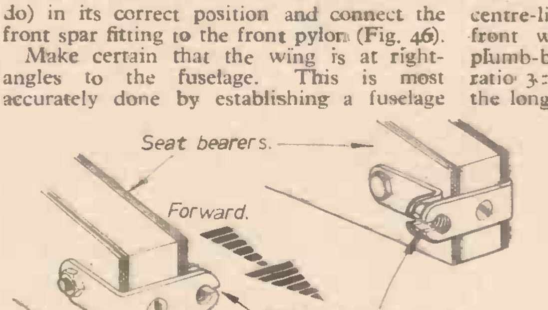


Fig. 46.—Setting the wing incidence prior to making the rear pylon on the job.

Make certain that the wing is at right-angles to the fuselage. This is most accurately done by establishing a fuselage centre-line on the floor and transferring the front wing spar line to the floor, using plumb-bobs, cords and tacks. Using the ratio 3:4:5 unit triangle system, work with the longest units possible to keep within the centre-line lengths, i.e., a 3ft. unit giving 9ft. along the spar line from the intersection and 12ft. along the fuselage side, the third side being 15ft. Measure with steel tape or wire.

Hold a straightedge against the lower surface of the wing spars and, with an adjustable level, set the wing at an angle of incidence of 3 deg. (Fig. 46). Fix the wing trestles in this position and, without altering this setting or that of the fuselage, make up the rear pylon on the job. Watch carefully to see that the centre-line of the pylons is exactly on the centre-line of the fuselage.

When the pylons are completed, remove the wing, dismantle the pylons (do not forget to label each strut) and paint or plate them before reassembly.



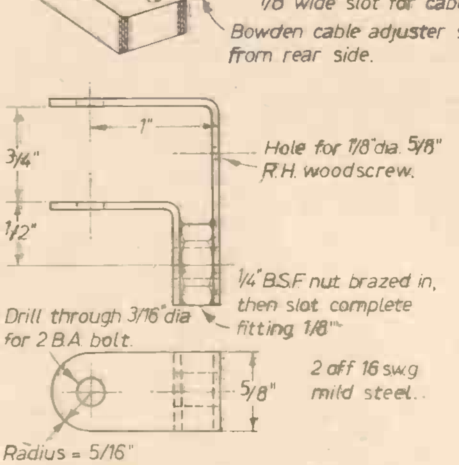


Fig. 48.—The cable adjuster brackets which are bolted to the seat rails.

Wheel Brakes

If wheel brakes are to be fitted, it should be done at this stage. Fit the undercarriage and bolt on the brake assemblies. Do not fit the wheels yet. Each brake assembly is marked "Port" or "Starboard" and it is imperative that they be assembled to their respective sides.

It is advisable to use 5 cwt. flexible stranded aircraft control cable for the actual operating cables. Cut lengths for each side and silver-solder a nipple to one end of each wire. Thread the wire through the brake assembly from the outside (wheel side) leading it through the cam return spring and, passing it out of the assembly through the hole provided. Run the wire into a large-diameter Bowden outer sheath and, avoiding sharp bends, run cable and sheath up the radius-rod on the forward side, lashing it at intervals with waxed thread or plastic adhesive tape.

The cable and sheath enter the fuselage through a small oval hole in the bottom skin 3in. inboard from the radius-rod fitting (Fig. 47). Fig. 48 shows the two small brackets which locate the cable adjusters and are attached to the inside faces of the seat rails at the front. The run of the cables is shown in Fig. 47. The brake pedal assembly which bolts to the rudder pedestal is illustrated in Fig. 51 and detailed in Figs. 49 and 50.

The forward end of the brake cable wire is looped around a cable thimble, tightly bound for a length of 1in. with 22 s.w.g. copper wire and soldered. A small shackle then connects it to the pedal lever.

Now fit the wheels. If they foul the brake shoes, unwind the small star adjusting wheel (accessible from the brake attachment back plate side) until the shoes have contracted sufficiently to permit the wheel to slip on. By adjusting the star wheel, tighten the shoes so that the wheel is almost impossible to turn. Now slacken off three "notches" on the star wheel. The length of the operating cable is now adjusted on the seat-rail cable adjusters to take up any slack.

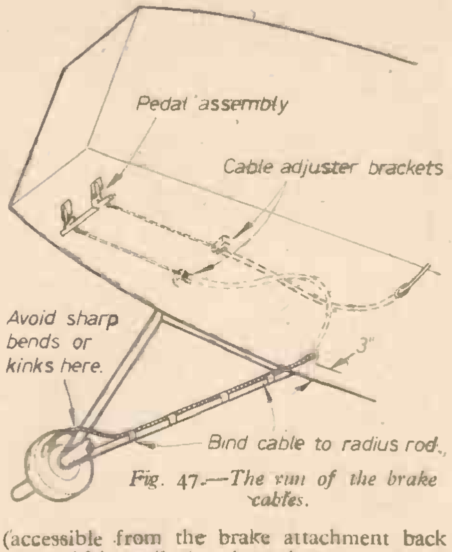


Fig. 47.—The run of the brake cables.

The tailwheel assembly is next made and

fitted. The leaf-spring for this can be made from a 1934-type Austin 7 rear spring. This will have to be softened for drilling and then re-tempered.

The standard tailwheel for the Minor is the 5in. Phoenix type which has double shielded ball-races.

Attach the tailplane and elevator to the rear fuselage and bolt on the fin. Fit the rudder. To ensure perfect and accurate alignment, the attachment of the hinges to the fin may be left until this point. The rudder should swing freely without any tendency to bind. A minimum of ¼in. gap should be left between the fin top rib and the underside of the rudder rib.

The Control Cables

The control cables in the fuselage are now made. The cable used is pre-formed flexible wire rope to specification W.9. Each control cable will have both ends looped to form an eye around a heart-shaped brass thimble.

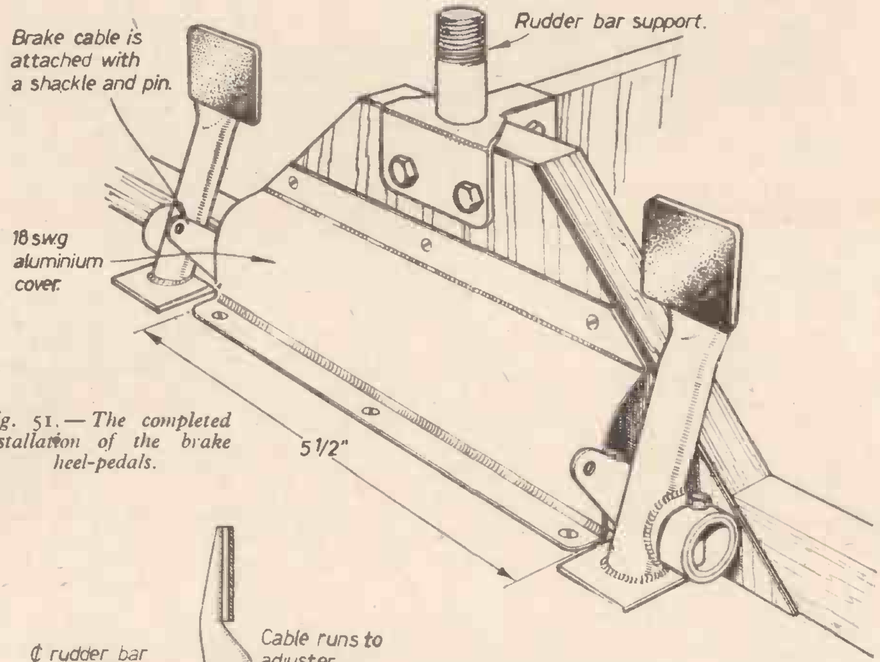


Fig. 51.—The completed installation of the brake heel-pedals.

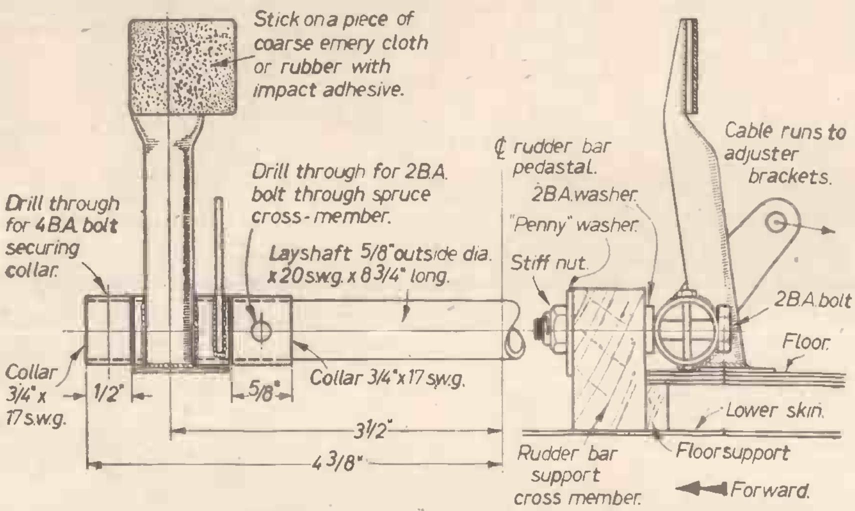


Fig. 50.—Assembly of the brake pedals.

One end of the cable will be spliced to a turnbuckle for adjusting its tension in service, and the other end will be attached to its respective fitting with a shackle through the spliced eye. All the fuselage cables have their turnbuckles situated in the cockpit. Remember to thread the end of the cable through the turnbuckle eye before making the splice at that end.

Making a Sleeved Splice

To avoid splicing an eye end, which demands skill, the end of the cable is inserted through a 3in. length of 3/16in. o.d. × 20 s.w.g. copper tube which has first been annealed and flattened to an oval section in the vice. The cable end is doubled back and threaded back through the tube. The thimble is put in place and the cable drawn taut. Make sure that the centre-mark denoting the length of the cable (explained farther on) is in fact central. Using a mallet and a wooden block, dress the copper sleeve to the wire.

Lightly clamp the splice vertically in the vice and heat with the soldering iron until it is possible to flow solder down through the sleeve around the wire. When it is thoroughly tinned and still molten, again dress the tube with the mallet. Take care not to spurt hot solder in your face. Avoid excessive heat in soldering as this would affect the strength of the cable.

Clamp the splice vertically in the vice so that about ⅜in. of the copper sleeve is firmly held in the jaws. Using either a hand-vice or a pair of smooth-jawed parallel grips, hold the other end of the sleeve again ⅜in. from its end and carefully give one and a half full turns, twisting cable and sleeve into a spiral. Unclamp and re-tin with the soldering iron. Trim the spare end back to the end of the sleeve. This splice is very strong and does not need to be pre-stretched before use.

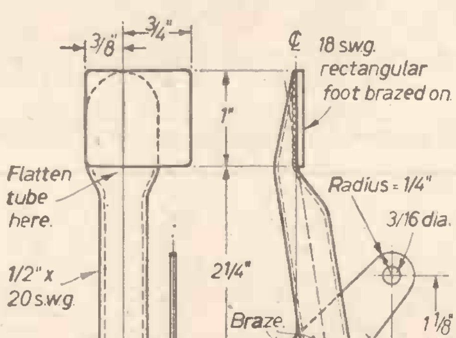


Fig. 49.—Brake pedal details. Two are required (right and left handed).

Finding Cable Length

Fix the pilot's controls in the central or neutral position (stick vertical, rudder bar central) and clamp strips of wood across the tailplane and elevator, fin and rudder to hold them central. Make a loop in one end of a piece of the cable and tie it with thread. Pull this tight around a thimble and insert a shackle, connecting it to, say, one of the elevator levers. Thread the other end through the pulleys to the control column. Pass the end around a second thimble through the eye end of a turnbuckle which is connected to the appropriate lug on the control column. Adjust the turnbuckle so that the last visible thread pitch at each end is five full turns inside the barrel. Holding a rule against the turnbuckle, screw it up so that the turnbuckle is ½in. shorter than the previous setting. This additional ½in. length of the cable must be allowed to counteract the shortening by approximately ¼in. at each end when the cable is twisted in the sleeves. Pull the cable taut around the thimble and tie back as before. Mark the cable at the centre of the thimble with paint (Fig. 52). Remove the cable, untie the ends and proceed with forming the eye end splices as detailed earlier.

In making the control cables for the rudder, do not forget to thread each cable through a length of ¼in. o.d. copper or tungum tubing to form the fairlead through the fuselage sides before making the second eye end to each.

Lead the elevator cables into position, using thin string or thread and connect them up. Operate the elevators, using the control column, and see that the cables do not foul any part of the structure throughout the full range of movement. Should they touch any fuselage members, try rerouting the cables or, if this does not rectify it, screw 2in. × ½in. strips of ⅛in. thick red fibre to the members as rubbing pads. No unsupported cable should be in such close proximity to any part of the airframe that any possible whip in the wire could bring it into contact with objects which might cause damage to, or be damaged by, the moving cable. If any doubt exists, make use of a fibre pad.

See that the slots in the pilot's seat are large enough to prevent cable-fretting.

Fit the rudder cables and shape the fairleads. Secure the ends of the fairleads with clips, as shown in Fig. 53, having first made sure that the cable runs in a straight line, in side elevation, between the rudder bar and the rudder lever. It is a mistake to lubricate the fairleads with oil or grease, as dirt will collect and act as a grinding medium inside the tubing, thus accelerating wear to both cable and fairlead.

Operate the rudder and check functioning. Should the cables tend to touch the fuselage

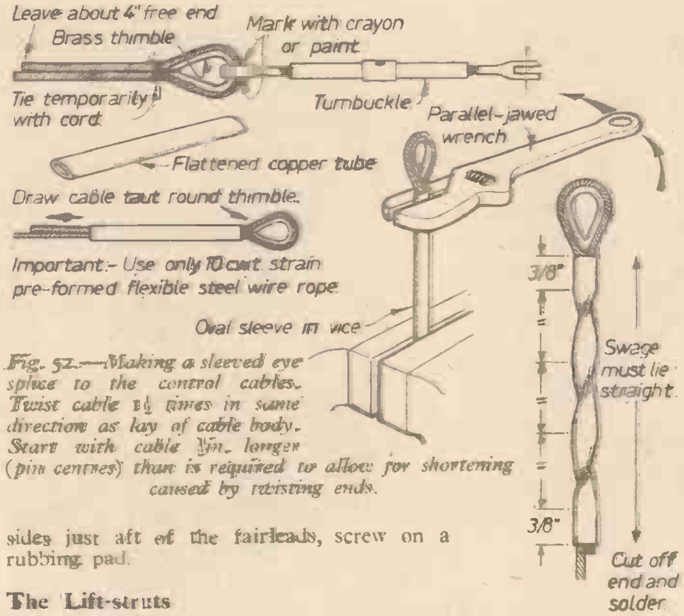


Fig. 52.—Making a sleeved eye splice to the control cables. Twist cable 1½ times in same direction as lay of cable body. Start with cable ⅝in. longer (pin centres) than is required to allow for shortening caused by twisting ends.

sides just aft of the fairleads, screw on a rubbing pad.

The Lift-struts

The four lift-struts are made from 22 s.w.g. streamlined mild steel tubing, section 2.5in. × 1.250in. Each strut is approximately 74in. in length and has a screw adjustment at the lower end.

Start by cutting the streamlined tubing into four pieces 6ft. 2in. long and form the lower ends. The threaded blocks are 1½in. long, 1.19in. in diameter and are bored and tapped ½in. B.S.F. A local garage should be able to make these up; alternatively they are available from Phoenix Aircraft Ltd., together with the actual adjustable eye end, which is turned from ⅝in. square bar.

The strut end is slotted on both sides of the minor axis and on the forward side of the major axis and dressed round the threaded block. Weld the block into the strut "rosette" fashion. The 22 s.w.g. mild steel closer plate is then edge-welded to the angled cut. *This must be done accurately.*

Braze in the two short 3/16in. dia. bore tubes which locate the bolts for the bracing wire fitting, Pt. No. 12W. This assembly is illustrated in Fig. 54.

Now make up the top fitting which picks up on the spar fittings. This is made separately from the strut and comprises a wrapper plate, a web and two gussets, all made of 16 s.w.g. mild steel plate, and a ¼in. × 17 s.w.g. steel tube. The steps in the making of this fitting are illustrated in Fig. 55. Connect these fittings to the lift-strut attachments on the wings.

Fitting Lift Struts

Set the fuselage in the rigging position with the wheels clear of the ground and, with the aid of an assistant, offer up the wings, bolting the root-end fittings to the centre pylon fittings and supporting them just beyond the lift-strut attachment fittings with the trestles modified with extension pieces.

Place a straightedge across the ribs on the top surface parallel to the main-spar and, using a spirit-level, see that each wing is horizontal. No dihedral is employed in the Minor rigging, since there is ample pendulum stability.

Temporarily bolt the lift-struts by their lower ends to the fuselage fittings and adjust the eye ends until about ¾in. of thread is showing. By holding each strut against its respective top strut fitting, it is possible to mark off the exact length of the strut. Remove the struts and the top fittings from the wing brackets. Cut the struts to length and mark the positions of the bolt holes. Press the top fitting into the strut end and drill the four holes, using a 3/32in. drill.

Refit the struts to the wing and fuselage. The top fitting, being a tight fit in the strut end, should not move although it is not bolted through. With strut and fitting thus located and accurately aligned, drill the four holes 3/16in. dia. and bolt through, using shaped packing washers under the bolt heads and nuts. The bracing wire lug is also bolted on.

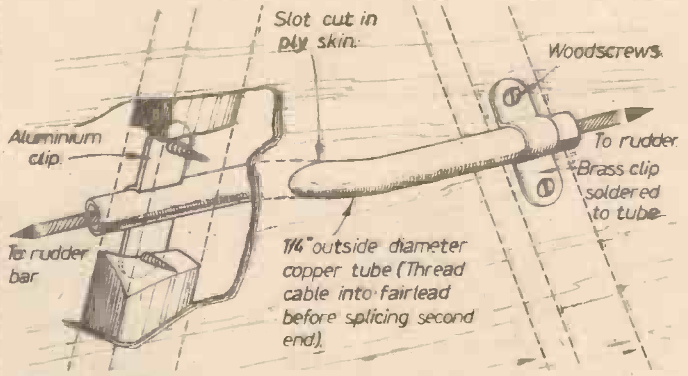


Fig. 53.—The copper fairlead which carries the rudder cable through the fuselage side. Bends must be gradual and smooth.

Remove the struts and unscrew the eye ends. Flush out the struts, using boiling water and detergent, afterwards rinsing in hot water. When dry, replace the eye ends, having first screwed on a ½in. B.S.F. thin lock nut, and paint the inside of each strut by filling and swilling with metal primer followed by overnight draining.

The final operation is to drill a ⅛in. dia. drainage hole behind the threaded block at the lowest part of the closer plate.

Once more fit the struts and make up the 10 cwt. cable cross bracing between each pair of struts. Each wire has a turnbuckle at its lower end and a shackle at the top. Make these in the same fashion as the control cables—they are equally important.

The Aileron Control Cables

The cable from the bottom lever of each aileron runs over the respective front spar root end pulley down into the cockpit through a small hole in the curved cockpit former, round the swivelling pulley and to the inverted "V" lever in front of the control column pedestal.

The two top aileron levers are connected by a balance cable which is made in two lengths joined with a double eye end turnbuckle to one side of the centre-section. This off-centre join, reached through a small inspection door in the undersurface of the port wing, facilitates dismantling.

The position of the hole in the cockpit former for the operating cable is found by stretching a cord *outside* the fuselage side from the pulley in the wing to the fore and aft location of the inverted "V" lever marked on the fuselage side. This must be a straight line and, when established, it is a simple matter to mark off where the cable passes through the cockpit former. A fibre grommet or rubbing pad must be provided at this hole. To improve the appearance, the fibre may be fitted to the undersurface of the former, a clearance hole being provided in the top ply.

The complete rigging system and control runs will be illustrated later on.

The complete set of plans for the Minor costs £11 10s. from Phoenix Aircraft Ltd., Cranleigh Common, Cranleigh, Surrey.

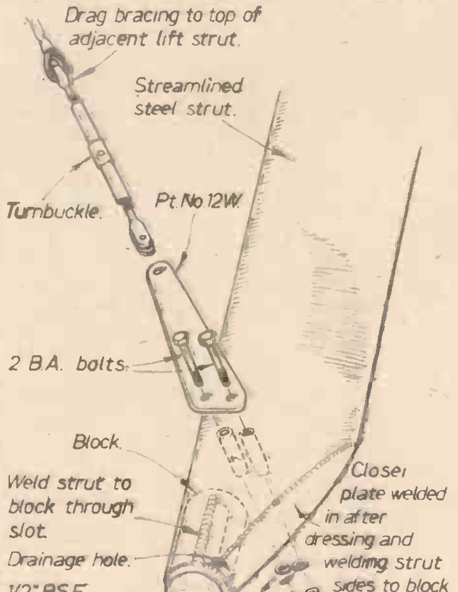


Fig. 54.—Detail of lower end of lift struts.

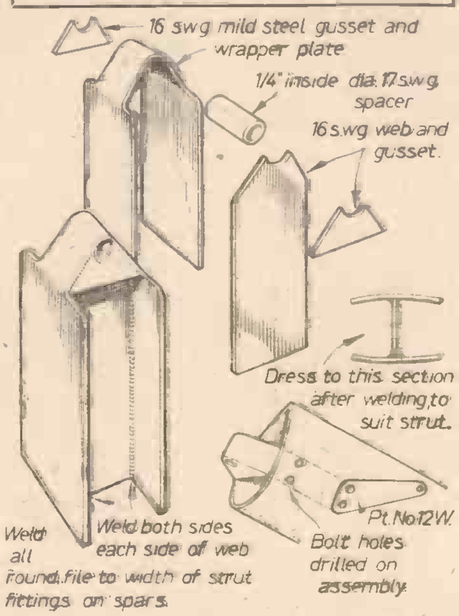
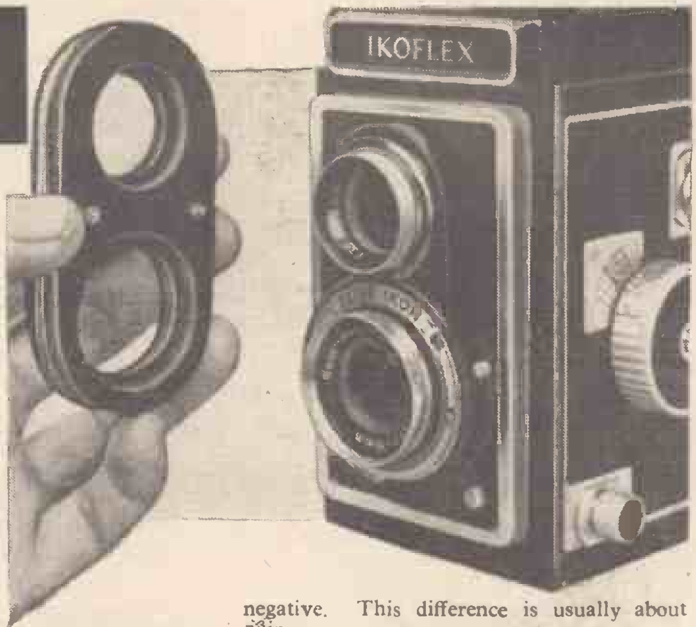


Fig. 55 (Right).—Upper end fitting for lift struts.

A Close-up Attachment



A Home-made Accessory for the Reflex User

By F. G. Rayer

IN the attachment described here and shown in the heading, the finder lens, at the top, is of smaller diameter than the taking lens, which is at the bottom. This is to suit the lens mount diameters of the Zeiss Ikoflex, but with some cameras both lens mounts are of the same diameter. With other models, especially those with small aperture taking lenses, the finder lens may be larger than the taking lens. The actual diameters of the close-up lenses are of no importance, provided they are at least as large as the camera mounts, to avoid cut off towards the corners of the negative and viewing screen. Reference to the way in which the four parts of the attachment serve to hold the lenses will show how dimensions can be adjusted for other lenses.

Attachment Construction

The four main parts are shown in Fig. 1, and numbered for reference. The apertures in part 1 just clear the camera lens mounts. Correct sizes and positions for the holes can be found by placing the camera, lenses down, on the piece of material to be used, and carefully drawing round the lens mounts with a sharply pointed pencil. Bakelite or paxolin is satisfactory, and should be fairly thick so that the attachment can fit securely in place.

The holes can be made with a washer cutter, fretsaw, or by drilling a ring of small holes and cleaning up with a file. The outside dimensions of the parts are not of much importance. Equal semi-circles can be drawn each end, before cutting the holes. Corners are then sawn off, and the piece filed to shape.

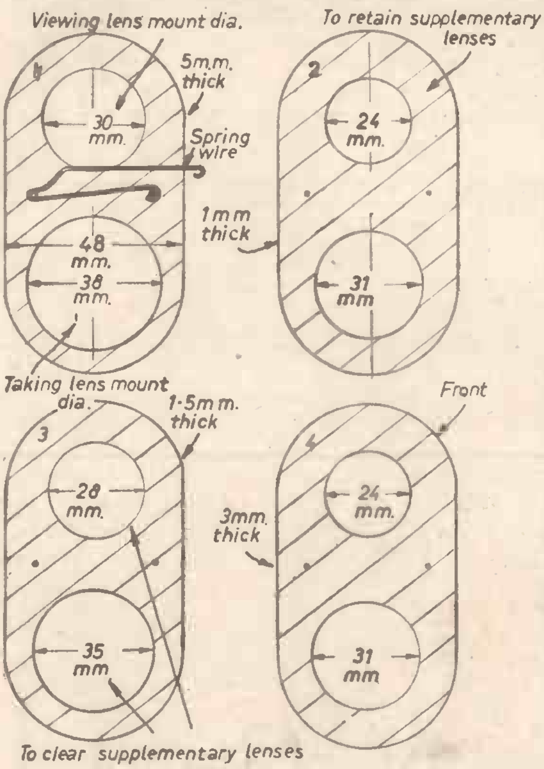


Fig. 1.—Parts required for the attachment and details of the spring clip. These can be altered to fit any camera.

Part 2 can be of very thin paxolin. Each hole is about 4mm. smaller in diameter than the close-up lenses to be fitted, as it serves to keep them in position.

Item 3 has holes just large enough to clear the lenses, and is of similar thickness to the lenses themselves. Stout cardboard is satisfactory.

The front, part 4, is of moderately stout paxolin, and has holes of the same diameter as part 2. Parts 2, 3 and 4 are best marked out directly from part 1, compasses being used to scribe circles of the diameter required.

The four pieces are then placed together, and two holes are drilled through them all, to take 6 B.A. or 8 B.A. bolts. The pieces can then be bolted together, and the edges cleaned up with a file.

If it is necessary to change the lenses for another pair of different power, the attachment can be taken apart by removing the two small bolts. The holes in the front piece are bevelled slightly, and the edges of the holes in pieces 2, 3 and 4 (front) are painted matt black.

Lens Powers

Close-up camera lenses are most generally available in 1, 2 and 3 Diopter powers, though other powers are also used occasionally. A 1 Diopter lens will take up from the nearest normal focusing setting of the camera. E.g., with the 1 Diopter lens in use, and the camera focusing set at infinity, the object will now require to be at a distance of 39.4in. With the camera adjusted to its nearest focusing point (say, 3ft.) the object needs to be at 18.8in. A 1 Diopter lens thus allows continuous focusing from 39.4in. to 18.8in.

With a 2 Diopter lens, infinity on the camera will give a subject distance of 19.7in., while the 3ft. setting will give 12.75in. A 2 Diopter lens thus allows focusing from 19.7in. to 12.75in.

In the same way, a 3 Diopter lens will allow focusing from 13.1in. to 9.6in.

There is, of course, no need to bother about the exact distance of the subject, because focusing is carried out on the screen, in the usual way. But here the power of the lenses should be selected to suit the kind of close-up shots which are to be taken, unless two or three pairs of lenses are purchased.

Compensation for Parallax

With all twin lens reflex cameras, the lens throwing an image upon the focusing screen has a slightly higher viewpoint than the lower lens, which provides the image recorded on the negative. This difference is usually about 1¾in.

If an object is being photographed which completely fills the focusing screen, about 1¾in. will be cut off the top of the object, on the negative. This can be avoided by always allowing a little free space above the object, on the screen. For example, if three fingers of one hand, side by side, are placed close above the object, they should be visible on the screen. At a subject distance of 20in., this would be approximately equivalent to leaving ¼in. clear above the image of the object on the screen. But at shorter distances, or with very near subjects which completely fill the screen, parallax becomes more important. With still objects, very near the camera, the effect may be eliminated by raising the camera about 1¾in., or lowering the object to a similar extent, before taking the shot. The distance between camera and object should not be changed when doing this.

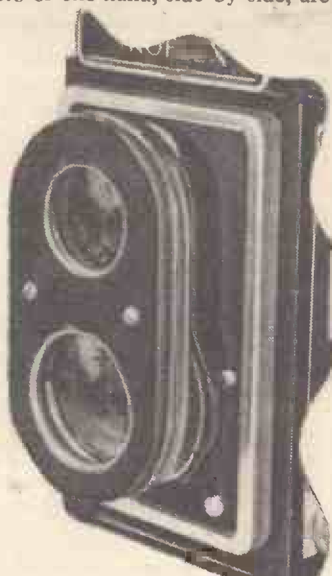


Fig. 2.—The close-up attachment in position

If part 1 is not made very accurately, so that the attachment is loose on the camera, this can be corrected by fashioning a clip spring to fit round the bolts, as shown in Fig. 1. This will press upon the bottom of the viewing lens mount. A fairly strong paper clip bent to shape will be suitable. Fig. 2 shows the completed attachment.

wash day watch dog

A Boon to the Busy Housewife

By A. F. Parker

COMPONENTS REQUIRED

One 1,000 Ω twin coil relay, operating current 1 mA (A. T. Sallis, 93, North Road, Brighton), 7s. 6d.
Buzzer or bell, 3 volt.
4½-volt flash lamp battery.
Piece of brass 3½in. x 2¼in. (same gauge as thickness of 4 B.A. bolt heads).
Piece of Paxolin 3½in. x 2¼in.
Piece of copper 3½in. x 2¼in. (light gauge).
Length of waterproof cable (twin core).
Two wanderplugs and sockets.
No. 42 instrument case (A. T. Sallis).

THIS simple instrument was devised mainly to give warning that rain had commenced so that nearly dried washing could be removed from the clothes line before getting soaked. It has various other uses, such as acting as a reminder to bring baby in from the garden, etc. It is very sensitive and will sound the alarm as the first drops fall.

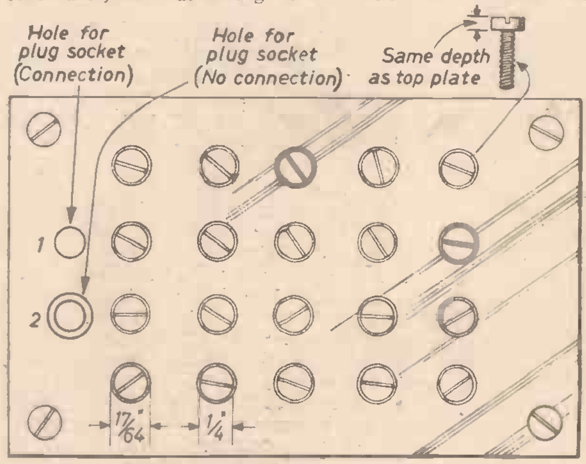


Fig. 1.—Layout of bolt heads and holes in top plate.

Construction

Place the copper on the bench, Paxolin on the copper, and then the brass on the Paxolin. Clamp all three in the vice and drill the four corner holes 4 B.A. Insert bolts and screw up tight (see Fig. 1).

Drill the remaining 22 holes to take 4 B.A. bolts, separate the three plates, and enlarge the holes in the brass plate only to 17/64in. This will enable the ¼in. dia. heads of the bolts to clear the holes. It is best to use a bench drill for this, as the holes must be precision drilled.

Enlarge No. 1 wanderplug hole in the brass plate to take a socket, also enlarge the remaining socket hole to completely clear the socket head. Enlarge the holes in the Paxolin to take the sockets, and also enlarge hole No. 1 (see Fig. 2) in the copper plate to clear wanderplug retaining nut.

Now when the plates are reassembled No. 1 socket makes contact with brass plate only, whilst No. 2 socket makes contact with copper plate only. Before assembling again, cut off the four corners of the copper plate so that the four corner bolts only make contact with the brass plate and Paxolin (see Fig. 3). Mount the 20 4 B.A. bolts with a continuity tester plugged into the wanderplug sockets, or a lamp and battery. The bolts should be inserted one at a time. Should the lamp light, it is because holes are not accurate. The best remedy is to reduce diameter of bolt head carefully with a file and screw up tight, before proceeding with the next bolt.

Wiring

Wire up as shown in the wiring diagram, Fig. 4. When completed, connect up, moisten the finger and place on one of the bolt heads. The buzzer should sound.

No switch is included in the circuit, so the buzzer can only be stopped by unplugging the moisture switch. If this is left to get really soaked it takes a considerable time to dry out to be ready for use again, so when it is unplugged take it indoors until next required.

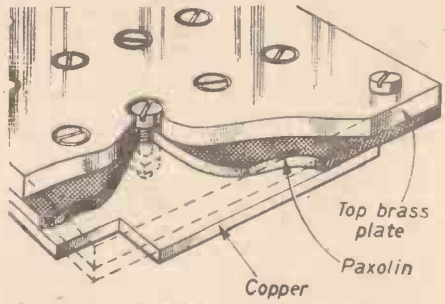


Fig. 3.—The assembled plates.

A metal case suitable for housing all components and battery was also purchased from A. T. Sallis at 3s. 9d., plus post 1s 3d. This was instrument box No. 42. Fig. 5 shows two views of the finished equipment.

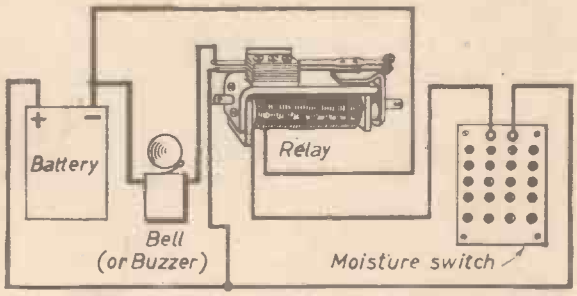


Fig. 4.—Circuit details. A twin-coil relay should be used, as mentioned in the list of components. The single-coil version shown here is merely for illustration.

How It Works

The principle of operation is simple. The first drop of rain which strikes one of the bolt heads recessed in the top plate completes the circuit and causes the bell to ring.

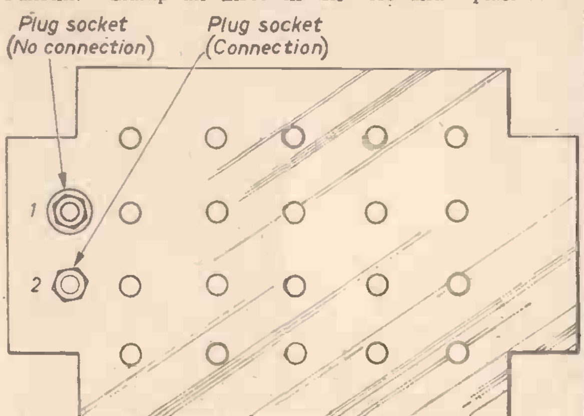


Fig. 2.—The back plate made of light gauge copper.

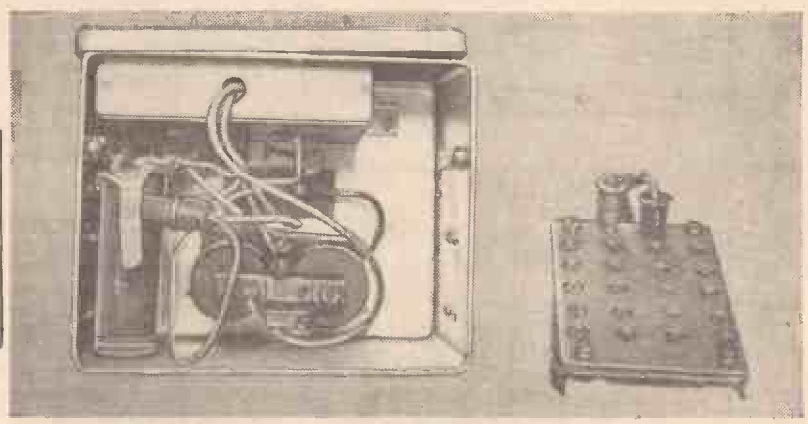


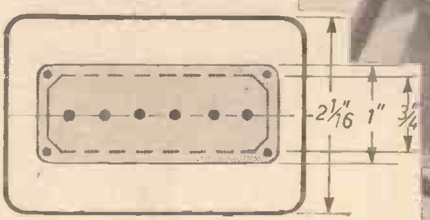
Fig. 5.—The finished mechanism and top of the warning device.

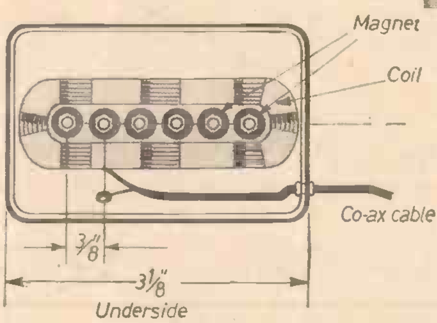
K. L. Archer Describes a Simple ELECTRIC GUITAR PICK-UP for You to Make

THE unit described is a simple magnetic pick-up to convert a normal plectrum guitar for electronic playing. The cost is governed only by the price of six TV ion traps which form the basis of the unit.

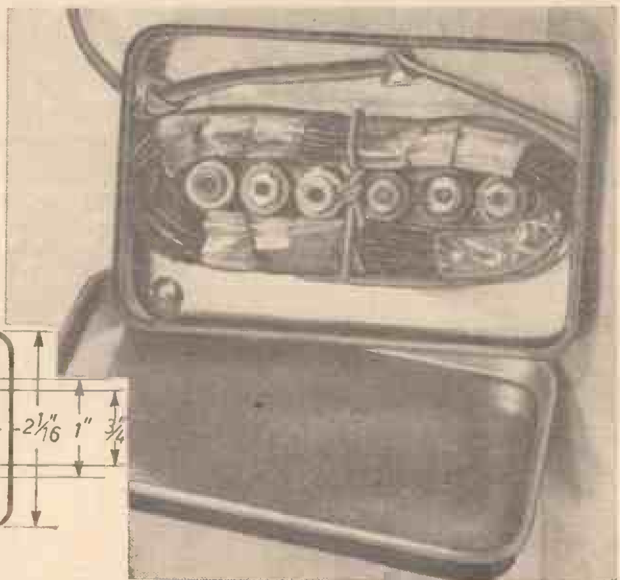
Construction

A small size Elastoplast tin is used as a housing, out of which a hole must be cut and covered with an aluminium plate, as shown in Fig. 1. The magnets removed from the ion traps are mounted inside the tin on the aluminium plate, using 6 B.A. steel bolts. These bolts, which are fitted heads outside, must be steel, although the nuts may be brass. It is essential when fitting the magnets to make sure they are all north or south poles uppermost, that is, all the same way. This can easily be checked by standing them in a row so that they all repel one another, then transfer them as they stand to their fixings (Fig. 2).





Figs. 1 and 2.—Plan and underside views. Fig. 3 (Right).—The completed pick-up.



The Coil

The coil consists of 1,000 turns of 38 s.w.g. enamelled copper wire wound loosely on a temporary former. The diameter of the former must be carefully arranged so that the coil can be taped and moulded to fit closely round the magnets. It will be necessary to tie the coil across its centre to keep it close to the magnets (see Fig. 3). When the coil is in place, a length of lightweight coaxial cable is passed through a hole in the casing and knotted. The coaxial screen is soldered to the casing as well as one end of the coil. The coaxial inner is soldered to the remaining end of the coil and the joint covered with a length of sleeving. When everything is in place (see Fig. 3) the whole assembly must be sealed up with a suitable wax to prevent acoustic pick-up. If possible it is wise to make a continuity check before sealing. After sealing, the tin lid is fitted to the underside and the whole assembly painted a black gloss finish, with the exception of the aluminium plate and the lip of the tin lid.

MATERIALS REQUIRED

6 TV ion traps Type IT6.
6 6 BA steel bolts.
Quantity of 38 s.w.g. enamelled copper wire.
Small size Elastoplast tin.
Quantity of sealing wax.
2ft. lightweight coaxial cable.

Mounting

The completed pick-up should be mounted underneath and just clear of the strings at the end of the fingerboard. Various methods of fixing may be employed depending on the shape of the instrument. All plectrum guitar strings are steel cored, but most types are magnetic. If non-magnetic strings are used electric type strings must be bought.

Almost all guitar pick-ups can become dangerous if used with certain types of A.C./D.C. (universal) amplifiers.

Experimental Electronic Telephone Exchange

BASICALLY the exchange will employ the principle of time division multiplex and switched highways for the ultimate connection, where each highway can carry up to 100 simultaneous conversations and sufficient highways are provided depending on the traffic of the exchange. The exchange lines are arranged in groups and each line in a group is connected by electronic gate circuits to the highway common to all lines in that group. Each highway in turn is able to be connected to any other, again by electronic gate circuits.

A magnetic drum is used as a semi-permanent memory. This drum carries all the information relative to all subscribers' lines and junctions, acting in this respect as the exchange library.

Dounreay's "Hot" Laboratory

ONE of the world's most elaborate "hot" radioactivity laboratories is a vital feature of Britain's new something-for-nothing fast breeder reactor at Dounreay, Caithness. No similar reactor has ever operated before and, because of its unusual features, it is essential for nuclear scientists to carry out laboratory examination of intensely radioactive fuel elements.

Everything in the laboratory is done by remote control, using closed-circuit television and protective windows.

Space "Weather"

THE American satellite, Explorer VI, has helped scientists to chart the weather of space in the earth's vicinity, by radioing signals back to earth. Previous to the satellite and rocket era it had been thought that changes in near-by space occurred slowly, if at all, but it has now been established that nuclear particles form winds and streams and violent changes take place. There are a few difficulties to be overcome before a completely accurate picture of the weather in space can be obtained.

New Ceramic

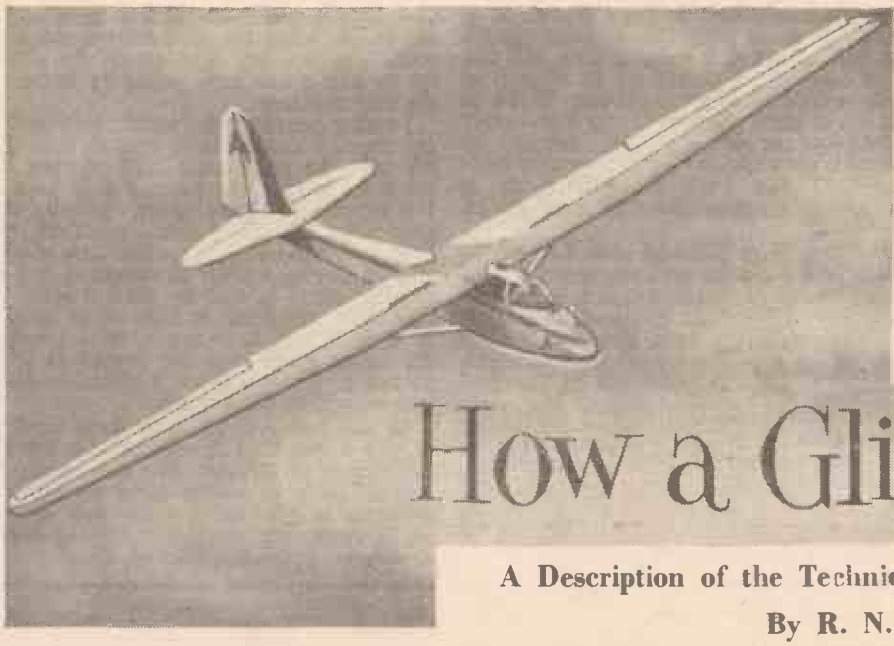
A CERAMIC made from powdered aluminium oxide has recently been developed in America. It transmits light, is heat resistant, can be pressed into any shape and is very strong. Lucalox, as it is called, due to its poly-crystalline form, can withstand high heat without becoming deformed, thus extending the range of instruments now limited by the heat resistance of their components.

Single Atomic Particle Study

THE American Physical Society has described a method of observing single atomic particles, using the field ion microscope. Study of its behaviour may eventually prove, or disprove, the theory that it is related to that of the universe.

New Mining Method

FROM Russia comes news of a new hole sinking method. Using liquid explosives piped through an aperture in the drill bit, to which a detonator is added, rock is shattered and a shaft 10ft. in diameter sunk at the rate of 3ft. every four minutes. Conventional methods are about one-tenth as fast.



How a Glider Flies

A Description of the Techniques a Glider Pilot Employs

By R. N. Hadden

A GLIDER is an aeroplane without an engine, and for this reason it must always fly "down hill." Yet in spite of starting with this seeming disadvantage the world gliding record for height is over 44,000 feet, while the record for duration of flight is over two days!

It may well be asked how are such achievements possible in a plane without an engine. The answer to this is that the glider is supported by the wind. Not wind as we normally know it, which blows parallel to the ground, but currents of rising air which blow vertically upwards.

Rate of Descent

When a glider is flying in a place where there is rising air, its normal rate of descent may be more than cancelled out by the rate at which the air is rising. It is, in fact, like a man walking down an escalator which is moving upwards. The man's normal rate of descent may be, say, 3 m.p.h. but the escalator may be rising at 5 m.p.h. so that, in fact, after a short time he will find himself at the top of the stairs instead of the bottom.

The whole secret then in being able to fly a glider for any length of time is to find a place where there are strong currents of rising air. Obviously it will make it easier to remain airborne if the natural rate of descent of the glider is small. In most modern gliders the angle of flight is about one in 25, in other words, if the glider starts off at 1,000ft. in still air it will be able to fly for five miles before it has to land. Assuming that the glider flies at 40 m.p.h. this is equivalent to a rate of descent of about 2¼ft. per second. If a glider is flying in air that is rising at, say, 10ft. per second it will actually be gaining height at the rate of 7¾ft. per second.

The thing that the glider pilot has to do then to remain airborne is to fly in currents of rising air so that he is blown upwards. But here is the snag—how does he find the rising air, because for every place where there is a current of rising air there is some place else where there is a current of descending air, and it is impossible to tell one from the other by just looking.

The Variometer

The problem of being able to tell when the glider is in a current of rising air is not as difficult as may appear at first sight, as a very ingenious instrument has been developed which will give an accurate indication of rise or fall. This instrument is called a variometer. It is quite true to say that the modern glider can do without almost any instrument with the exception of the variometer. With this instrument the pilot can tell whether he is rising or descending to an accuracy of within 6in. per second.

Before going on to see how the glider pilot searches for rising air it is as well to take a quick look at the variometer to see how it works. It consists basically of two flasks, rather like vacuum flasks, which are insulated to prevent temperature changes. These flasks are connected to two tapering tubes, as shown in Fig. 1. One tapering tube has its bottom connected to one flask, while the other has its top connected to the other flask. This is shown to an exaggerated scale in Fig. 1. In each tube there is a pith ball, one coloured red, the other green.

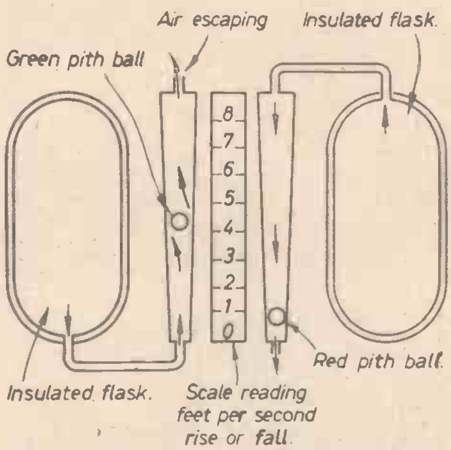


Fig. 1.—The variometer, showing how the green pith ball is blown up the tapering tube as the glider rises.

When the glider is being carried upwards on a current of rising air the pressure is decreasing, and so air flows out of the flasks. The air flowing out of the flasks has the effect of blowing the green pith ball up the tube; the faster the air is flowing out of the flasks the higher is the green ball blown up the tube.

Exactly the opposite happens when the glider is descending. As it comes down from a high altitude to a lower one the pressure of the air which is increasing causes a flow into the flasks. This makes the red ball rise up its tube. The faster the descent the higher the red ball rises up the tube.

This, then, is the secret of remaining airborne. The pilot tries to fly in places where the green ball indicates ascent, and tries to avoid the places where the red ball indicates descent. Armed with this sensitive instrument the pilot is in a good position to remain in the air. However, he must still have some idea of where to look for rising air, and the best place is on a hillside.

Fig. 2.—Glider hill soaring in rising air.

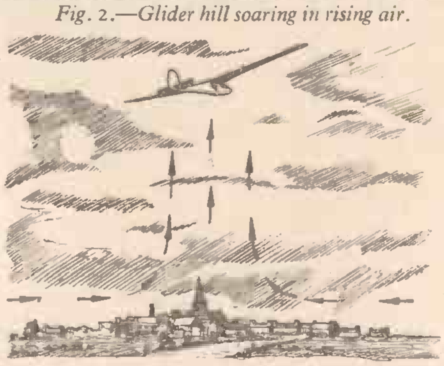


Fig. 3.—Glider flying in a thermal which has been started by the sun heating the air over a town.

Hill Soaring

Fig. 2 shows how wind blowing horizontally is deflected upwards by the hill. This is an ideal place for gliders because the lift is both strong and continuous. The higher the wind the higher the lift, in a fresh wind gliders can fly at heights which can vary from 1,000 to 5,000ft. above ground level. There are several places in this country which are fortunate enough to have ideal hillsides for gliding.

This type of gliding is known as hill soaring, and is the easiest type of soaring flight. All the pilot has to do is to fly up and down the hillside making sure that his variometer never indicates loss of height for any length of time. When duration records for gliding are set up it is usually by hill soaring. The record depends on how long the pilot can stay awake!

Cross Country Flying

Once a pilot has progressed as far as hill soaring he will never be satisfied until he has tried a cross country flight. This type of gliding is much more difficult as the pilot has to try to find patches of rising air in which to gain height to enable him to fly farther across country. Every time he loses height he must look for more rising air to help him regain his altitude.

Looking for rising air is not always easy, but a useful tip can be had by watching seagulls. It will be found that seagulls do not soar in just any place, but that they all choose a particular spot. This is the place where there is rising air. Very often the spot where there is rising air is over a ploughed field, a town, or power station.

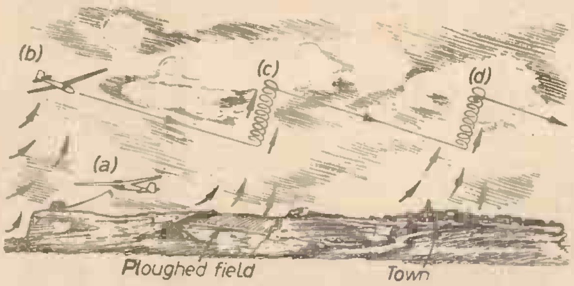


Fig. 4.—Cross country glider flight.

Fig. 3 shows how a patch of rising air starts over, say, a town. The sun warms the town and the air just above it. As the air is warmed it gets lighter and starts to rise, while cold air flows in from the sides to take its place. Once the air starts to rise it does so quite quickly, often at a rate as high as 10ft. per second.

As the air continues to rise a point is reached where condensation starts to take place, and this is the beginning of a puffy white cloud. When condensation takes place the effect is to make the air rise even more quickly, and this continues right up to the top of the cloud. This type of rising air is known as a thermal.

If a pilot is hill soaring and he wants to make a cross country flight, first of all he will try to gain the maximum possible height over the hill to give him a good start. When he is as high as he can go he will look out for a likely cloud, which may indicate that there is a thermal underneath. He then flies towards the place where he thinks he is likely to get lift. If he is lucky he will suddenly see the green ball of his variometer indicate a rise. When this happens he must start to circle to try to remain in the current of rising air. If he is lucky he will be able to climb a few thousand feet in the thermal before it weakens. When the lift dies off he will set off again in the direction in which he wants to go. When he has lost most of his height he will have to repeat the performance if he can find another thermal.

A sketch of a cross country glider flight is shown in Fig. 4. The pilot is launched at (a) and then hill soars at (b) until he sees a likely looking spot for a thermal under a cloud (c). At (c) the pilot climbs by circling in the thermal until he has enough height to set off at once again to try to find another thermal over the town at (d). And so he can go on as long as he can find thermals when he wants them.

A Cloud Street

Sometimes the pilot may be lucky enough to encounter what is known as a cloud street. These consist of a whole series of cumulus clouds so close to each other that the lift under them is almost continuous and very strong. In these conditions he can fly quickly along in a straight line under them neither gaining nor losing height.

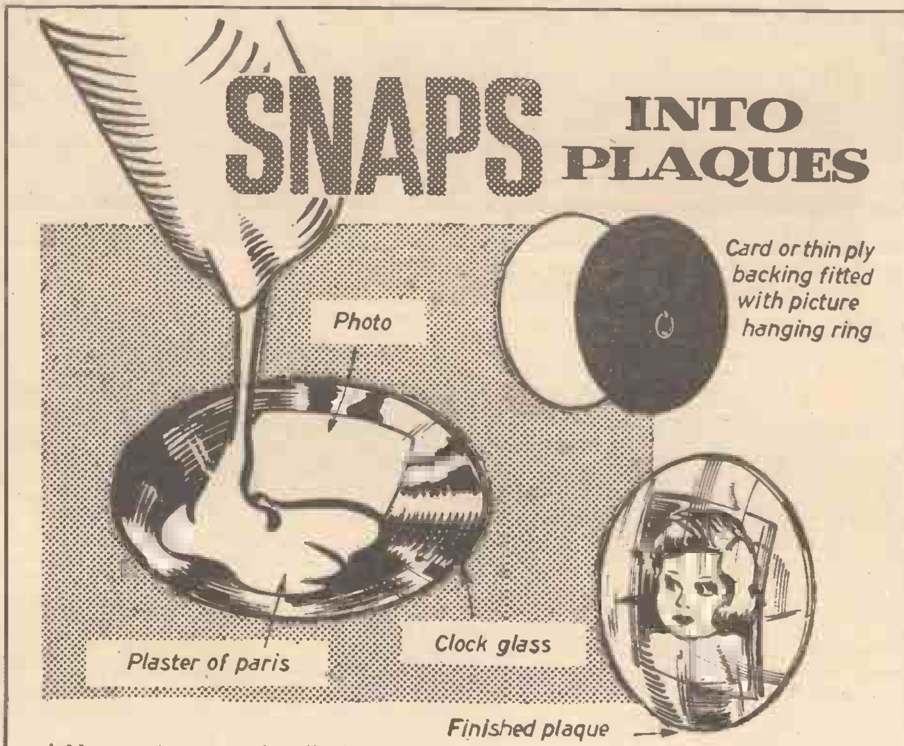
Another type of lift for gliders is what is known as a standing wave. It is really the equivalent in the air of the waves which can be seen in fast-flowing water which remains in a fixed position. When a standing wave forms in the air it is usually triggered off by some quite low hills, though the lift may extend to many thousands of feet. A glider pilot who is lucky enough to find himself in a standing wave will find that without any great effort on his part he has no difficulty in gaining height. This type of lift is often characterised by a stationary cloud over the peak of the lift. Actually the cloud is not stationary but forms on the leading edge as quickly as it disappears from the trailing edge.

The Take-off and Landing

So far only the techniques of flying a glider once it is airborne have been discussed. However, the two most important aspects of gliding are taking off and landing. A glider can be launched by several means, the most sophisticated way of getting off the ground is to be towed by an aeroplane to the required height. However, the cost of this method is rather high and the more usual way is to use a motor-driven winch which can tow the glider up to 40 m.p.h. The glider climbs as quickly as possible until it is nearly over the winch, when the pilot releases the tow rope. Another way is to launch the glider by an elastic tow rope pulled by some of the club members.

Landing presents some problems especially for the cross country flyer, because once the lift fails the pilot must land whether he wants to or not, and he may only have a few minutes to choose where. Usually the pilot will try to find a good, open field free from telephone and power cables. One advantage of landing a glider as compared with a powered plane is that its stalling speed is very low, sometimes as little as 30 m.p.h. If there is, say, a 10 m.p.h. wind blowing the actual speed over the ground is only 20 m.p.h. For this reason a glider can land in a remarkably short space.

In this article it has only been possible to give a very brief description of a few of the aspects of gliding. For this reason if anyone wants to obtain more information of where to glide or of clubs, they should get in touch with The British Gliding Association, 19, Park Lane, London, W.1.



AN attractive type of wall picture can be made with a favourite photograph, a clock glass, plaster of paris, a small sheet of thick cardboard and a picture-hanger ring. Soak the photograph (which, for preference, should be printed on thin photographic paper) in lukewarm water, shake off the surplus water and place it centrally, face down, in the centre of the glass. You can, if you wish, cut the picture to an irregular shape before soaking. Over the picture pour plaster of paris, mixed with water to a cream, until it completely fills the glass. Level off with a piece of flat wood and leave to set. Then apply cellulose cement to the surface and leave to dry. Finally, fix a circle of card, complete with ring, to the surface with cement.

PUZZLE CORNER

1.—The Christmas Present

LAST Christmas a firm presented to its employees an envelope containing a certain number of pound notes. The total cost to the firm was £4,427 and all employees received the same amount of money. The name of the 100th man on the list was McPherson. How much did each man receive?

2.—How Long?

TAKE out your watch and see how long it takes you to work out this multiplication sum:

1 x 2 x 3 x 4 x 5 x 6 x 7 x 8 x 9 x 0 ?

Answers

1.—Since 4,427 is exactly divisible only by 19 and 233, there must have been either 19 or 233 employees. We know there were at least 100, so the first solution is impossible. Therefore each man must have received £19.

2.—You should see at a glance, of course, that the answer is nought.

HOVERCRAFT

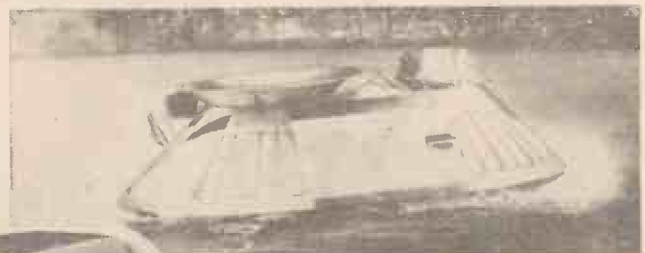
THE VEHICLE OF THE FUTURE

American Developments are Discussed by Donald S. Fraser

America's first "ground effect" car, built by scientist Walter A. Crowley.

AIR cushion vehicles may provide a new form of future transport and one such vehicle, the Curtis Wright air-car, one of a growing family of new machines designed to travel on a thin cushion of air over land, sea, marsh, sand, ice and snow, was demonstrated recently. Such machines, which do not need wheels, tracks or hulls, have been developed in several countries. Here, for example, we have the Saunders-Roe Hovercraft, which last June flew off the Isle of Wight at 30 m.p.h. It travels a few inches from the surface by forcing a cushion of air downwards from a giant fan, while air jets propel it.

The new Curtis Wright Corporation's four-passenger air-car.



A small Curtis Wright air-car being flown over water.

Pegasus I is a two-passenger, 850lb. car, designed for speedy travel 2ft. above land or water. It lands smoothly on small wheels.

Scientists predict that this craft may eventually revolutionise transportation, with trains as fast as planes that fly above a rail that they never touch, and a super-fast, all-purpose vehicle that combines the advantages of a passenger car, speed boat, truck and helicopter.

U.S. Air Cushion Vehicles

In the United States several types of air cushion vehicles have been developed. Besides the four-passenger air-car, which is designed to travel at about 60 m.p.h. at about a foot from land or water surfaces, other vehicles planned, or in the process of development, include a small scooter, cars to travel at various heights above the ground, ocean-going passenger ships and freighters, and low-flying helicopters.

Ground Effect

The air cushion phenomenon, or "ground effect" as it is commonly called, is not new. Scientists have known for years that a jet of air forced out of the bottom of a vehicle against a hard surface, such as the ground or water, forms a cushion that reduces friction and provides lifting power.

This ground effect does not aid flight at high altitudes, but a vehicle designed to travel up to a few feet above the earth's surface can be continuously suspended in the air as long as a compressed air cushion is maintained beneath it. Freed of friction from land or water, the buoyant vehicle requires very little power to attain great forward speed.

Advantages

One of the great benefits of "ground effect" travel would be its convenience. A flying vehicle could ride above city streets and highways, which in many parts of the world are clogged with cars, vans, lorries and buses.

People isolated because of the lack of highways and bridges could "fly" wherever they pleased. Farmers could transport food to market and manufacturers could make deliveries quickly and by the most direct route. The family vehicle could serve as transportation and as a pleasure craft, able to operate as a car or a boat. Any field would be a good road, any beach would be a good harbour.

"Ground effect" travel would be economical. The two engines, one for lift (a simple device to draw in and blow out air) and the other for propulsion, would be in a low horsepower range, inexpensive to produce and simple to operate. The two engines together would require less fuel than a car or a boat because they would use no power to overcome the friction that inhibits to-day's conventional vehicles.

America's first air-car being tried out on water.

First U.S. Model

One of the first successful "ground effect" cars in the United States was built by a scientist, Walter A. Crowley, who amazed his neighbours by flying his tubular steel vehicle over roads and ponds.

Mr. Crowley is now with a company, Spacetronics, which is basing its two large ground cushion vehicles, which will be used for sea cargo service, on his work.

The Ford Motor Company has produced two vehicles, the lift for which is provided by "Levapads," flat circular plates that have compressed air forced out of their centre to form a cushion which keeps the vehicle an inch above the ground. Vehicles supported by this device travel on a smooth surface and may be best suited for rail transport.

Other vehicles being developed include vehicles for low-level flight, which would incorporate wheels and propellers as well as the air-cushion system. The U.S. Army is testing an air-cushion helicopter machine, which uses four propellers to form a cushion for take-off from the ground. In the air the propellers can be tilted for helicopter-like flight at altitudes above the air cushion.

The "flying jeep," developed by the Piasecki Aircraft Corporation, has two horizontal rotors housed in the front and rear. It should be able to fly at 150 m.p.h., rise and descend vertically, hug the ground and thread its way between buildings and trees and under bridges. It would need no runway, but use its wheels, if desired, for take-off and landing.

Will this type of craft ever completely replace conventional forms of transport? It is debatable, but most of us will live long enough to find out.

Modify Your old "78" TO PLAY "45s"

D. A. Collins Tells You How

MANY owners of three- or four-speed players probably have lying idle an older type radiogram in which the turntable runs at 78 r.p.m. only. Many of these players may be modified to run at a lower speed and so act as emergency players in the event of breakdown of the more modern equipment. The writer owned an old Garrard single-speed player which he decided to modify, and the following article deals with the details of the modifications required.

The Speed Control

The speed control on the original model operated over the range 70 to 86 r.p.m., and it was found that if the arm of the speed control, which was limited in its travel by a scale, was allowed to move farther back by the removal of the scale, very smooth braking took place allowing lower speeds to be obtained. The object now was to test for constancy of speed at the settings available. The speed control arm was moved back until the turntable was revolving at a speed noticeably slower than 78 r.p.m., and a stop watch was employed to measure the speed. By trial and error methods a speed of 45 r.p.m. was obtained.

Fig. 1.—The modified player.

Testing for Constancy

To test for constancy of speed and in order to be able to make critical adjustments, the turntable was timed successively for 100, 200, 500 and 1,000 revolutions of the turntable. When the time taken for the turntable to perform any given number of revolutions is known, it is a matter of simple arithmetic to calculate the number of revolutions per minute. The writer's results were: 45.2, 44.87, 44.91 and 45.12 r.p.m. Obviously the slight discrepancies between these speeds were more likely to be due to personal errors than to variation in turntable speed, and it was concluded that the speed was constant at this setting. The position of the control arm at this setting was carefully marked.

It was found that a speed of 33 r.p.m. was obtainable, but that the braking action was harsh, resulting in inconstancy of speed. Some readers, however, may have a player which will provide constancy of speed at 33 r.p.m., and it is recommended that this speed be tried.

A rubber stop was screwed into the mounting board just beyond the 45 r.p.m. mark to prevent the arm from being moved back accidentally beyond this position. The same procedure was used for finding, testing, and marking the 78 r.p.m. position of the speed control arm, and another rubber stop was used at the other end of the scale to limit the travel of the arm. Over a period of a week, a variation in mains voltage of 13 volts r.m.s., the largest encountered during this period, caused no appreciable change in speed at either setting.

Housing the Player

At this stage the writer bought a small cabinet. Readers who intend to house the finished player in the original radiogram cabinet will be saved most of the work of cutting the motor deck and of mounting the player. The original head was useless as far as 45 r.p.m. records were concerned, but this problem was easily overcome by buying a new head and arm of the crystal turnover variety. This must be mounted on the player deck in such a manner that the arm makes a tangent with the turntable for all positions of the head, with the needle at the point of contact. The position of the arm must be found by trial and error to suit the requirements of the equipment in the reader's possession. The arm support was already part of the player, but it was found necessary to move it to a new position to suit the new arm.

It was found impossible to make the new arm perform the operation of switching, and it was decided to build into the player a stop/start switch of the press button type. When the player is inverted, two wires will be seen coming to the motor from two points in the original radiogram chassis. One of these wires passes up through the deck to the switch, which is built on to the framework of the player. The wire from the other side of the switch passes down through the deck to a terminal on the motor. The other mains lead is connected directly to the other terminal on the motor. All these wires must be removed. They will probably be found to be in a poor condition, and in the interests of safety new wires should be used. If the player is to be used separately from the radiogram, two yards of twin flex will be required. One end of this flex carries a mains plug to suit individual requirements. At the other end, one lead goes directly to a terminal on the motor, and the other lead goes directly to the switch. The remaining terminal on the switch is connected to the other terminal on the motor (see Fig. 2).

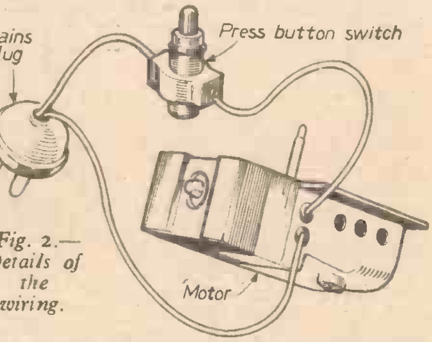


Fig. 2.—Details of the wiring.

If the player is to be left built into the original radiogram the mains plug is unnecessary, and the two ends of the wire are connected to the same points from which the original ones were removed.

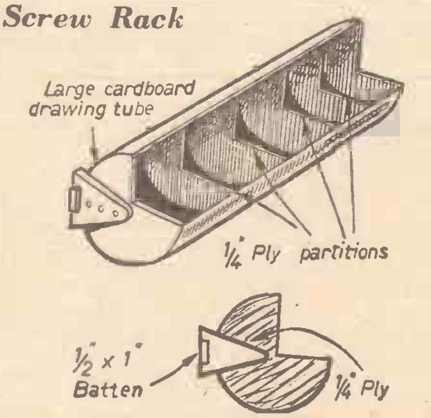
The two leads from the turnover head are connected to an input plug to suit the amplifier or radio being used. Any screening on these leads must be connected to the earth end, i.e., the chassis side of the input plug.

Fig. 1 shows the modified player, which has already given many hours of pleasing reproduction of records.

How to Make a Handy Screw Rack

A LENGTH of stiff cardboard tube obtainable from stores supplying drawing office equipment forms the basis of this handy rack for storing screws and pins, etc.

Choose a tube with a large diameter and cut off a piece about 18in. long. Mark off a quarter of its surface area with two straight lines then cut along the lines. In the two ends of the remainder glue and panel pin two "formers" which are made by fretsawing two circles of ¼in. plywood and then cutting away one quarter of each. Similar pieces, equally spaced along the cut tube form the necessary pigeon holes. Two triangular ¼in. plywood brackets screwed to each end are fixed to a hardwood batten glued down the length of the container. Screws through this and the tube hold the assembly to the wall or bench.



How to make the rack.

A SIMPLE EPISCOPE

By Trevor Holloway

Show Your Holiday Snaps 3ft. x 4ft.

PHOTOGRAPHS, picture postcards, cuttings from books and magazines, foreign stamps, coins and many other interesting objects can be screened in their natural colours with the aid of the simple episcope shown in Fig. 1. Slides are not required.

Briefly, the instrument functions as follows. The light from two electric lamps of the ordinary household variety shines on to the object to be screened. These light rays are reflected back through the lens in the focusing tube and directed on to the screen.

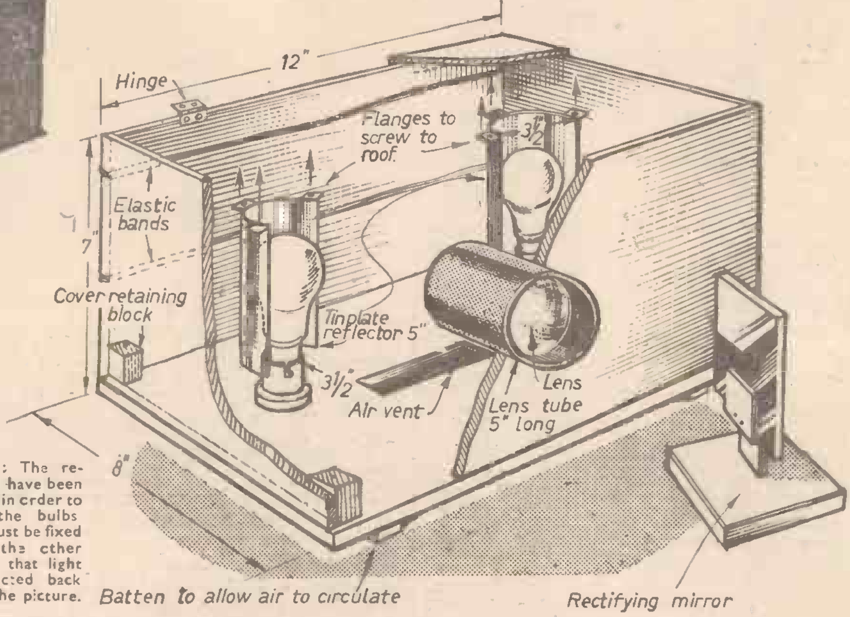
The size of the picture will be determined by the focal length of the lens and the power of the lamps. By using a 2½in. reading glass as a lens and two 60-watt lamps it was found by experiment that an ordinary 2¼in. × 3¼in. snapshot gave a clear and sharp reproduction about 3ft. × 4ft.

Reference to the cutaway view shown in Fig. 3 will give a general idea as to construction. The apparatus consists of a baseboard measuring 12in. long and 8in. wide, on which the two lamps are mounted in batten-holders (see Fig. 2). On top of the baseboard rests the cover section, which houses the lens and focusing tube and the two reflectors.

The Baseboard

Although a size of 12in. × 8in. has been suggested, these dimensions are by no means binding and may be increased as desired.

The batten-holders should be screwed in place to allow the lamps to have at least 1in. clearance of the sides of the cover section. Lamps are connected in parallel and a ventilation slot should be cut in the centre of the baseboard. Four small wooden blocks should be screwed at the corners to act as retaining blocks to keep the cover section in position. This means that the blocks will have to be inset according to the thickness of the wood used for the cover section.



Note: The reflectors have been rotated in order to show the bulbs. They must be fixed round the other way so that light is reflected back on to the picture.

Fig. 3.—A cutaway perspective view of the complete episcope, showing constructional details.

The baseboard should be mounted on two strips of wood in order to allow air to pass up through the ventilating slot. Ventilation is necessary as the two lamps give off considerable heat which tends to curl photographs on the mounting flap.

Cover Section

Dimensions of the cover section should correspond with those of the baseboard, plus a height of not less than 7in. The rear panel is not a fixture, but hinged at the top so that it may be opened and used as the mounting board.

The two tin reflectors should be about 5in. in length and curved to fit approximately half-way around the lamps. They may be cut from cocoa tins or similar containers and are secured to the underside of the roof of the cover by means of the flanges seen in Fig. 3.

Ventilation holes are also necessary in the roof of the cover section, and these should be screened with tin shields to prevent light escaping into the darkened room when the instrument is in operation.

The circular aperture for the lens tube cannot be cut until the exact diameter required for the lens plus the thickness of the lens tube is known.

Lens and Focusing Tube

Many multiple and surplus stores offer magnifying or reading glasses at reasonable prices. For the instrument described in this article, a lens of 2in. or 2½in. dia. is recommended.

(Concluded on page 274)

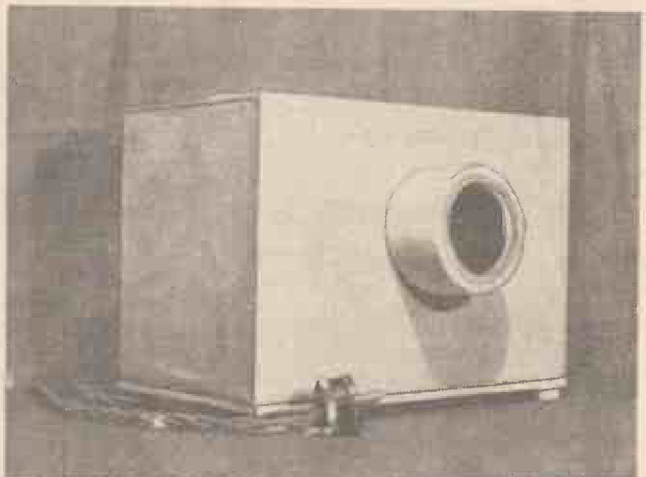


Fig. 1.—A view of the completed episcope.

Fig. 2 (Left).—The baseboard, showing batten lampholders, ventilation slot and locating blocks for the cover.

THE AUTOMATIC HOUSE

PART 1

THIS month's cover shows the baby alarm in operation. If baby cries an electric bell commences to ring or an alarm light comes on; they continue until switched off. Other uses are to switch on any electrical device by the phone bell ringing, as a burglar alarm or to warn an absent teacher that his class is misbehaving.

Housing

Wood is suggested for this and the general appearance of the prototypes can be seen in Fig. 1 and on the cover. The units are a detector loudspeaker, control box and alarm unit.

PARTS REQUIRED

Those with little experience are advised to keep exactly to the specification of the prototype and not to use alternative parts.

One 8in. moving-coil speaker, 3 ohms impedance, fitted in a wooden cabinet with very thin cloth cover in front, or better still, a metal grille or a few cross struts only.

Tr_i—Standard speaker transformer used as a valve input transformer. If a multi-ratio type is available it is very suitable.

Tr_f—Filament transformer, 6.3 v. at 3 amps. to suit A.C. mains used. With 200 to 240 volt mains a standard speaker transformer will do, although the valves will be a little under-run.

Valves :

V_a and V_b are EF50s and 2 B9G bases to suit are required.

V_c is a 6X5 and an International Octal base to suit is required.

Capacitors :

C_a/C_b—8/32 μF or similar in one can, 350 v. working. If can is not isolated from tags it must be wrapped in tape.

C_c—25 μF 12 v. working electrolytic capacitor.

C_d—25 μF 50 v. working electrolytic capacitor.

C_e—.01 μF Sprague or Mica type coupling capacitor, 350 v. Use a 1,000 v.w. if available.

C_f—.1 μF paper condenser, 350 v.

C_g—25 μF 50 v.w. electrolytic capacitor.

C_h—.01 μF 350 v.w. paper condenser. (No other value must be used in this position, even if sparking does occur at relay points.)

Resistors :

R_a—100K ½ watt.

R_b—470K Ω ½ watt.

R_c—470 Ω ½ watt

R_d—1,000 Ω ½ watt.

R_e—1,000 Ω 5 watts or larger.

R_f—500 Ω 3 watts.

R_g—470K ½ watt.

R_h—5,000 Ω ½ watt (do not use another value even if small sparking at contacts persists).

R_j—15,000 Ω within 10%, 7 watts or higher rating. If other relays are used instead of the 200 Ω P.O. type 3000 this value will have to be modified. (See under relays.)

VR_d—Variable resistance 50K or 25K contacts must be isolated from earth. This is usually so, but some ex-Govt. variables have the middle tag earthed. This would make the chassis live to mains.

Knob for above (insulated type)

Anode Relay

Any delicate relay which will operate on 1½ mA or less and will release on about ½ mA will suit. If the coil resistance is less than 8,000 Ω put a resistor in series to bring it up to this value. If the coil resistance is more, then leave the circuit as it is. One pair of n/o contacts are required.

The prototype used a surplus relay, 8,000 Ω, No. 2389, from Messrs. Annakin at a cost of 3s. 6d. P.O. type 3000 relays with coil resistances of 50K or 100K fitted with one pair of contacts are quite suitable and the Siemens H.S.1000 plus 1,000 Ω type will do if the return spring is removed.

S_m—Toggle switch, on/off.

S_s—Toggle switch, on/off.

S_b—Toggle type throw-over single-pole (i.e., one-pole two ways).

The Second Relay (Auto Switch)

This is a P.O. type 3000 with a coil resistance of 200 Ω from Messrs. W. Benson (Part 338) or Messrs. K. R. Whiston (Part No. 3003X) OR to order from Messrs. L. Wilkinson (Croydon) Ltd., two pairs of n/o contacts are required; others may be left in place or removed. If coil resistance of other value is used, alter value of R_j so that total of coil and resistance is 15,200 Ω approx. If the resistance is above 15,000 Ω, leave out Rj and use a piece of copper wire instead.

3 two-terminal blocks.

6 v. electric bell.

6 v. panel lamp and holder (6 v.).

Neon lamp complete, Arcolectric SL50 Red for 250 volts. Order through any radio dealer. Red glass is best with neons.

6 v. Transistor type battery. Insulate terminals with tape if it is in a metal box and not fixed down.

Nuts, bolts, tags, solder, wire, etc.

All components are available from normal radio dealers such as Messrs. R.S.C., Leeds, except where other suppliers advertising regularly in *Practical Wireless* have been given.

Control Box Chassis

A baking tin from a walk-round stores was used but any chassis 8in. × 4in. × 3in. deep will suit. No electrical connections are made to the chassis, but if a metal case is made it should be earthed and isolated from the chassis by insulators.

The back control knob (sensitivity) must be of an insulating type with the grub screw filled with sealing wax. Alternatively, the shaft may be cut into a screwdriver type slot so that it may be set with ease, but resist tampering.

Twelve ventilation holes should be spread over the sides or metal grilles may be fitted. The mains consumption is only about 30 watts.

Positioning the Components

This is not vital provided the input transformer Tr_i is not put near or parallel to the filament transformer Tr_f. The two E.F.50 valves require 1½in. dia. holes, the 6X5 one of 1⅛in. and the condenser C_aC_b one roughly 1¼in. These holes may be cut with tank cutters, special chassis cutters or by drilling small holes round and filing the edges smooth when the middle has been removed. All these holes must be drilled and completed before mounting components.

The P.O. relay of Fig. 3 is shown with a suitable mounting bracket. This is screwed to the chassis underneath the relay which is attached by two fixing studs. On no account must the dowel be used for this purpose. A clearance hole *is* necessary for this dowel in the bracket. The P.O. relay may be positioned upright to facilitate wiring and make more space, but the cabinet would have to be higher. The relay should

Fig. 1.—The three completed units.

This new series, starting here with baby alarm, will also include automat time clocks, delay switches, thermosta door bolts and automatic opening a burglar, fire and frost alarms, lou extension systems, counting devices, ...

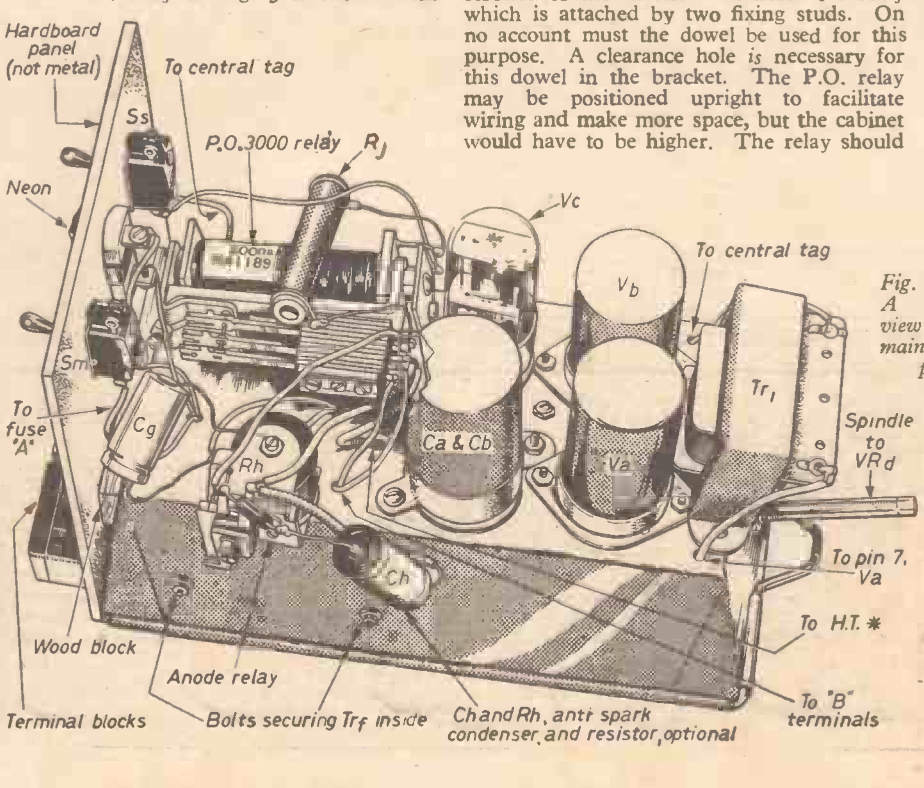


Fig. ... A view ... main ... p...

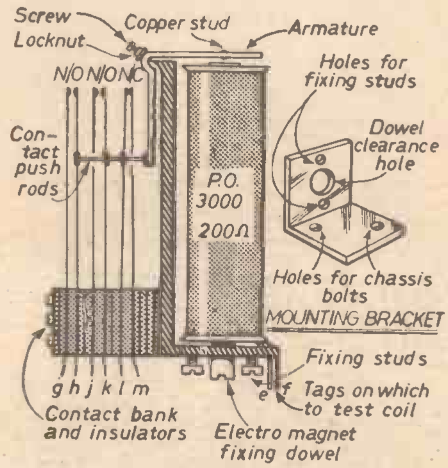


Fig. 3.—The relay P.O. Type 3000.

be inspected and tested before wiring in circuit.

The front panel is cut out of hardboard or a modern laminate or plastic. It is shown in Fig. 1. Holes must be drilled to suit the switches and two holes filed together will make the necessary oblong hole for the decorative neon warning lamp (Arcolectric Type S.L.50 for 250v.). The three two-terminal blocks are screwed in position. The panel is fixed upright to the sloping sides of the baking tin by using a fillet of wood as in Figs. 2 and 7.

The Components Mounted Inside

The filament transformer is mounted on one side as shown. A standard pentode output transformer may be used for this purpose (as in the prototype).

Make sure the fuses are insulated from the tin when they are mounted, and insert 2-amp. fuses into the clips. VR_d is mounted tightly in the centre position at the back.

Note the position of the central tag. This tag or pair of tags is mounted so that it is insulated from the tin. Special tags may be purchased from radio dealers, or one may be made from two paper clips, a piece of Perspex and a long nut and bolt (see Fig 4).

All other components are mounted "in air," between various solder tags on the components.

a positive
ic lighting,
ts, electric
nd closing,
d speaker
etc.

P.O. Relay Type 3000

These surplus relays are usually of 200 ohms resistance, as specified. Readers with little experience should keep exactly to the specification.

In Fig. 3 note when tags e and f are connected to a D.C. supply the armature pulls in, contacts g and h come together and j and k do likewise. l and m are not required. If another bank of contacts is fitted they may be removed and kept as spares.

The locknut and nut on the armature retaining screw will govern the

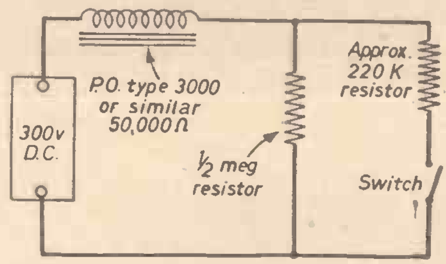


Fig. 5.—Adjusting the P.O. Type 3000 relay for use as an anode relay. Adjust so that relay pulls in on 1½-2 mA. with switch closed and falls out on ½ mA. with switch open.

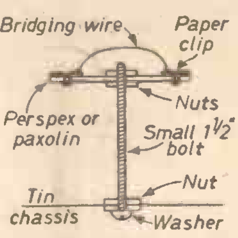


Fig. 4.—Making the central tag.

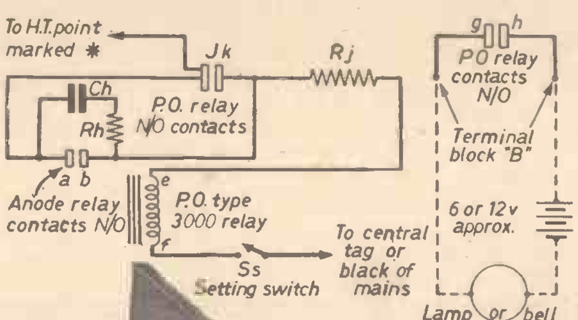


Fig. 6.—Wiring of relays in baby alarm.

2 (Left).— perspective showing component positions.

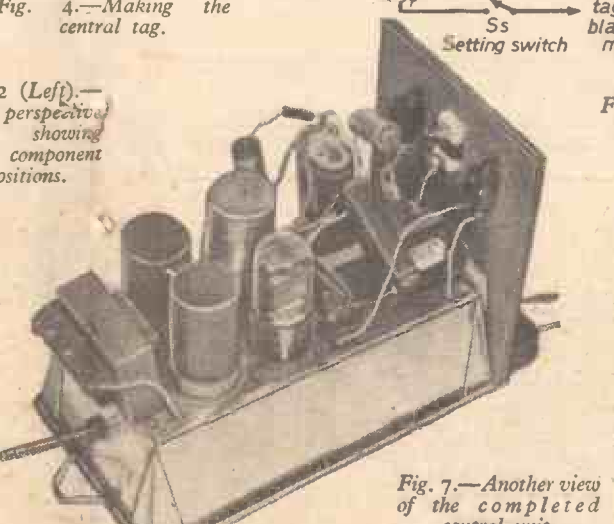


Fig. 7.—Another view of the completed control unit.

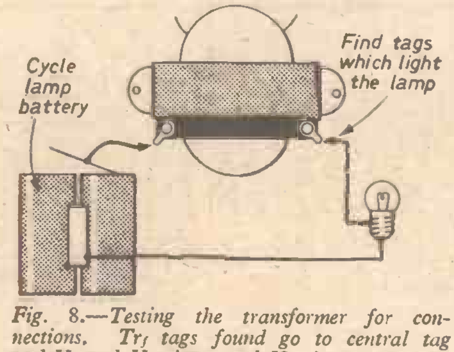


Fig. 8.—Testing the transformer for connections. Tr_f tags found go to central tag and V_a and V_b pins 1 and V_c pin 2. Tr_s tags found go to speaker.

STEP-BY-STEP WIRING

The Filament Circuit

This is done with plastic covered wire. Various colours will help to avoid ambiguity.

For the advanced experimenter the full circuit is given in Figs. 6 and 12, and for the beginner step-by-step wiring follows :—

1. If the transformer Tc_f is not marked test it as shown in Fig. 8 using a torch battery and flash lamp bulb.
2. Refer to Figs. 9 and 12 and wire red mains lead terminal to Fuse "A." Take other side of fuse to switch S_m on the front panel, make a small hole in the tin to pass the wire through. (In future this method will be assumed.)
3. Wire the other side of the switch to the neon lamp and to the primary side of Tr_f and from there to pins 3 and 5 on V_c.
4. Wire black mains terminal to fuse "B."
5. Other side of fuse "B" to other side of neon, to other side of Tr_f primary, to Tr_f secondary (any tag) and to the *central tag* already referred to.
6. Wire pins 9 of both V_a and V_b to *central tag.*
7. Wire pin 7 of V_c to central tag also.
8. Join pin 1 of V_a to pin 1 of V_b and to pin 2 of V_c and on to the spare secondary tag of the transformer.
9. Plug in the valves and switch on. V_c should light up but V_a and V_b will get slightly warm after 10 minutes.

The H.T. Circuit

1. Make sure pins 3 and 5 on V_c are connected to the "red" mains side of the filament transformer as detailed.
2. Connect pin 8 to a 500 ohm resistor (R_f) and solder the resistor to the lower capacity tag of the large electrolytic condenser C_b. This condenser must be inspected. If the can is isolated all is well. If not, or if in doubt wrap the can in insulating tape where it is mounted or the tin chassis will become live to H.T., mains etc. There are three tags on it, the negative must be connected to the *central tag.* Now join the tag connected to the 500 ohm resistor to the other tag (higher capacity one) via a 1,000 ohms resistor (R_e).
3. Switch on unit and leave for two minutes. Switch off. Short between junction of 500 and 1,000 ohm resistors to *central tag* with screwdriver or insulated wire. A big spark should jump. Voltage test should show about 300v. D.C with central tag minus polarity.

The Wiring of V_a Circuit

1. Make sure of the V_a location and that the valve base numbers are understood. All coding is done when looking at the bases from underneath, starting at the locating projection in the central bush and working in a clockwise direction as shown in Fig. 10a and b. Make sure pins 1 and 9 are already wired.
2. Join pin 4 to *central tag*
3. Join R_a to pin 3, cutting the lead to about ½in. long.
4. Join C_e to pin 3 also, having sufficient sleeved wire to allow the condenser to lie underneath VR_d in Fig. 9.
5. Join R_b to pin 2 and at the same time join C_f to pin 2.
6. Take other end of C_f to *central tag.*
7. Join R_b and R_n together at the unused ends and connect to junction of R_e and C_a (in H.T. circuit).
8. Join secondary of Tr_f to central tag and other side of winding to pin 7.
9. Join two wires from Tri primary to terminal block A. If there is any doubt about the transformer windings refer to Fig. 8 and test as shown.
10. Take pin 6 to central tag via R_c. Connect also pin 6 to central tag via C_c noting that the positive side goes to pin 6, this is very important. Some wiring is shown also in Fig. 8. Verify that pins 5 and 8 and the central spigot tag of the valve base are not used. Check wiring against the circuit of Fig. 12.

Wiring of Vb Circuit

1. Check that the anode relay is operating correctly as shown in Fig. 11 or, if a P.O. type with 50,000 ohms coils is used, as in Fig. 5. Basically the relay must release on ½ mA or more and pull in on 1 mA for full sensitivity, but if it pulls in on 2 mA it will do. A baby crying may take the current up to well over 5 mA according to the pitch of the cry.
2. Check that C_e (already wired one end) is a Mica or Sprague type and connect it to pin 7. Connect pin 7 also to the central tag board via R_g.
3. Connect pin 6 to VR_d *exactly* as shown in Fig. 8 and connect pin 6 also to central tag via C_d making sure the positive side goes to pin 6.
4. Join the side tag (shown in Fig. 9) of VR_d to control tag (Fig. 4) via R_d. Leave the other tag of VR_d unused as shown.
5. Join pins 2, 3 and 4 together and take a lead to the *coil* tag d of Anode Relay.
6. Connect c *coil* tag of anode relay to H.T. line at junction of R_e and C_a already wired.
7. Join C_g across the anode relay coil from c to d making sure that the positive side is connected to c, that is to H.T.+.
8. Verify that pins 5 and 8 and control spigot tag are not used.
9. Verify that pins 1 and 9 are already wired in the filament circuit.

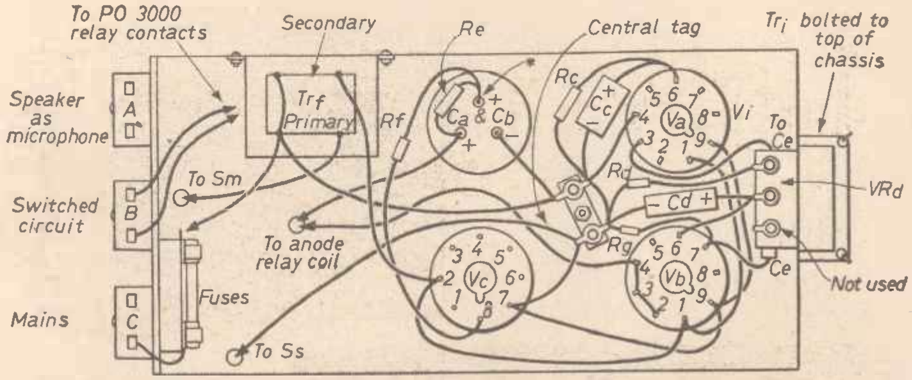


Fig. 9.—Chassis from underneath, showing larger components and some wiring.

operating current, and should be set quite freely. Wire a 4½v. battery in series with the coil, tags marked e and f in Fig. 3, and make sure the relay pulls in and releases perfectly.

Anode Relay

The prototype shown in Fig. 2 is No. 2389 (8,000 ohm), but a P.O. type 3,000 may be used with a coil resistance of 50k or 100k. The anode relay must be adjusted to pull in on 1 or 2 mA and fall out on ½ mA. If it will pull in on 1 mA the instrument will be very sensitive.

If using the 8,000 ohm surplus type wire up as in Fig. 11. Now by bending the stop get the armature so that it is within a few thousandths of an inch of the electromagnet. Then bend the spring and the contact stay so that there is very little pressure holding the armature off the electromagnet. The smaller the pressure the better. Now bend one contact until it almost touches the other. If this is done carefully the relay will pull in on 1 mA and fall out on ½ mA.

P.O. 3,000 As Anode Relay

The circuit of Fig. 5 can be used. Setting the relay is done by loosening or tightening the armature locking nuts, bending the contact stays which are springy and hold the armature open. The armature must be almost on the magnet and only very small gaps are necessary between the points. The relay should work on the same currents as those above.

Wiring

Full step-by-step details are given in the column 3 box on the previous page.

Testing the Detector

Plug in the valves and then have a good look underneath to make sure that all the soldered connections are still in place and not shorting. This is very necessary when using a thin tinplate chassis as it is inclined to warp when EF50 valves are inserted.

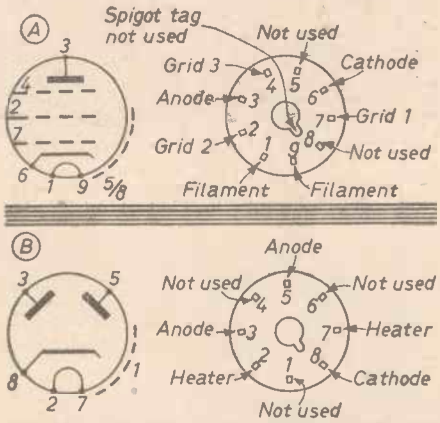


Fig. 10.—(a) EF50 valve base and (b) 6X5 valve base. Both are drawn from underneath.

Switch on. Any signs of overheating show an error in the wiring and it should be rechecked. Switch off and connect a 3 ohm speaker to terminals A. Switch on and leave for two minutes to warm up. Turn VR_d fully clockwise and observe very carefully the contacts of the anode relay. They should be open. Less than ½ mA will be flowing and the relay has been checked as releasing on this figure.

Watch the contacts very carefully and turn VR_d slowly anti-clockwise and at a certain point well over half-way round the points will slowly, but definitely, come together. A good light and a white background are necessary to observe the points accurately.

Now leave VR_d in such a position that the relay points are not touching, but any further movement anti-clockwise would cause them to pull together. This is the set position and must be done in the quiet.

Observe the points again very carefully while making a medium pitched "Coo-oo-oo" noise. The speaker should face the person, but may be up to 6ft. away. The points will be seen to come together.

When in complete silence, the points should part again. If a small spark occurs across the anode relay points when the next relay is wired in do not worry and do *not* alter the value of C_f and R_h (which are not yet in circuit).

Variation in Components

Take great care over polarity of electrolytic condensers, the H.T. smoothing ones are in

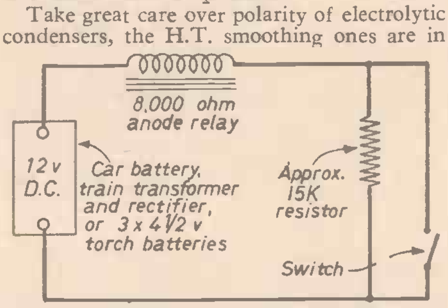


Fig. 11.—Adjusting circuit for 8,000 ohm anode relay. Adjust so that relay pulls in on 1½ mA. with switch closed and falls out on ½ mA. with switch open.

one case with one common terminal. The details of the connections are shown on the outside casing. If a multiratio speaker transformer is available, experiment with the best secondary tag to connect to pin 7 of V_a. Generally the higher the impedance the better. The normal tolerance of the resistors will not affect the working, the author used resistors *outside* the tolerance limit satisfactorily.

Wiring in the Auto Switch (P.O. 3,000 relay)

Refer to Fig. 6. The anode relay already wired as far as its coil is concerned is not shown. Its two points that close when noise is made are shown as a and b. The P.O. 3,000 relay coil is shown. This relay has two pairs of n/o (normally open) contacts which are marked g and h, j and k. Refer also to Figs. 2 and 3.

Check that the relay is working correctly. Observe that the n/o pairs of points are in fact open. Proceed as follows:—

(*Concluded on page 266*)

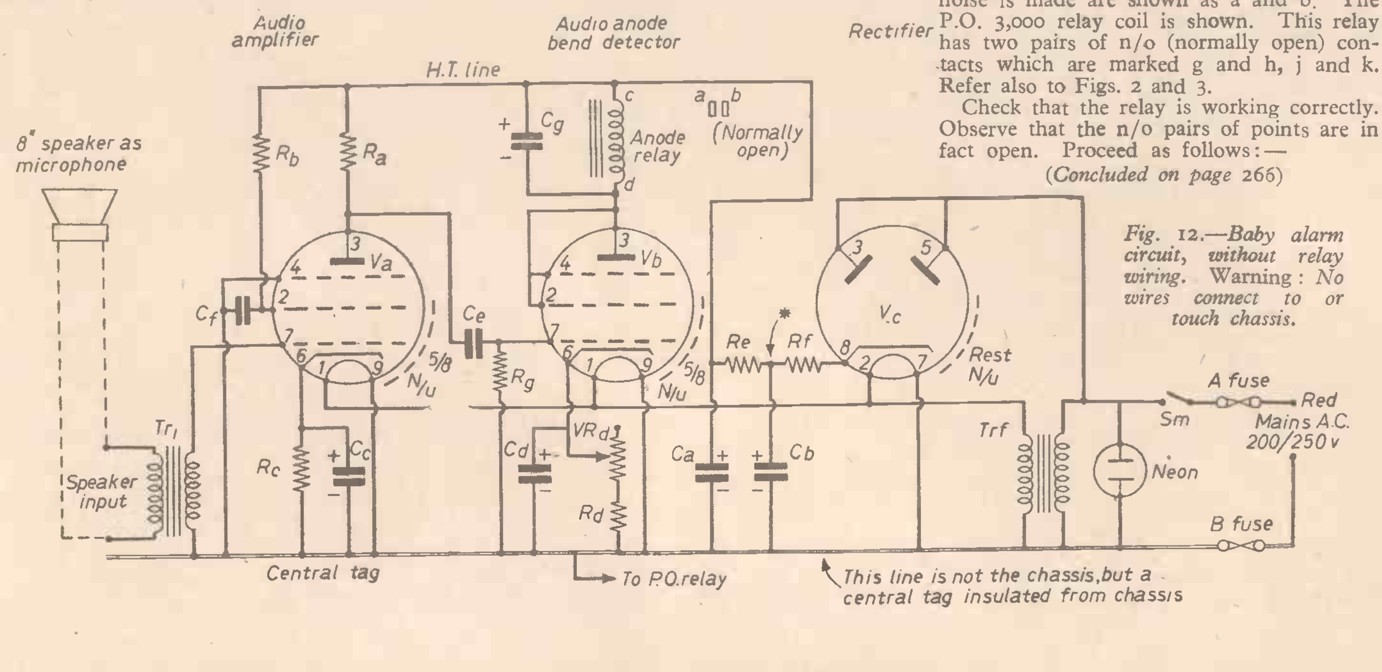


Fig. 12.—Baby alarm circuit, without relay wiring. Warning: No wires connect to or touch chassis.

BUILDING YOUR OWN

3-4 Berth Caravan

This Concluding Instalment Deals Mainly with Exterior Fittings and Building the Interior Layout

By H. C. Piggin

The Door

THE bottom door is a plain panel of hardboard on softwood framing. The upper door is glazed and is made from rebated softwood with dowelled mortise and tenon joints. Both are hung on ordinary steel flapback hinges which are allowed to protrude about ½in. so as to swing the doors clear of the van. The middle joint between the doors is made up by false rebates nailed on (Fig. 15).

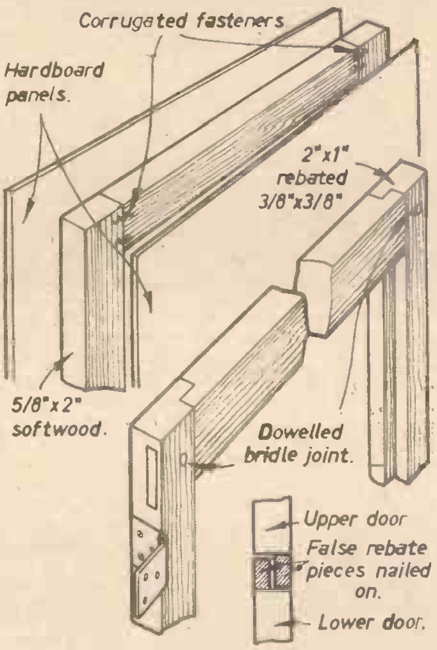


Fig. 15 (Left).—Details of the panelled lower door and the glazed upper door.

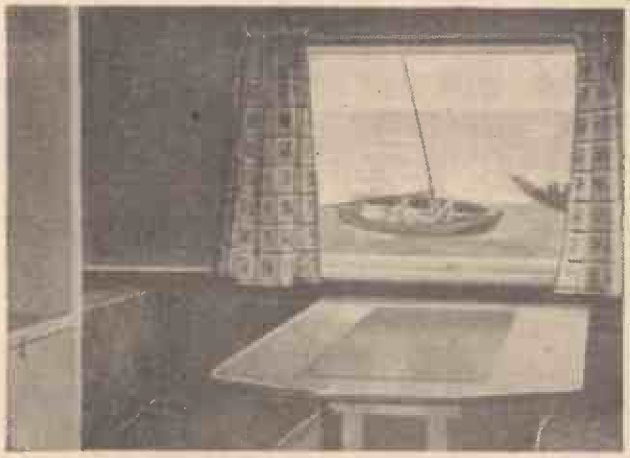


Fig. 16 (Above).—A photograph of the interior of the author's caravan.

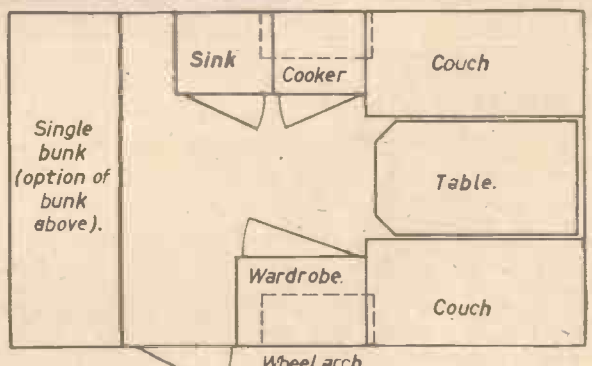


Fig. 17 (Right).—Suggested typical layout for 3-4 berths. Couches and table make double bed. There is space for storage under couches and bunk.

Exterior Fittings

The "J"-type roof guttering is screwed on to the roof canvas overhang, being set on to half-dry paint.

The aluminium storm-strips over the opening windows are similarly fixed, together with those at the doors.

Ventilators are fitted to the outside, one over the sink and cooker unit, and one in the wardrobe. The positioning of these will depend on the interior layout, of course, and must be plotted carefully. It is as well to drill small holes through the hardboard at the corners of the vents so as to plot the position of any extra fixing battens of 1in. × 1in. softwood which will have to be glued on to the interior of the skin. The surplus skin between the fixings is cut away with a padsaw.

The van should be primed and undercoated. However it is best to leave the final gloss until the van has been given a short tow to shake things down.

All bright aluminium waist and corner mouldings are screwed on to wet undercoat, any surplus being carefully rubbed off.

Naturally the more care that is taken over the painting, the more professional will be the final result. Plenty of patience, thin coats and good rubbing-down in between will give the best results.

A number-plate, it should be pointed out here, is a legal necessity. Rear lights and reflectors are needed only if the van is towed at night. And whilst on the subject of the law, it is as well to check on the car insurance policy to make sure that the "third party" is valid when a caravan is attached to the car. Wing mirrors on the

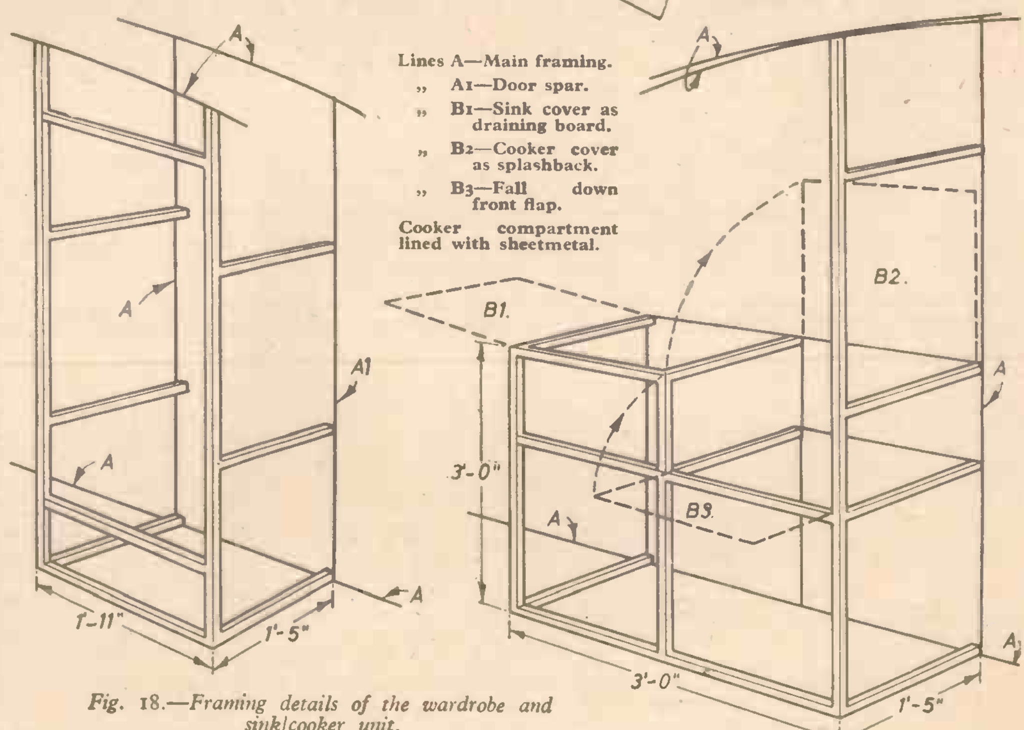


Fig. 18.—Framing details of the wardrobe and sink/cooker unit.

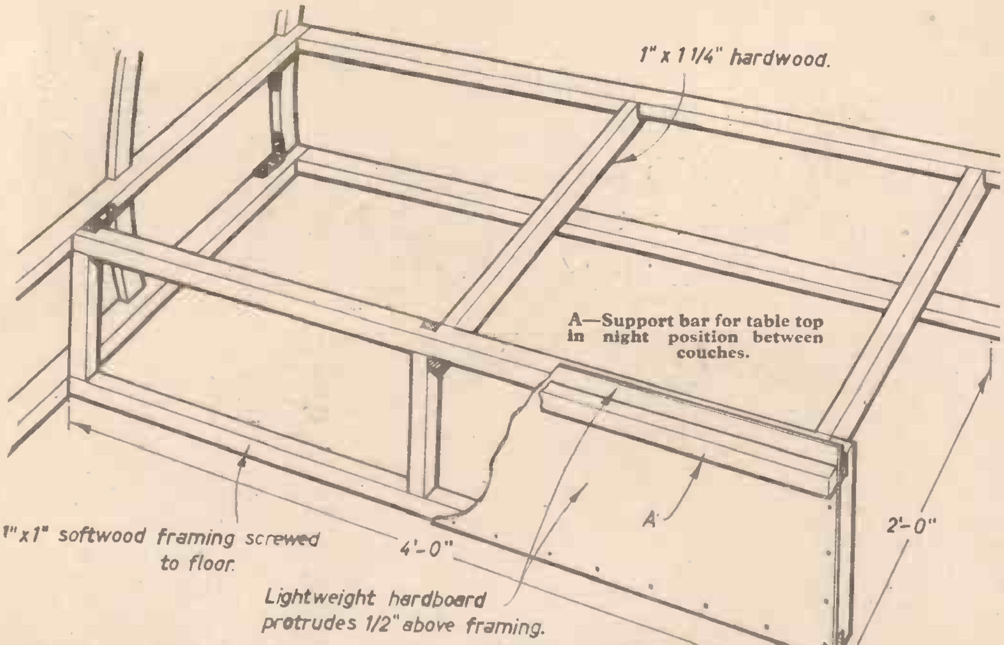


Fig. 19.—A dinette couch. Other couch and bunk are of similar construction. Joints are halved, glued and screwed and the ⅛in. hardboard top rests on main van spar and front framing.

car are also necessary if a clear view through the front and rear van windows is not obtained from the driving seat.

The Interior

No one interior layout is entirely satisfactory to every enthusiast, and as this part of the van is so dependent on personal choice, only general guidance is given (Figs. 16 to 20).

In this small van with its light construction, the wardrobe is essentially part of the main structure and helps to brace the roof, as also does one side of the cooker unit. It is desirable that both of these should be kept fairly central, within six inches or so one way or the other. The dimensions otherwise are not critical.

All furniture is permanently fixed and is built on to existing mainframes wherever possible to save weight. Softwood framing 1in. × ¾in. will be found to be adequate for most pieces, being panelled with light-weight hardboard (nominally 1/16in. thick or 3mm. ply).

Where weight is carried, as on seats and beds, the longest unsupported run of framing is only 24in., and some reinforcement of cross-members is necessary.

Doors are framed-up in the simplest possible style, use being made of corrugated box-fasteners rather than complicated joints.

Walls are lined with 3mm. ply; one of the pinky colours such as Japanese luan, or gaboon looks well and is relatively inexpensive. It may be left plain or lightly toned with polish. It should be fixed with small brass pins.

Where fixings cannot be obtained on existing framing, small 1in. cubes of softwood can be glued on to the caravan skin at about 6in. intervals. When cutting the plywood, the use of templates cut from stout paper is recommended for the awkward shapes.

In small vans it is advisable to keep the interior light in finish. The roof should be painted dead white, and all interior woodwork and hardboard should be lacquered in pale tones—birch grey is very pleasant—perhaps relieved occasionally by some brighter contrast here and there.

Useful ideas can often be obtained by inspecting commercially-built caravans.

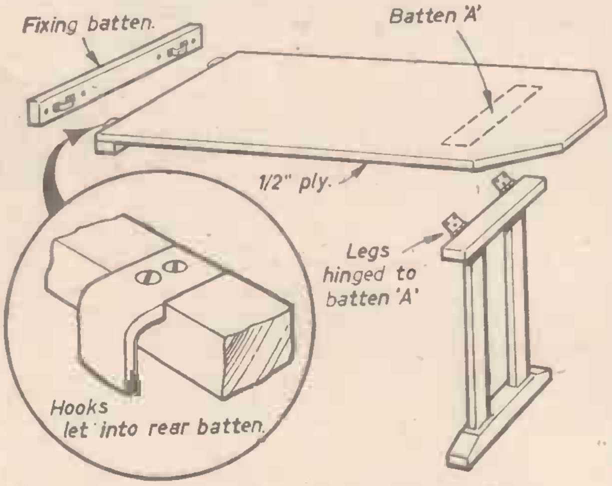


Fig. 20.—Details of a "hook-on" table.

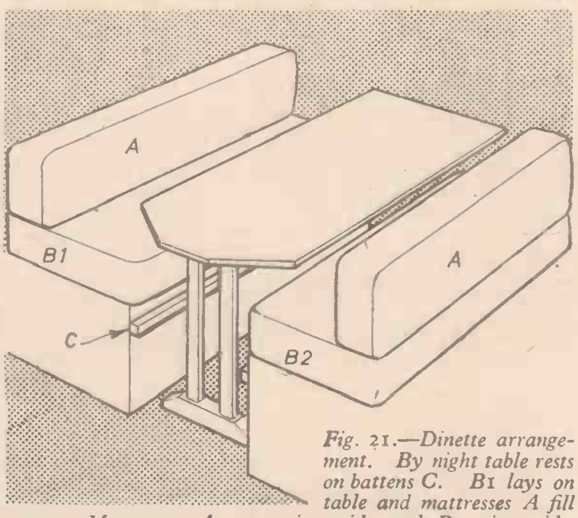


Fig. 21.—Dinette arrangement. By night table rests on battens C. B1 lays on table and mattresses A fill space. Mattresses A are 12in. wide and B 23in. wide.

BOOKS Received

Turbines. By F. E. Dean. 144 pages. Price 8s. 6d. net. Published by Frederick Muller Limited.

THIS simply written and well-illustrated volume is part of the Mechanical Age Library. The introduction is in effect a "potted" history of the water wheel and the turbine and is followed by chapters which outline the working principles of the various types of turbine. Many plates and diagrams are included.

Make Your Own Photo Equipment. By Geoffrey I. Lilley. 116 pages. Price 18s. 6d. net. Published by the Fountain Press.

A GREAT many people must have been put off photography as a hobby in the past by the initial expense of the equipment involved. The handyman is provided here with the means of overcoming this difficulty. The book contains detailed instructions for making a wide range of equipment, including cameras and stands, lighting equipment, camera jigs and sets, darkroom equipment, enlargers, slide projectors, etc. There are also special chapters on using wood, materials and finishes, bellows construction, etc. Both photographs and drawings are used to illustrate the book and the last few pages are occupied by a list of fittings and materials and sources of supply and a comprehensive index.

Making a Start With Marionettes. By Eric Bramall. 111 pages. Price 12s. 6d. net. Published by G. Bell and Sons Ltd.

THE experience and "know how" of an expert puppeteer are passed on to the amateur via the pages of this book. All aspects of the subject are covered and there are chapters on construction, costumes, stringing, the stage, lighting, sets, scenery, stage properties and, finally, producing the play. Photographs and line drawings illustrate the book.

Electricity in Your Aquarium. By L. Warburton. 116 pages. Price 7s. 6d. net. Published by Percival Marshall and Co. Ltd.

THE modern aquarium employs a multiplicity of devices, the majority of which are electrically operated. Heaters, thermostats, aerators, alarm gadgets, etc., all require the aquarist to possess a knowledge of electricity if he is to operate them efficiently and especially if things go wrong. Providing this knowledge is the author's primary aim, and his book should fulfil a long-felt want.

AN ELECTRIC BOMBING GAME

THE principle of the game is that a plane equipped with electric motor is suspended from a long arm, pivoted so that the plane follows a circular path. It carries three "bombs" or darts, each of which can be released at any point in the circuit, in attempts to secure high-scoring hits on a target below.

The circuit is shown in Fig. 1, and this will help to make the working of the model clear. To commence, the bomb release switches are closed. The three electro-magnets then hold the darts under the plane. When the motor switch is closed, the propeller begins to revolve, and this causes the plane to follow its circuit round the supporting mast or tower upon the top of which the boom is pivoted. A motor speed control is fitted because it was found that the plane tended to go much too fast after two or three circuits. Also it allows bomb dropping runs to be made at various speeds. Each time one of the bomb release switches is opened, a dart falls from the plane, turning to stick point first in the target below. The competitor's aim is, of course, to release the darts at such instants as will obtain a good score. When all three have been dropped, the motor is switched off, the bomb release switches closed, and the darts are again placed on the magnets.

F. G. Rayer Tells You How to Make It

The control panel is a short distance from the model, and connected to the masthead by five-core flex. Provided a motor with wound field is used, the model will run directly from low-voltage A.C. obtained from a mains transformer. With a motor of this type, the model can also be run from batteries, but a permanent magnet motor will be more economical for battery operation. Such a motor will *not* run from a mains transformer unless a rectifier is added to obtain D.C.

In a model of this kind, actual dimensions are not very important, and can be modified to suit materials to hand. This also applies to the length of the boom, which governs the diameter of the circuit flown by the plane.

Masthead Slipring Tubes

Four separate circuits are required, with the axle itself used as the common return. To permit this, four pieces of copper or brass tube are necessary, each fitting into the others with a little clearance, as shown in Fig. 2. The actual diameter of these tubes is of no importance, provided at least one thickness of paper can be used as insulation.

Referring to Fig. 2, the axle should be about 6in. long, and brown paper or other insulation is wound round it until the smallest diameter tube is a fairly tight push fit. Insulation is then placed round the tube, and the next larger tube pushed on. This is then repeated until the four tubes are in position. Each tube is shorter than the next smaller diameter, as in Fig. 2, about $\frac{3}{8}$in. clear being allowed for the contacts. At the bottom, the thinner tubes are also longer, so that leads may be soldered on. The largest tube of all is only about $\frac{3}{4}$in. long and has a large washer soldered to it, ready drilled, to provide a flange.

This part of the model can be made quite easily, with success, if the ends of the tubes are clear of burrs or roughness which may cut the insulation. After the tubes have been assembled, a test can be made with a battery and bulb to assure that each tube is insulated from its neighbours, and the axle.

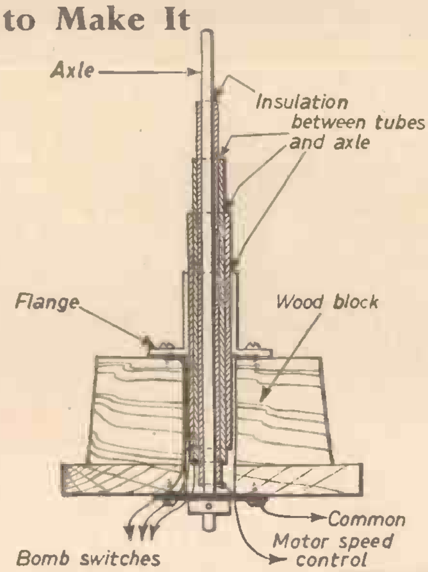


Fig. 2.—Axle and slipring tubes.

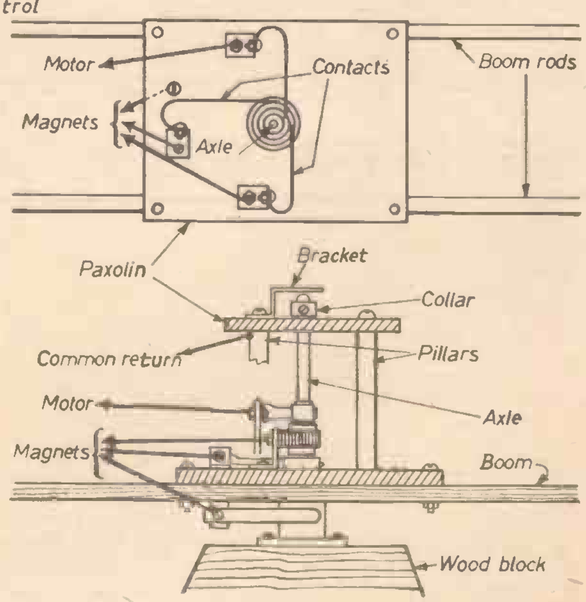


Fig. 3 (Right).—Plan and side views of the contact assembly.

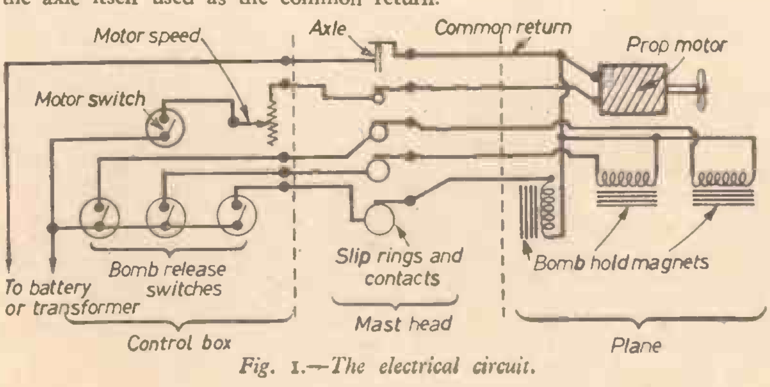


Fig. 1.—The electrical circuit.

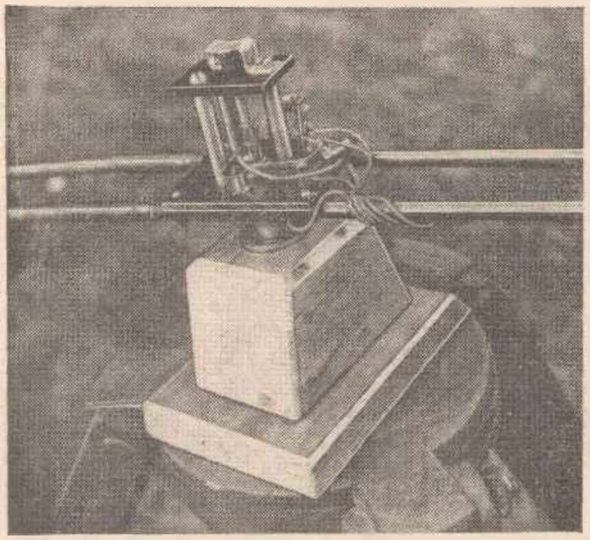


Fig. 4.—The contact assembly mounted on its wood block.

The Base

A wooden block about 2in. × 3in. × 2½in. high is cut, and a clearance hole is drilled. The assembly is then placed in this hole, and the flange screwed to the top of the block. At the bottom a larger piece of wood, say, 4in. × 4in. × ¾in. thick, will be useful when making a mast. If a constructional toy axle is used a wheel can be locked to the bottom, and held by grub screws, as in Fig. 2. This takes the downward weight of the boom, which rests on the axle, and which would otherwise tend to push it down inside the tubes.

The axle connection, or common return, should be identified by using a separate lead or flex of distinctive colour. The other four connections need not be marked, because a trial will immediately show which is the motor lead.

Projecting insulation which would prevent contact with the tubes is removed. If the model can be placed on a small table, and the darts dropped to the floor, a mast or tower about 2ft. high will do. But if the mast is to stand on the floor, it needs to be at least 3ft. 6in. high.

Contact Assembly

This has four brass strip contacts arranged to bear upon the upper exposed portions of the slipring tubes, as shown in Fig. 3. The bottom of the assembly is a piece of Paxolin about 2in. × 2¼in. centrally

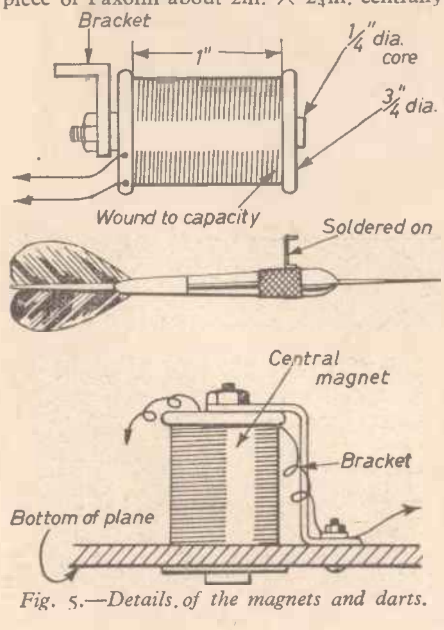


Fig. 5.—Details of the magnets and darts.

drilled to clear the third tube. Three pillars about 1½in. high hold a smaller piece of Paxolin, about 1½in. × 1in., which is drilled for the axle. Long bolts with spacing tubes sawn from ebonite or metal may be used instead of the pillars.

A strong bracket is bolted to the top piece as shown, and bears upon the top of the axle, which should be slightly domed. This takes the downward pressure of the boom and plane. A collar inserted between bracket and top piece prevents the rotating assembly being lifted off.

The four contacts are about 1½in. long and ½in. wide, and cut from thin brass. The brass strips from 4½V. flat flashlamp batteries will do well. One strip is bolted to a small bracket under the assembly, and bears upon the large, short

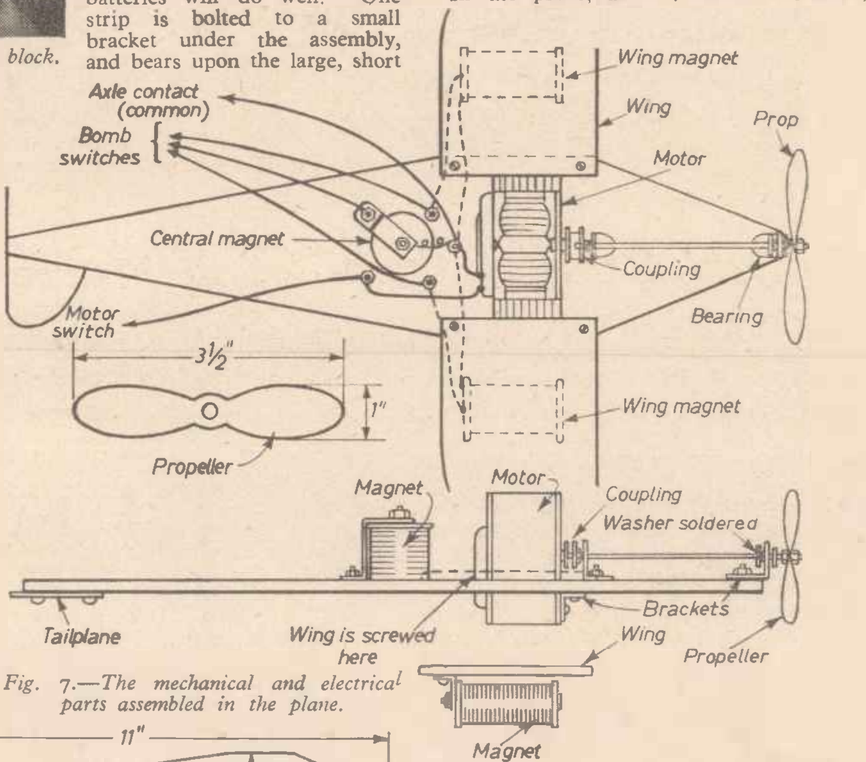


Fig. 7.—The mechanical and electrical parts assembled in the plane.

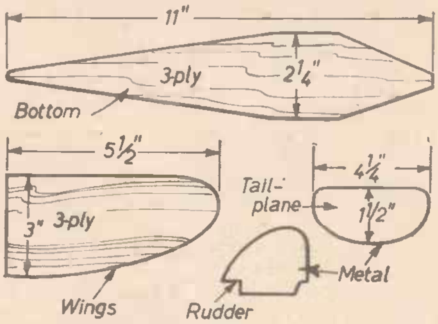


Fig. 6.—The plane bottom, wings, tailplane and rudder.

tube with flange. The other three strips are fixed to brackets of suitable height, and these can be cut from scrap metal. The strips are bent as shown to increase their resilience. The brackets are adjusted so that the strips bear well upon the tubes, then the 6B.A. bolts passing through the Paxolin are tightened. Additional nuts, bolts or tags should be provided for connecting the plane. If the top bracket is secured to one of the pillars, the common return connection can be taken from the bottom of this pillar.

The boom is made from 1ft. interlocking aerial rods of the type sold as surplus. One rod is bolted each side of the Paxolin, as shown in Fig. 3, being drilled for 8B.A. bolts. The rods must not touch the bolts holding the adjacent brackets. This is most easily assured by countersinking the bolt-heads when fixing these two brackets. Alternatively, washers can be placed between boom rods and the Paxolin base of the contact assembly. It is shown completed in Fig. 4.

Bomb Magnets and Darts

The magnets may be wound, or obtained ready made, or taken from an old bell or buzzer. The actual size and gauge of wire will not be important provided they are powerful enough to hold the darts with the operating voltage to be used. Fig. 5 shows the dimensions of suitable magnets, wound to capacity with 32 s.w.g. enamelled wire, for 10V. or similar voltage.

In the plane, a 12V. motor was used, and this was found to run with more than ample power from a 10V. transformer. This voltage was therefore adopted. For a 6V. motor, the magnets can be wound with 28 s.w.g. wire. Many small bell and buzzer magnets would be suitable for this voltage. If magnets are made, the core must be of iron or other ferrous metal, and a layer or two of stout paper should be placed round the core before winding.

The wing magnets are horizontal, being mounted on the small brackets shown in Fig. 5. This improves the appearance of the plane. The central magnet, also shown in Fig. 5, is covered by the body of the plane, and projects down through a clearance hole cut in the bottom.

Small darts of the usual type, available from sports shops, were used. A small strip of tinplate (tinned iron) about ¼in. wide and bent to the shape shown in Fig. 5 is soldered to the brass body of each dart, near the point of balance. The darts then hang horizontally when the strips are placed against the cores of the energised magnets. This gives the most realistic appearance, and the flights and heavier weight at the point will make them turn and stick into the target board.

(*Continued on page 265*)

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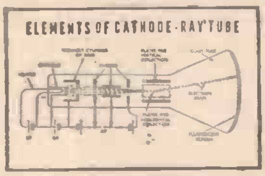

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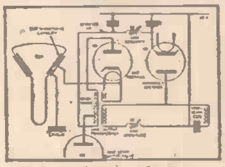

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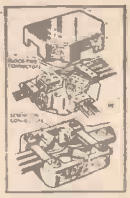

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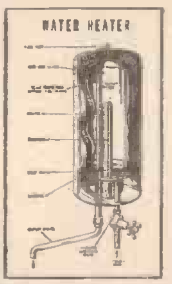

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If small children may work the model it is better to substitute "bombs" without sharp points. Darts with blunt points will penetrate a strong paper target placed on a tray of sand, or ballbearings may be used instead of darts, and dropped into a partitioned box.

If the model is used from both batteries and a mains transformer, it will be found that a somewhat higher voltage is needed from the transformer to hold the darts, and this should be allowed for when choosing the transformer.

The Plane

Bottom and wings are cut from three-plywood and tailplane and rudder from aluminium, to the dimensions in Fig. 6. The motor and propeller shaft are fixed to the bottom piece, and this is best done before adding the wings or other parts. In the model shown, the motor projected through a cut out, as in Fig. 7, to keep height down, but this will not be necessary with some motors. It is fixed with brackets at such a height that the propeller shaft is about ½in. above the three-plywood bottom, and a coupling like that used with model boats supports the rear end of the shaft, a suitable bearing bracket holding the front end. A similar bearing bracket can also support the motor end. A solid coupling is not recommended because great care would then be needed to get the two motor bearings and shaft bearing exactly in line. But with some motors it would be possible to add a shaft with a solid coupling and dispense with the front bearing. This is particularly so with small model motors which could be nearer the front of the plane. The front of the shaft was threaded 6B.A. so that a metal propeller could be held with locknuts.

The Propeller

This is cut from aluminium, to the size shown in Fig. 7. After noting the direction in which the motor runs (which will be reversible with a permanent magnet motor operated from D.C.) the blades are given a fairly steep angle—about 45 deg., or a trifle less towards the ends. A few trials will soon show if this will be suitable, and the pitch of a metal propeller can easily be modified as required. It will in any case probably be necessary to reduce the motor speed with the control resistance, to prevent the plane circling too rapidly.

A tinplate propeller can be soldered to the spindle. A plastic or wooden propeller, as used for flying models, could be a tight push fit.

Five 6B.A. bolts are fixed to the bottom of the plane, to form connecting points. The central magnet is located as in Fig. 7, a bracket being cut from scrap metal to hold it. The wings can then be screwed on, the magnets fixed below them, and wired to the bolts, as shown. The common return connection should not be confused with the others, or difficulty will arise from motor or magnets being in series.

The shaped wooden front, shown in Fig. 8, has a channel cut to clear the shaft and coupling, and it is screwed on from below. A bracket is screwed to the top of this front piece, as seen in Figs. 8 and 9, to suspend the plane.

The rear cover is cut from aluminium. After bending it to fit, a slot is cut for the rudder, which is secured with a rivet or small bolt. This cover can be lifted off without disturbing the working of the plane, and is used merely to improve appearance, and conceal the motor, etc., after wiring up. If suitably shaped it will clip on, and needs no fixing.

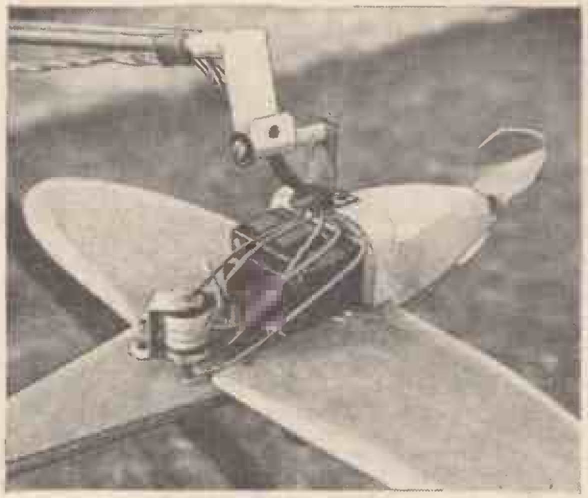

Fig. 9.—A view of the plane with cover removed.

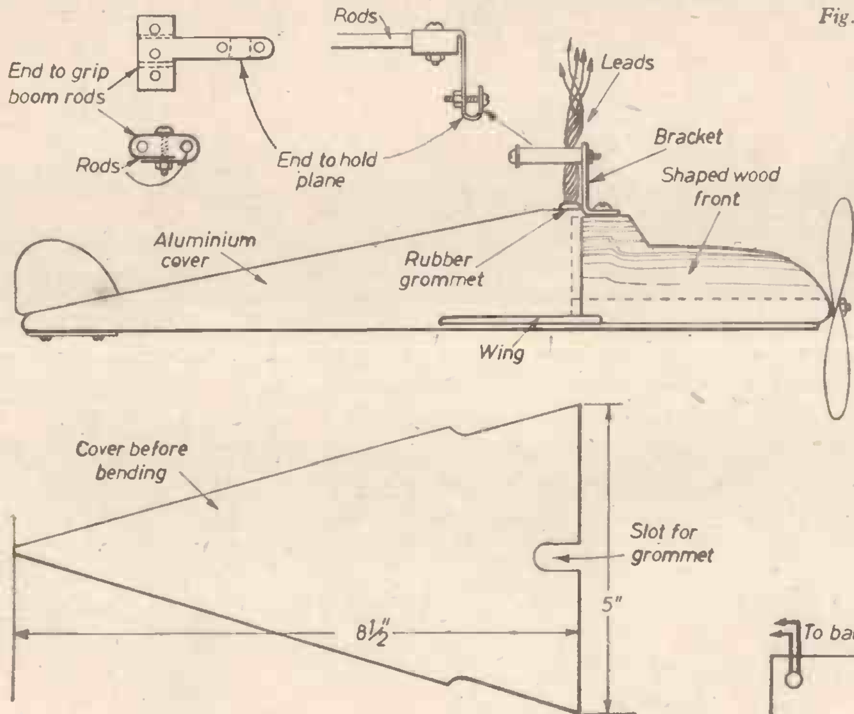

Fig. 8.—Aeroplane covers and suspension.

The Boom

This is made up by pushing other rods into the sockets of those bolted to the contact assembly. The rods are drawn together at the end, and held by the piece shown in Fig. 8, which folds round both rods and is clamped by means of a bolt. The projection is then bent down and formed into a loop to hold the plane, being clamped together by another bolt.

The boom is extended in the opposite direction by adding one rod each side, and a counterbalance weight is secured to these rods. This weight should be so adjusted, or slid along, until the whole rotating assembly approximately balances. With reasonably good balance, the plane will travel at about the same speed all the way round, even if the tower pivot axle is not absolutely vertical. Two pieces of wood or metal are clamped across the rods to prevent the weight moving.

Control Box

Layout and wiring of this item will be seen from Figs. 10 and 11. The control panel

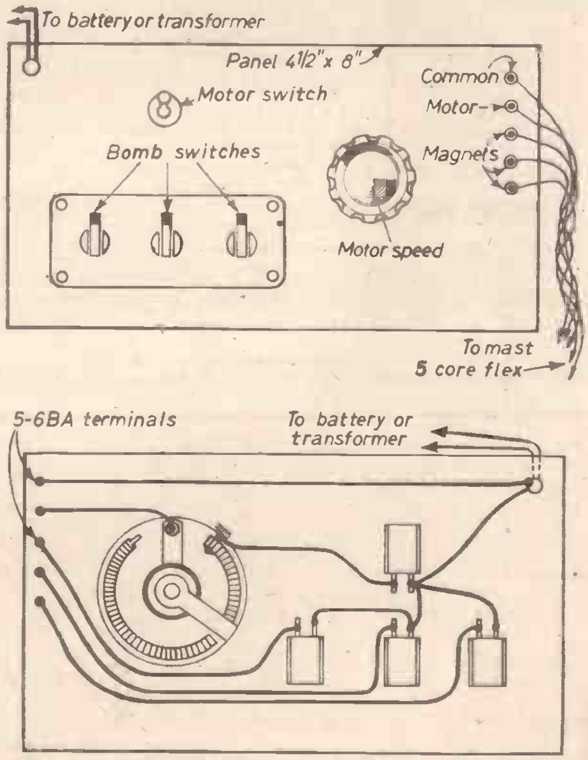

Fig. 10.—Top and underside views of the control panel.

carries four switches, a wire-wound speed control or variable resistance, and five terminals for connecting up the five-core flex passing to the masthead.

If the three bomb release switches are fitted as in Fig. 10, they will be "off" when pulled forward, the motor switch being "on" in this position. For transformer running, it would be possible to use spring-loaded push switches, which break the circuit when depressed allowing the darts to fall. The magnet circuits would then be restored automatically after the darts have fallen, ready for re-loading. In the interests of economy, ordinary switches are better for battery running. To commence, all the dollies are upwards in Fig. 10, this leaving the motor off, but the magnets on. The motor switch is then operated first, and the bomb switches as convenient.

Any variable resistance of about 5 ohms, and able to carry the motor current without overheating, will suit the average A.C./D.C. type model motor. For economical permanent magnet motors, run from D.C. only, a somewhat higher resistance will be necessary—say, 15 ohms maximum.

Fig. 11.—Control box and dart bombs.

Connections and Supply

The five bolts in the plane are connected to the five points on the contact assembly by means of thin flex or single strand bell wire. To avoid difficulty, ensure that the "common" lead goes to the axle contact.

A five-core flex lead about 6ft. long is then made up, and joined to the five leads emerging from the masthead fitting. A small insulated strip, with five bolts, will do well to make connections here. The axle connection is then taken to the terminal marked "Common" in Fig. 10. With the motor switch on, the other leads are touched on the "motor" terminal in Fig. 10, until the motor is seen to run. The three magnet connections can then be made.

The two leads issuing from the control box may be taken to a battery or transformer, but if a transformer will always be used this can be enclosed in the box, if this is deep enough.

The magnets were found to require just over ¼ amp. each, with the motor taking about 1½ amp. according to speed. A mains transformer with a number of tappings will be most convenient, as a suitable working voltage can then easily be found.

For battery running, a permanent magnet motor should be used, as mentioned, and will require less current. With battery operation it is easy to use one battery for the motor, and another for the magnets. If necessary, a different voltage may then be used. To do this, connect both batteries to the "common return," but take one battery to the motor switch, and the other to the bomb release switches.

A fairly stout piece of softwood should be placed under the target, which can be drawn or painted on card or paper. A central sector should have the highest score, with scores decreasing in both directions away from this.

The Automatic House—A BABY ALARM

(Concluded from page 258)

1. Wire C_6 to tag of contact a of the anode relay and connect it via R_6 to tag b. This is shown in Fig. 2, but the condenser is normally located upright at the side of anode relay. Use sleeving on the wires and make sure they cannot short.

2. Join contact a also to contact j on the P.O. relay, and continue the lead to the point marked * in Figs. 9 and 12. This is a high voltage lead and no shorts must be possible.

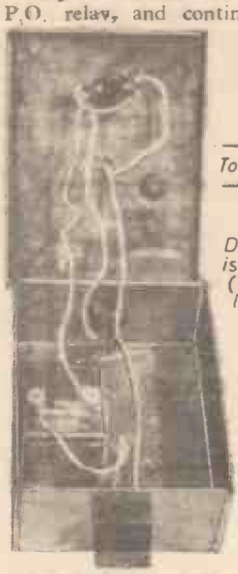

Fig. 14 (Left).—The bell box with lid removed.

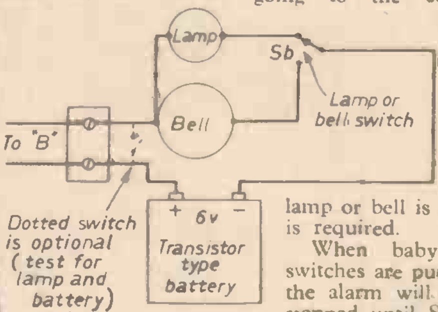

Fig. 13.—Wiring the bell box.

3. Join contact b of the anode relay to contact k of the P.O. relay and take a lead also to the coil tag e of the P.O. relay via R_7. This resistor will get very hot in operation and must be fixed on stiff wires well away (say, 1in.) from V_c and P.O. relay coil. It can be seen in Fig. 2.

4. Join the other P.O. coil tag. f, to the switch on the panel S_3. Connect the other side of the switch to the *central tag* under the chassis.

5. Join P.O. relay tags g and h to the terminal block B.

Setting Up the Baby Alarm

The speaker is placed facing the baby, the nearer the better, but good operation with babies of average audio power is obtained at even 6ft. It is wired to block A.

The A.C. mains lead is wired to block C. Care should be taken about live (red) lead going to the correct terminal. Double insulation is provided, but the chassis may be earthed for added safety. The unit may be in any convenient place.

A lamp or bell circuit is wired with a small dry battery as shown in Fig. 6 to block B. The lamp or bell is placed where the warning is required.

When baby is quiet both toggle switches are put down. When baby cries the alarm will be given and cannot be stopped until S_3 is put off. In quiet it may be put on again and the unit is reset. For very sensitive settings progressively rotate. VR_1 anti-clockwise putting S_3 on and off until the alarm just does not ring in silence.

An Alarm Unit

A suitable alarm unit for putting on the television, etc., may be made in a wooden box or even an Oxo tin as shown in Figs. 1 and 14. This is fitted with a warning lamp and six volt bulb, a bell or buzzer and a change-over switch.

The switch may be set at whichever type of alarm is required, light or noise. A muting switch may be fitted in one battery lead and a test button as shown in Fig. 13.

Ambient Noise

The sensitivity control can be set so that the relays do not operate until extra noise hits the speaker. Where jet aeroplanes or trains run near the house experiments will have to be carried out to find the best setting, generally it is not easy to deal with this type of interference.

Using Other Microphones

Other microphones are not suitable for use with this unit. The use of an 8in. speaker is so that even small compression waves can be converted to electrical energy, most other microphones would require more amplification with attendant feed-back troubles.

Part 2 will deal with some ideas about automatic electric light switching.

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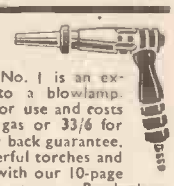

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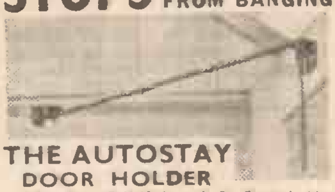

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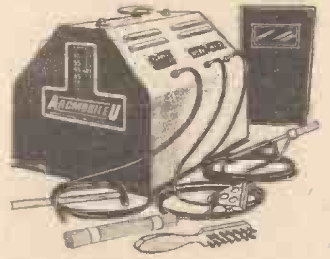

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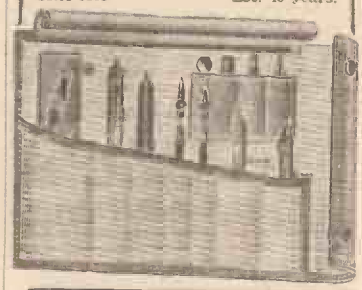

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Letters to the Editor

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

Transport of the Future

SIR,—I would like to offer my views in answer to your "Fair Comment" article in the September issue.

It is quite obvious that future transport will be in the air; one has only to view the vast expanse of open air to see it's the only direction we can go. I have been a motorist for 25 years and I was also a private pilot until recently. I know which form of travel I prefer, but unfortunately there are a number of difficulties which seriously restrict air travel.

First, I would like to point out that we in this country are very slow on the uptake where new inventions are concerned. I note with deep regret that nearly every device which is simple and cheap to build is being developed in the U.S.A. because it appears they have more foresight.

Besides the three projects you have mentioned there is one which I have taken a deep interest in, namely the "Bensen Gyrocopter." This has been developed in the U.S.A. and has been on the market for the past two years. So far there are only two on the British register, why? Well, to begin with we come against the first "snag;" this machine has not yet got full approval by the Popular Flying Association, although permits to fly have been granted.

Snag No. 2, and in my opinion, most important, having built this machine for a very modest sum, nobody mentioned that to fly it one must hold a pilot's licence. One Air Ministry spokesman stated that an "helicopter endorsement" is required. To obtain one would cost a tremendous sum, only to find that this machine is entirely different, being an autogiro.

As to the question of "free for all" this condition would never arise. Personal air travel can never completely replace the car. Two points arise; these small machines are very restricted in many ways, the smaller and lighter they become the more they are restricted by the weather. Night flying is not very practicable for several reasons, i.e., cost of instruments, further licence endorsements, etc.—W. D. TAYLOR (Hants).

Lens Calculations

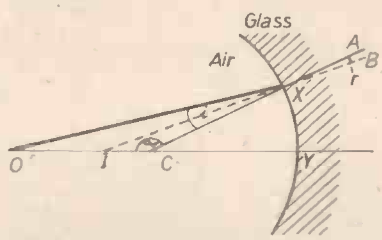
SIR,—Re Mr. Beresford's query concerning the formula connecting the radius of curvature, focal length, and refractive index of a lens (September, 1959).

This formula is:

$$\frac{1}{f}=(\mu-1)\left(\frac{1}{r_1}-\frac{1}{r_2}\right)$$

Where f is the focal length, μ is the refractive index and r_1 and r_2 are the radii of the two sides of the lens.

PROOF:



C is the centre of curvature.
O is a point object.
I is the image (virtual).

$$\frac{\sin i}{\sin r}=\mu \qquad \therefore \frac{\sin i}{\sin \alpha}\times\frac{\sin \alpha}{\sin r}=\mu$$

In triangles OCX and ICX

$$\frac{OC}{OX}=\frac{\sin i}{\sin \alpha} \qquad \frac{IX}{IC}=\frac{\sin \alpha}{\sin r}$$

($I\hat{X}C=A\hat{X}B=r$ vertically opposite angles)

$$\therefore \frac{OC}{OX}\cdot\frac{IX}{IC}=\mu$$

For Rays Near the Axis

$$\frac{OC}{OY}\cdot\frac{IY}{IC}\simeq\mu$$

Object distance is u; image distance is v.

$$\therefore \frac{u-r}{u}\cdot\frac{v}{v-r}=\mu$$

$$\therefore uv-rv=\mu uv-\mu ur.$$

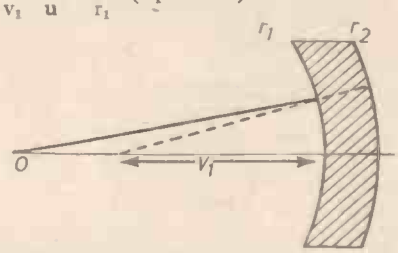
Divide by uvr

$$\therefore \frac{1}{r}-\frac{1}{u}=\frac{\mu}{r}-\frac{\mu}{v}$$

$$\therefore \frac{\mu}{v}-\frac{1}{u}=\frac{\mu-1}{r}$$

Refraction at first surface:

$$\frac{\mu}{v_1}-\frac{1}{u}=\frac{\mu-1}{r_1} \text{ (equation I)}$$



Refraction at second surface is from glass to air, therefore the effective refractive index is $\frac{1}{\mu}$

The first image now acts as the object.

$$\therefore u=v_1$$

$$\therefore \frac{\frac{1}{\mu}}{v}-\frac{1}{v_1}=\frac{\frac{1}{\mu}-1}{r_2} \text{ (equation II)}$$

To eliminate v_1 multiply equation II by μ and add to equation I.

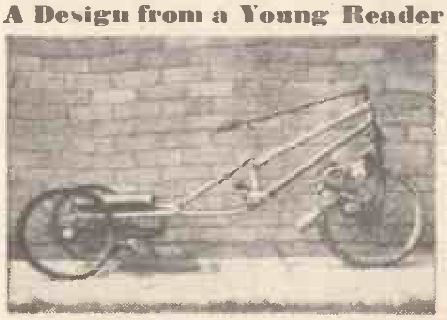
$$\frac{1}{v}-\frac{1}{u}=(\mu-1)\left(\frac{1}{r_1}-\frac{1}{r_2}\right)$$

But $\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$

$$\therefore \frac{1}{f}=(\mu-1)\left(\frac{1}{r_1}-\frac{1}{r_2}\right)$$

The same formula may be proved for any lens if a sign convention is used for all the above symbols.—S. R. BROADFOOT (Beds).

A Design from a Young Reader



J. S. Kidger's power-truck.

SIR,—The photograph shown above is of a power-truck I designed and built myself. It has three wheels and is of all metal construction, which is bolted together and not welded or brazed. It can be fitted with a 50 c.c. Power Pack engine or just left as an ordinary truck, with the engine it will do approximately 20 m.p.h. on a flat surface. It is a one-seater and is fitted with a cable brake. The power-truck is easy to make and does not need a proper workshop. The wheels are 16in. dia. and the rear two are sprung with 4in. saddle springs and the front one is pneumatic. A bicycle frame is used for the main construction as well as 4ft. of 1in. galvanised piping and 5ft. of brass piping. It weighs about 60lb. and is 6ft. long, 1ft. 10in. wide and 26in. high.—J. S. KIDGER (Glos). (Aged 15 years.)

Space Raiders

SIR,—Thank you for your most interesting article entitled "Space Raiders," which appeared in your December, 1959, issue.

In this modern day and age, there are many problems which human imagination just cannot comprehend. There is a tendency to waive such happenings aside as "queer." One must, however, always allow for the curiosity of man. The universe as we see it is plainly physical; dead or nearly lifeless planets swinging round in their governed orbits. The chance of life as we know it on our planet existing anywhere else is most unlikely. Life after death is yet also debatable, but if true, happenings such as flying saucers may be common.

My real point is that if one met some peculiar object, one might be tempted to have a closer look. Any foreign object, flying saucer, etc., might take offence at being investigated by a human being and in all probability one would never be seen alive again.

Fear stems from unsound opinions and rash logic, rather than a clear cut and proved inquiry. In science all man-made problems dissolve in the pure light of common sense.—SGT. A. ALLISON (B.F.P.O. 20).

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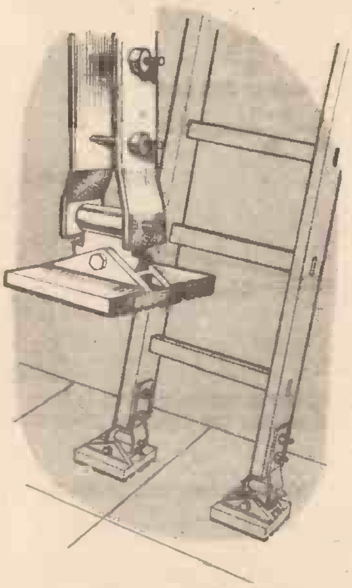
TRADE NOTES

A REVIEW OF NEW TOOLS, EQUIPMENT, ETC.

Safety Ladder Feet

TO prevent ladders from slipping there are on the market devices called the Augur Safety Ladder Feet. These com-



Augur safety ladder feet.

prise steel brackets for bolting to the feet of wooden or metal ladders with uprights 1in., 1¼in. or 1½in. thick. Adaptors of simple design can be supplied to make the Augur Safety Ladder Feet suitable for the standard types of metal ladders. Intermediate universal links allow the ribbed, non-slip rubber pads to rest flat on the floor at all working angles and align them also on uneven and sloping floors. Square castings with bonded, non-slip pads made from oil resistant, ribbed rubber grip the floor firmly, prevent slipping, and do not stick to the floor. Augur Safety Ladder Feet are distributed by Vulcascot (Great Britain) Limited, 87/89, Abbey Road, London, N.W.8, and cost £1 9s. 6d. per set. They are available from most ironmongers.

Carbide Files and Discs

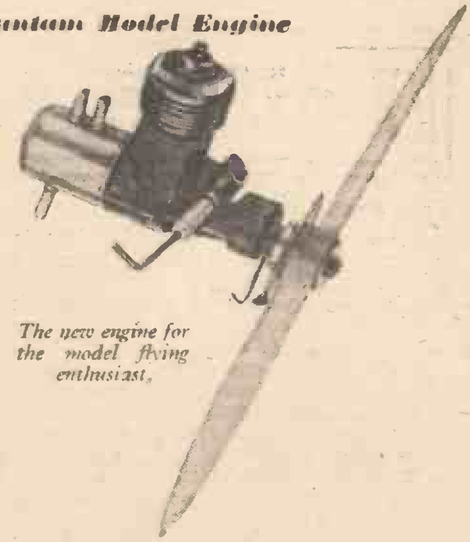
VERY much longer lasting and free from the bugbear of a base material which tears easily, Cintride carbide files and discs are the newest form of abrasive for the handyman. Base sheets of steel, faced with an abrasive surface consisting of cemented carbide grains, form Cintride's basic idea. These can be used with power drills and by hand to abrade a wide variety of materials, including tiles, hardwoods, plastics, asbestos, leather, glass, firebricks and soft metal alloys.

The files, which are coarse on one side and fine on the other, will cut on both the forward and backward strokes and all these carbide abrasives are resistant to solvents and can thus be cleaned easily.

The discs, which are backed by a flexible steel plate and sheet rubber, are available in diameters of 5, 6 and 7in., with ½in. or ⅝in. centre holes, priced at 12s. 6d., 16s. 11d. and 19s. 11d. respectively. The 14in. long files cost 16s. 6d. each from local stockists. The makers are Cintride Ltd., Grange Lane Works, Sheffield, 5.

New Davies-Charlton Bantam Model Engine

RETAILING at only 34s. with integral alloy fuel tank, precision built and with a 12 months' guarantee, the new Davies-Charlton Bantam model engine is now available for the model flying enthusiast. The new machine will turn a 5¼in. × 3in. propeller at well over 15,000 r.p.m. Instantaneous starting is ensured by the Quickstart, a device which cannot jam, is unbreakable and cannot foul the propeller. There is a new positive-action jet assembly; replaceable propeller bolt, special wear resistant steel cylinder and many other refinements. The manufacturers are Davies-Charlton Limited, Hills Meadow, Douglas, I.O.M.

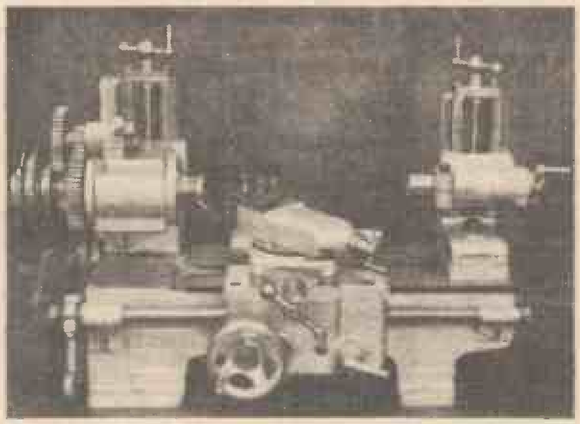


The new engine for the model flying enthusiast.

Accessories available are the Bantam multi-purpose spanner, price 1s. 6d., which fits cylinder head, glowplug, rear crankcase cover and acts as a screwdriver for the propeller bolt, and the Quicklip, a quick release positive connector for glowplug operation that cannot short the battery. It costs, complete with leads, 5s. 5d.

THE BORMILATHE

THE Bormilathe is claimed by the manufacturers to be a distinct breakaway from the orthodox in machine tools. It was designed with the requirements of the amateur market in mind. In the sphere of metal working, it is a centre lathe with variable height of centres and with automatic sliding motion to the cross slide and full screw cutting capabilities. The tailstock can be set over for taper turning. By winding off the cross slide unit and substituting a milling table it offers the facilities of a small horizontal milling machine. By mounting an angle plate on the milling table, surfacing, boring and end milling can be carried out in a single setting. It may thus be used for machining simple press tools. For the wood-worker there is available a saw bench with tilting table and a special stub arbor for carrying the saws. This machine has many more advantages. A complete range of accessories is available. The basic machine costs £39 10s. The manufacturers are Murad Developments Limited, Stocklake, Aylesbury, Bucks.



The multi-purpose Bormilathe.

H.S.S. DIAMETER PUSH BROACHES

W. H. MARLEY AND CO. LTD. have on the market a range of Marlco H.S.S. Diameter Push Broaches designed to replace reaming or boring of close tolerance holes on a production basis. They are made to precision tolerances from 18 p.r cent. T. high speed steel and complete the component bore to "U" hole tolerance, starting from a nominal drilled hole. The range, comprising four complete sets, includes sizes from 3/16in. to 1in. Special sizes can be supplied on request. The prices of the sets range from £4 2s. to £8. The manufacturers are W. H. Marley & Co. Limited, New Southgate Works, 105, High Road, London, N.11.

Marlco push broaches.

GUIDE FOR BUYERS

THE National Federation of Engineers' Tools Manufacturers has published its first "Guide for Buyers" which gives details of the suppliers of British made engineers' cutting tools. A feature of the publication is the alphabetical list of tools in four languages—English, French, German and Spanish. Overseas buyers will have no difficulty in finding in the Guide the names and addresses of British suppliers of all types of engineers' cutting tools.

Part 4 of the Guide contains an alphabetical list of trade marks, trade names and brand names.

Copies of the Guide may be obtained from the N.F.E.T.M., Light Trades House, Melbourne Avenue, Sheffield, 10, price 5s. each (including postage).

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Our new Catalogue No. 14 has 500 items nearly all illustrated. Radio Control Government Surplus, etc. Price 2/-. Refund on Order. Post 6d.

TIME DELAY UNITS

This unit consists of a small geared escapement mechanism, which is wound by pressing a button at the side of the case and is electro-magnetically released when 12-24 v. is applied. This unit will operate from a 12 v. supply, and is ideally suitable for modification to a rudder unit for model boats, etc., when fitted with a miniature motor—such as Ever Ready. The unit is in a small die-cast box, approximately 2in. x 2¼in. square and 2in. deep and is easily removable. Price 6/-, post 1/6.

12 VOLT MOTOR

CM 3 Type, 2,000 r.p.m. approx., at 1 amp. under load, .8 amp. no load. Will also operate on 6 volt about half output. Weight 11 oz. Size 2½in. long, 1¼in. wide, 1¼in. high; shaft ⅛ x 3/16in. dia. Ideal for boats up to 4ft. Price 25/-. Post 1/6. Brand New Condition.

MASTER CONTACTOR

10-hour clockwork movement with contacts that make and break every ½-second, also fitted with thermal switch and suppressor gear—all contained in a neat metal container, forms basis for making time switch, etc., brand new 12/6, post 1/9. This is an ideal unit for plugging into transmitter when carrying out receiver tests single handed. Delivers ½ sec. pulses.

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12 v. to 24 v. stepping mechanism, 120 impulses for 1 rev. of pointer, glass front, resetting control, on/off switch, flex, etc., will make an ideal 0-120 magnetic counter for coil winding, etc. Brand new 7/6, postage 1/6. Has sound possibilities as electric pendulum clock. Will work in conjunction with Master Contactor.

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This plug has a locking device and once the two portions are plugged together it is impossible for them to come apart unless the knurled ring is rotated on the socket. Fitted with 18in. length of cable and new and boxed. Price 2/6, plus 1/- post. Suitable for trailers, caravans, etc. 25/- per doz., post 2/6.

ARTHUR SALLIS RADIO CONTROL LTD.

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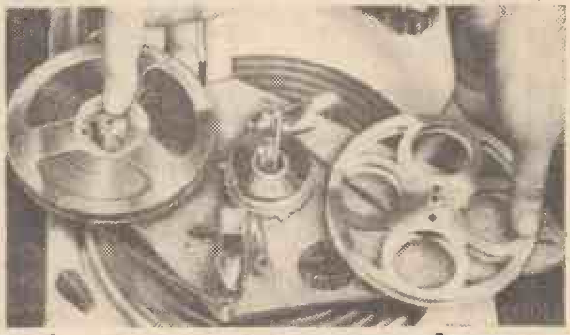
A REVOLUTIONARY NEW BRITISH INVENTION!



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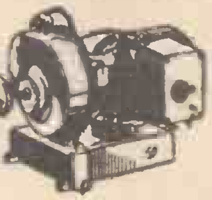

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Telephone Set Type "A" ringing and speaking both ways on a 4-core cable. Very loud and clear over any distance. The handsets are as illus. and the set is complete except wire. 4-core at 8d. per yard or 2-core at 3d. per yard extra. Price 75/- set, post 3/6. **Set "B."** Two headphones connected to breast microphones, with leads, plugs and fitted carrying cases. Join instruments together with two wires and 1½ volt battery for a super Intercom. 25/-, post 3/6. **Set "C."** Similar to set "A". Instead of P.O. Type handsets, two P.O. Desk Type Instruments are supplied; with usual drawer in base. Complete and ready for use. Price 150/-, post 7/-. **Set Type "D."** Speaking only both ways on twin wire. The two handsets supplied are as illustrated with on/off switch, built-in handle. Supplied complete with battery and two 2-way terminal blocks. Price complete, excepting wire, 38/9. Twin flat PVC wire, 3d. per yard; Twin flat PVC flexible, 4d. per yard; Twin Twisted Silk Flexible, 6d. per yard.

TELEPHONES SOUND POWERED. No batteries required. Just connect with twin flex for clear speech. Transmitter Receiver Units, 4/6 ea. Twin Flex, 4½d. yd. Post 1/-.

INSPECTION LAMP. Fits on forehead, leaving hands free, battery case clips on belt. 7/6, post 1/6. Takes E.R. Battery No. 1215, 2/9, post 9d.

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Many Uses in Workshop or Laboratory.

This is an Edwards type 4, with ½in. shaft, coupling, oil-filter and union for tubing. £6.10.0, post 3/6.

VARIAC type, 200 C.U.H., infinitely variable, 0-270 volts 2.5 amps. Mounted in metal case with 0-250 voltmeter and 0-1 ammeter with its own input and output leads. Complete unit, £12.10.0, carr. 7/6.

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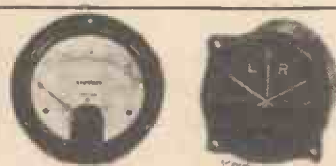
TERMINAL BLOCKS 4/- doz., or box of 50 for 15/-. 2-way, 6/- doz., 50 for 22/6, post 1/6.



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250 ,,		3½in.	MC/FR	55/-
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5-0-5 ,,		2½in.	MC/FR	20/-
30 ,,		2½in.	MC/FR	12/6
100 ,,		2½in.	MC/FR	12/6
200 ,,		2½in.	MC/FR	12/6
5 Amperes		2in.	MC/FS	27/6
15 ,,		2in.	MC/FR	10/6
25 ,,	D.C.	2½in.	MI/FR	7/6
30-0-30 ,,		2in.	MC/FR	15/6
50-0-50 ,,		2in.	MC/FS	12/6
20 Volts		2in.	MC/FS	10/6
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300 ,,	A.C.	2½in.	MI/FR	25/-

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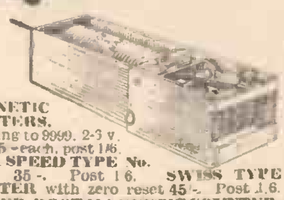
CROSSPOINTER METER with 2 separate 100 microamp movements, 22/6. Post 2/-.

BULKHEAD FITTING. 9in. diam.; flat tripod type, suitable for lamps up to 100 watt, complete with pushbar switch lampholder. Ideal for farm buildings, garages, greenhouses, etc. Brand new, 17/6. Post 2/6.



MAGNETIC COUNTERS. Counting to 9999, 2-3 v. D.C., 15/- each, post 1/6. **HIGH SPEED TYPE No. 100C.** 35/-. Post 1/6. **SWISS TYPE COUNTER** with zero reset 45/-. Post 1/6.

VEEDER-ROOT MAGNETIC COUNTER. General purpose type with zero re-set. 800 counts per minute up to 999,999. 48 volt D.C., 55/-, post 2/6.

SMALL COVERED RELAY. 400 ohms, 2 make (heavy duty) contacts with terminal block. Very compact. 7/6 complete, post 9d. Large Quantities Available.

ROTARY CONVERTERS. Input 12 D.C. Output 230 A.C., 50 cy. 135 w. In fitted case with variable resistance. 0/300 voltmeter. The ideal job for television where A.C. mains are not available. £10 carr. 15/-. Special connectors one fitted with 6ft. heavy duty flex and clips for D.C. side. 10/- set, post 1/-.

CONVERTER. Input 12 v. or 24 v. D.C. Output 230 v. A.C., 135 watts. £8/10/-. Carr. 7/6.

BATTERIES. Portable Lead Acid type 6 volts 125 amp. hours. In metal case 16in. x 8in. x 11in. (Two will make an ideal power supply for our 12-volt Rotary Converters.) Uncharged £6/10/-, carr. 15/-. 24 volt 85 ampere, £15/-/-, carriage 30/-.

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SYNCHRONOUS MOTOR. 200/250 volts A.C. 50 cycles with gear train driving 5 dials 1/10th hr.—10,000 hrs., 27/6, post 2/6.

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SMALL MOTORS. 12 volts D.C. 3,000 r.p.m. with speed governor in end cap. 2in. x 1½in., 12/6, post 2/-.

GEARED MOTORS for the model maker, small but powerful 12/24 volts A.C./D.C. 4/8 r.p.m., 35/-, post 2/6. **GEARED MOTORS.** 220-240 volts A.C. 175 r.p.m. Torque, 15lb. in Klaxon, £10, carriage 15/-.

MOTORISED FUEL PUMPS. 24 volts D.C. 400 g.p.h. Pulsometer type with flange for fitting on side of tank. Plessey type also available for use with pipe system. Either type, 55/-, carriage 3/6.

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NIFE BATTERIES. Nickel cadmium, 6 volts 75 amps., crated and connected. Alkaline filled. Brand new. £7.10.0. cge. 15/-.

BATTERIES for the model maker. Miniature, silver zinc, Venner type H.105, 1.5 volts 1.5 amp. hour. *Size:* H't. 2 ins. W'th 1.13 ins. D'th, .63 ins. Weight, 1.25 oz., 17/6, post 1/-.

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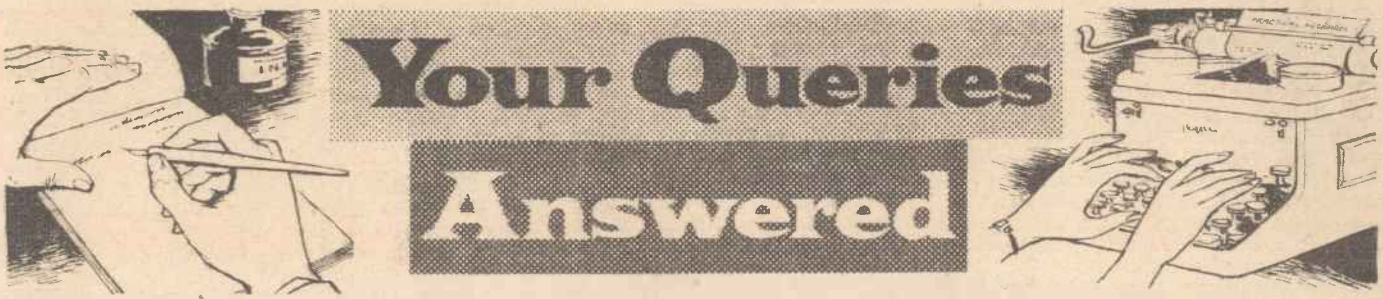

Flattening Perspex

I HAVE an ex-Government Chart Table Plotter Mk.1, part of which consists of a rectangle of Perspex which may be rotated around for drawing courses and reading bearings on a chart or map.

This Perspex is fastened by a central brass disc to some radius arms. Either side of this fastening the material has curled up into a slight bow so that only a portion of the perspex is in contact with a flat table. I should be grateful for suggestions as to how it may be flattened and a recurrence of the bowing prevented. The Perspex rectangle is removable from the rest of the apparatus.—M. J. Gilkes (Brighton).

PERSPEX can be moulded into shapes under moderate elevation of temperature and we suspect that the warping has occurred where the metal is located because of heat transferred from the fingers through the highly conductive brass disc.

The deformation can be pressed out under weights after the Perspex sheet has been warmed. Further warping might be prevented by placing a strip of non-conducting material between the metal and the Perspex.

Binocular Prices

BINOCULARS of an 8 × 30 specification can cost from £11 to £50. What are the reasons for these variations in price?—A. Briner (Croydon).

THE higher price, for the same specification, is caused by the maker having a higher standard of optical and mechanical precision. In many cases improvements such as lens blooming, or the use of special types of rare glass, etc., are found in binoculars of higher price. The extent to which the improvement is felt to justify the increase in price must be a matter of personal choice. In general, brilliance and definition, especially near the edges of the field of view, may be better in the higher priced binoculars.

Exposure Meter Conversion

I HAVE a Weston Master II Exposure Meter. As you know, the light scales on this instrument read in candles to the square foot. Is there any method whatsoever of using this meter whereby I can convert readings taken with it to foot candles?—J. M. Ryan (Eire).

THE Weston Master II is not suitable for an accurate measurement of illumination in this way. The following is a method by which an approximate indication of foot candles can be obtained: a reflected reading should be taken from a matt white surface, i.e., a sheet of blotting paper, and the resultant indication multiplied by four to give foot candles. As illumination of 1 lumen per sq. ft. equals 1 foot candle a surface "d" ft. from 1 candlepower will have illumination equalling 1/d squared lumens per sq. ft. This can form the basis of a check with an average candle.

Pre-set Bellringing Device

I HAVE a Smiths electric clock movement that I wish to use as a master clock to ring school bells at a certain time each day. The bells are "mains" bells working off a transformer. Could you please help me with the circuit?—D. G. Jones (Yorks).

YOU should, of course, use a powerful clock, preferably one having a long hour hand. We suggest that you mount on the clock face an annular ring of insulating material, such as Bakelite, in which radial holes about ⅛in. in diameter are drilled at the appropriate places (times). Through these holes screwed brass rods can be mounted, projecting inwards to touch the hour hand as it passes. All these contact rods should be connected together.

Presumably you will require the bells to ring for about a quarter of a minute only. This can probably be arranged by mounting, on a wheel which runs at about 1 r.p.m., a small cam which is arranged to close two light metal flexible contacts for about 15 seconds. Or perhaps it would be better to use a slower wheel to close contacts for a smaller portion of its revolution. These contacts should be connected in series with the hour-hand contacts to an insulated terminal, the other terminal being mounted on the plates of the clock mechanism.

The clock could be connected in series with a low-voltage supply, a switch and the coil of a relay. The contacts of the relay will then energise the bell circuit, whether this is battery or transformer operated. It will, of course, be necessary to switch the bells off at night.

Scratched Spectacle Lenses

DESPITE great care, the plastic lenses of my spectacles have become badly scratched.

Can you suggest any method of removing these scratches, say by some polishing process, or by coating the lenses with cellulose paint which does not require special skill or carry any risk to the lenses?—A. Gilston (Leeds).

THE extent to which the plastic lenses of your glasses can be renovated depends on the depth and severity of the scratches and also on the composition of the plastic material from which they are made. Merely superficial scratches can be removed by repolishing the lenses, an expert job, using a very fine abrasive powder, such as putty powder and rouge (iron oxide), together with a revolving soft circular mop. The application of cellulose lacquer would destroy the clarity of the lenses. The same applies to the surface application (no matter how carefully done) of any other transparent hard-setting solution. The only solution which you could use for such a purpose would be a solution of Canada balsam in benzene. This would take at least a week to dry, and the result would not be permanent. You can obtain small amounts of this solution from Messrs. Flatters & Garnet, Ltd., Oxford Road, Manchester, 3, price about 3s. 6d. per oz. bottle. The only satisfactory job is to be sought in the skilled repolishing of the lenses by a competent optical firm, but if the lenses are deeply scratched it is doubtful whether this will be possible.

Restoring a Writing Desk

I HAVE acquired a portable writing desk, veneered with brass binding and brass inlay.

Please advise me how to clean both brass and wood without damage and how to refix those parts of the inlay, strips about ⅛in. wide × 3/16in. deep, which are loose.

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Finally, how should I treat the box so that it will not need frequent polishing ?—H. A. Andrews (Warwick).

WE presume that the veneer is of burr walnut. If any of this is loose or blistered it should be lifted and carefully glued down again, using a cellulose-type adhesive. The loose inlay strips, even if of brass, may be refixed with adhesive, first clearing out any old glue that may remain. Critically examine the french polish on the wood veneer and other parts; if this is in bad condition, scratched or discoloured, dissolve it off with methylated spirit, including that on the brass inlay. If the brass is found then to need it, polish it with the very finest emery cloth, or possibly fluid metal polish. If the wood veneer needs rubbing down, use No. 0 glasspaper. With the woodwork clean and the brass-work bright it only remains to have the whole desk carefully french polished, letting the polish cover the brass inlay as well as the wood. White polish, with a little yellow polish in it, should be used.

Annealing Oven

I WISH to construct an annealing oven for borrosilicate glass and would be greatly obliged for any help you can give me on the matter.—G. S. Robertson (Suffolk).

YOUR annealing oven will have to be constructed of firebrick either in the form of slabs, if small, or of fireclay bricks if large. The shape will depend upon the form, size and quantity of the objects to be fired and annealed; also to some extent upon the heating, whether by a fire, by gas or by electricity. If the glass is in flat sheets then a stained glass artist's kiln would meet the case. Working drawings for two such kilns were given in "The Art and Craft of Stained Glass," by E. W. Twining (Pitman). If the objects to be annealed are few in quantity and are upstanding in the round, then a toolmakers' muffle could be used. It appears to us that the main thing to do is to so design a kiln that the objects placed in it can be raised to a temperature just below the melting point in as long a time a possible and then even more slowly allowed to cool. As you doubtless know, the cooling is the more important and this with objects of average size should not be less than, say, 24 hours. Preheating may take six hours, but both stages depend upon the size, or mass, of the kiln materials. The larger and thicker the walls of the kiln the more perfect will be the annealing.

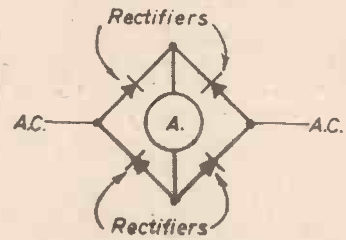
A Multimeter

I WISH to make a multimeter, with a low mA moving coil meter, with selected resistors and shunts, etc. I should be pleased if you could tell me how to calibrate a scale, to read A.C. and D.C. volts, milliamps, and high and low ohms.—A. M. Stratton (Worcester).

YOU could use a full-wave, bridge-connected copper-oxide rectifier connected with the moving-coil milliammeter as shown for the A.C. measurements. When A.C. is perfectly rectified a moving-coil instrument indicates the mean current, but if the scale is calibrated in r.m.s. values the reading will only be correct when the wave-form is sinusoidal and the external resistance is high. For A.C. milliamp readings the instrument should be calibrated against a standard instrument.

A.C. voltage readings can be obtained by connecting resistors in series with the set-up. If I is the instrument current required to give full-scale deflection with voltage V the ohmic value of the series resistor required to give a multiplying power of 10 is $9V \div I$ ohms. For D.C. voltage readings a similar scheme is used but the instrument is used without the rectifier. The instrument itself may be used with shunts for D.C. amp. readings in the usual way, but it is advisable to connect a resistor in series with the bridge and to shunt the whole circuit to read A.C. amps.

For measuring resistance a 1.5-volt battery may be used. If I is the instrument current for full-scale deflection and r the resistance of the milliammeter it should be connected in series with a resistor of R ohms, R being equal to $\frac{1.5}{I} - r$ ohms. A scale of ohms may then be marked on the dial with its zero at full-scale deflection. The resistance scale can then be marked opposite the D.C. amps. scale, the resistance (ohms) to be

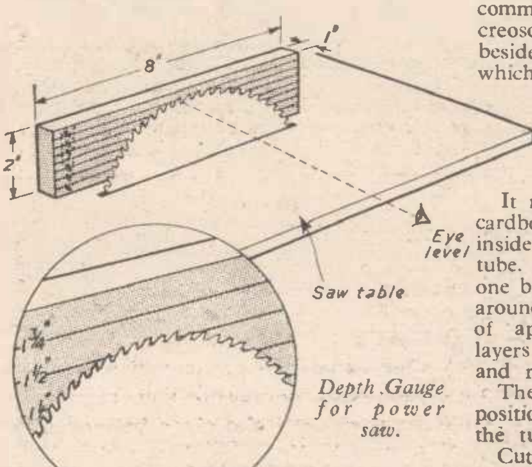


Circuit for a multimeter.

marked opposite a scale reading i amps. being equal to $\frac{1.5}{i} - (R+r)$.

Grooving Depth Gauge

I HAVE a drill-powered saw table which I use frequently for grooving at different depths. Could you suggest some form of simple depth gauge which I could make?—J. Douglas (Cardiff).



Depth Gauge for power saw.

WE suggest that the device shown in the illustration would be of use to you. Take a piece of white close-grained wood (beech is excellent), 8in. × 2in. × 1in. On one of the 2in. sides scribe lines ¼in. apart with a marking gauge and fill in the lines with black; any ball-point pen will do the job.

In use lay the block on the saw-table alongside the saw blade and sight the markings at eye-level against the maximum height of saw teeth for depth of cut, then tighten the saw table screws.

Laying a Parquet Floor

I AM in the process of laying a parquet floor. I am, however, anxious to know whether ordinary glue is suitable for joining these pieces.

I should also like you to describe a suitable mastic upon which to lay these blocks. The floor is at present a fairly good boarded floor about 12 years old.—S. C. Harrild (Petts Wood).

ANY type of glue may be used for cementing down the blocks of parquet floors, but we advise a good casein glue, since this is extremely strong, as well as waterproof and damp-proof. You can obtain a good casein glue under the trade-name of "Casco" from Messrs. Leicester, Lovell and Co., Ltd., 14/18, Nile Street, London, N.21. Your existing wood floor will be quite in order as a foundation for the blocks. Each block should be pre-drilled obliquely with a small hole through which a long thin nail can be driven when the block is finally positioned; care, of course, being taken to punch the nail head below the wood surface of each block. The blocks will thus be casein glued to the wooden flooring and also nailed thereto, as well as cemented with casein to their adjacent blocks.

You will, we think, find casein glue as good as any for the purpose, for once the blocks are laid down and lightly nailed or pinned, there will be little strain on them. If, however, you require a stronger cement, you will find several for the purpose among the products of Dunlop Special Products, Ltd., Fort Dunlop, Erdington, Birmingham, 24, to whom we must refer you for further particulars.

You can, of course, use a mastic "bed" of soft bitumen to form a matrix in which to lay the parquet blocks, but this is a messy business. The bitumen is liable to get on the wood and to discolour and stain its upper surface and edges. Usually, the provision of such a matrix is not necessary. It would, however, be advantageous to brush a coat of creosote over the underlying floor boards and to allow it to dry in before commencing the parquet work, since the creosote would act as an efficient steriliser, besides dealing with any wood-boring insects which may exist in the present boarding.

A SIMPLE EPISCOPE

(*Concluded from page 255*)

It may be possible to obtain a length of cardboard postal tubing having a suitable inside diameter to serve as the focusing tube. If such a tube is not available, make one by pasting a strip of thick brown paper, around, say, a tin or other circular object of appropriate diameter. Three or four layers of pasted paper will form a strong and rigid tube when dry.

The lens should be wedged firmly in position about 1in. from the front end of the tube.

Cut the lens tube hole in the front panel of the cover section. The tube should fit "thumb tight" so that it may be slid in or out for focusing purposes.

If you possess a folding camera, however, there is no need to buy a lens or make a focusing tube. Simply open the back of the camera and set the shutter to "time," then place the lens in alignment with the aperature in the front panel. Focusing can be achieved by the normal camera mechanism.

Operating

Two elastic bands slipped over the hinged mounting flap will serve to keep the majority of objects to be screened in position. Subjects for screening should, of course, be placed upside-down, but this will not correct the picture appearing on he screen right-to-left instead of left-to-right. This trouble may be rectified by setting a small mirror in front of the lens at an angle of 45 deg.

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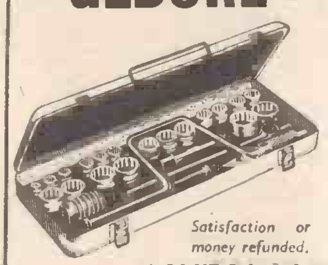

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Vol. XXVIII No. 450

COMMENTS OF THE MONTH

Utility Cycling Declines

IT is seldom that one sees the old specialist cycle dealer's shop to-day. Most of them have been forced to combine their cycle business with the vending of some other commodity, radios, toys or mopeds—usually the last. The obvious deduction is that they can no longer sell enough cycles to provide a living. Why then should this be so? The rise in the sales of scooters and mopeds indicates one obvious answer. The man who would at one time have bought a bicycle, now, due undoubtedly to the higher standard of living enjoyed by millions and the greatly improved hire purchase facilities, can afford to buy mechanised transport.

Another factor affecting sales of the non-lightweight dealer is the trend for sporting cyclists, clubmen and to a certain extent tourists, to buy lightweight frames, built to their own specification. This has been encouraged by the difference in purchase tax rates which made it much cheaper for a rider to buy a frame and equip it himself. Here, again, the better financial status of the customer has its effect by allowing him to purchase the more expensive hand-built frame, etc.

The fact that there are fewer cycles sold and, therefore, fewer cyclists on the roads is not only shown by figures, it is also noticeable to everyone who uses the road regularly. Cycle traffic to-day is, in fact, only 60 per cent. of the 1938 level. No wonder so many cycle dealers are having to turn to other products in order to make a living!

Bicycle Joint Publicity Scheme

Is anything being done to arrest the steady decline in home sales? A scheme designed for exactly that purpose is the bicycle joint publicity scheme introduced by the National Association of Cycle Traders and recent reports indicate that the Association is well satisfied with results so far. We quote part of the president's New Year message, "The bicycle joint publicity scheme has fulfilled its purpose to maintain and increase the sale of cycles. The plans for the coming year offer a greater attraction and impact to encourage more people to use cycles." Successful as the scheme has been in arresting the decline in home sales, it is possible that, given the enthusiastic co-operation of dealers and manufacturers, results could be even better.

The columns of newspapers contain many advertisements for motor cars and motor cycles but often none at all for bicycles. Traders may have found in the past that this type of advertising is of little benefit to them, but it might be a different story if their advertisements were backing up publicity specially designed to sell cycling as a pastime.

Anyone fired with enthusiasm for cycling by reading national publicity on the subject is immediately going to ask, "Where can I buy a bicycle?" An adjacent trader's advertisement should provide the answer.

Newspaper advertising, however, is not the only type open to the cycle industry and there are many other occasions when valuable publicity can be obtained in return for only a small outlay. Such an occasion was the recent Schoolboys' Own Exhibition and full use was made of the opportunity by the British Cycle Corporation, who had two stands there. One stand was an arresting display of cycles and included the actual machine used on a recent round the world trip.

Eileen Sheridan and David Duffield, the tricycle enthusiast, were in charge of the other stand which was laid out with obstacles as a bicycle testing ground. Youngsters were queueing (literally) to take part in the competition for the fastest round. The Y.H.A. also had a stand at the exhibition.

At the Camping and Outdoor Life Exhibition the cycling organisations were well represented, both the B.C.F. and the C.T.C. having stands. The International Cycling Week on the Isle of Man was being publicised at a special booth and details of an all-in travel, food and accommodation scheme were available.

Cycling most certainly comes under the heading "Outdoor Life" and it is to be thought that the cycle industry might have been better represented than it was. Lightweight equipment for the cycle camping enthusiast was there in plenty, but where were the bicycles?

New Cycle Show Sponsor

The news that the *Daily Express* is to sponsor the Cycle and Motor Cycle Show at Earls Court this year is very welcome. Lack of support and interest have become more noticeable over the last few years; this in spite of the inclusion of mopeds and scooters. The powerful support and the unequalled publicity potential of this national newspaper should give just the "shot in the arm" necessary. The recent Boat Show sponsored by this same newspaper was an eye-opener and the huge attendance owed more than a little to the continual publicity afforded by the pages of this daily.

Fausto Coppi Dies

Probably the greatest name in cycling and hero of cyclists the world over, "the Campionissimo," Fausto Coppi, died in January. In the immediate post-war years and right up to his death his name as a competitor was sufficient to pack the spectators into any cycle meeting. He was the ideal roadman and his style, his machine, his training methods and his diet were all studied by cyclists everywhere.

Among his 130 road event wins were the Tour de France twice, The Tour of Italy five times and the Tour of Lombardy five times. He held the world 1-hour record for 14 years and won the world pursuit championship more than once; in 1953 he won the world road championship.

At the time of his death another great career lay before him as director of race teams, where his knowledge and experience would have been of immense benefit. The British firm of cycle manufacturers, Elswick-Hopper had also secured his services as technical adviser.

A virus contracted on a visit to Africa is believed to have caused his death from malaria in Tortona near his birthplace Castellania. Many hundreds came to pay their last respects to "the Campionissimo," including many famous names in cycling.

Wareham, Dorset—a busy scene by the old bridge.

A Touring Machine Specification

We occasionally receive requests from readers to detail a cycle suitable for touring. This is largely a matter for personal preference, but here is our own specification.

THE basis of any cycle is, of course, the frame, and here we would recommend the tourist to have a frame made by a reputable dealer to suit his personal measurements. Have it built in Reynolds 531 butted tubing. The size of a frame is measured from the top of the saddle pillar lug down the seat tube to the centre of the bottom bracket. To decide what size you need, take your inside leg measurement (say, 32in.), deduct crank length (7in.) and saddle depth (2in.) which leaves 23in. as the frame size. Another important dimension to consider is the wheelbase. The shorter it is, the more lively the machine; the longer it is, the more comfortable. We consider 42 to 44in. suitable for the tourist. Frame angles are also important for the same reasons and a good compromise between the lively and the comfortable is achieved with head and seat tube angles of 70 to 71 deg. The frame should be built to accommodate 27in. dia. wheels and plenty of clearance left under the fork crown and between the rear wheel and chain stay bridge so that larger tyres may be fitted easily for winter riding. A frame built on these lines is shown in Fig. 1.

Most tourists use multi-speed gears and if a derailleur is employed, the rear ends must be spaced wide enough to accommodate the wider hub required.

A special hand built frame gives the rider considerable choice regarding brazed-on fittings. We would suggest a lamp boss on the front forks, oil nipples in the head, mudguard eyes halfway up front forks and seat stays and a rear lamp bracket on the chainstay. An oil nipple will be required on the bottom bracket, and pump pegs spaced 18in. apart on the top tube. Finally, have fittings brazed on the down tube and on the chainstays for a derailleur gear, or else a special gear-type rear end fitted. We recommend the use of cantilever brakes, so only one hole, for fitting the front mudguard, need be drilled in the fork crown.

Brakes

Cantilever brakes are best for touring because of their unrivalled smooth and powerful braking action, their rigidity and freedom from "snatch" and the fineness of adjustment which is possible (see Fig. 2).

Wheels

Strength and lightness are the requirements for the tourist. There is no point in having wheels wider than 1¼in. and, in our opinion, the most suitable are 1¼in. Endricks, 27in. dia. A good selection of tyres is available for these wheels and we select a medium tread open-sided tyre as being the most suitable.

Obtain the best hubs you can afford. In our opinion there is no particular advantage in wide flanges. The rear hub should be chosen to suit the type of gearing envisaged, i.e., with a long thread for a multi-speed block.

Chainset and Gearing

The strongest type of chainset is solid forged, i.e., the right-hand crank and the spider are made in one piece. The chainring is fitted to this type of chainset by means of bolts passing through the arms of the spider. This enables the chainring to be changed easily if required.

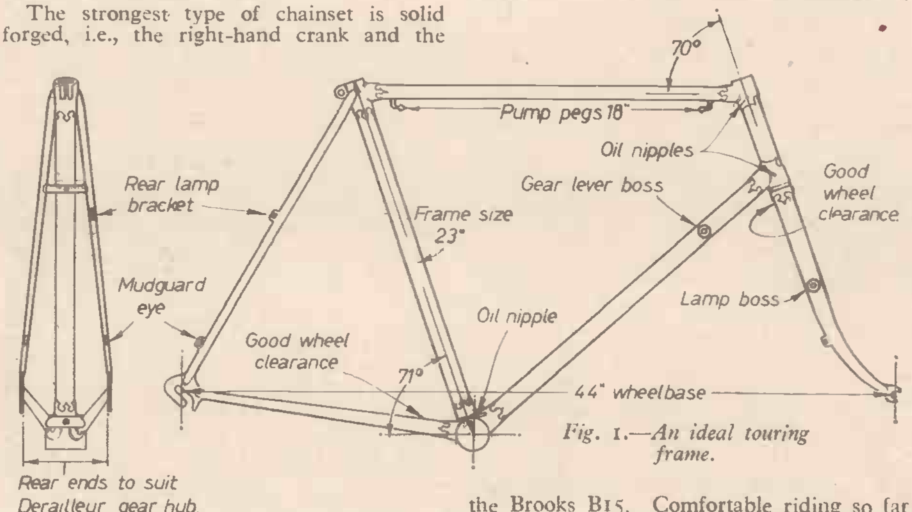

Fig. 1.—An ideal touring frame.

By making use of 3/32in. chain, chainring and block it is possible to obtain five-speed gears and this is, we think, the best arrangement for the tourist. Five gears should be quite adequate for touring anywhere in the British Isles, but if at any time a super range of ten gears is required, it can be obtained by fitting a double chainring and change mechanism.

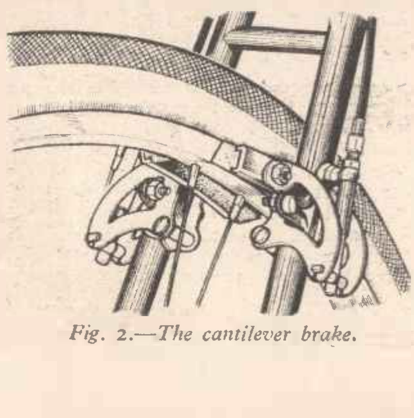

Fig. 2.—The cantilever brake.

Pedals and Mudguards

The type of pedals used is mainly a matter of individual choice, but whether they are metal or rubber, it is advisable to obtain good quality, especially the ball races. We prefer a metal "quill" type.

It is worth paying considerable attention to the mudguards as much of future comfort, particularly in wet weather, depends on them. If the shallow curved type are used, make sure they are wide. If the narrow type with deep sides are used, fit them as close to the tyres as possible. Beware of narrow types with only a shallow curve; they are not very effective. A large mud flap is worth while on the front mudguard.

The Saddle

The range of different types of saddle available is very wide. At one extreme is the heavy, multi-sprung, padded cushion saddle and at the other is the ultra-narrow cutaway sprint type. Neither of these is suitable for touring. Our own preference is for a medium-wide unsprung leather-topped saddle of the type exemplified by the Brooks B15. Comfortable riding so far as the accomplished tourist is concerned is not achieved by a padded saddle but by the rider becoming physically hardened.

Handlebars

A multiplicity of different shapes is available to the tourist. Some turn up, some turn down and some are flat. The shape chosen is largely a matter of individual preference but our choice is a pair of bends which turn down. They should have a 4in. to 5in. drop, have a good straight portion on top and not be too wide. These will give two riding positions, one on top and another on the hand grips for riding into a headwind or obtaining extra pulling power when hill climbing, etc.

Accessories

Our list is toeclips and straps, 18in. pump, bell, lightweight dynamo, lighting outfit and regulation reflector, a good tool and puncture repair kit, cape, leggings and sou'-wester, and a capacious saddlebag. Splash-guards for wet-weather riding are useful on both front and rear wheels.

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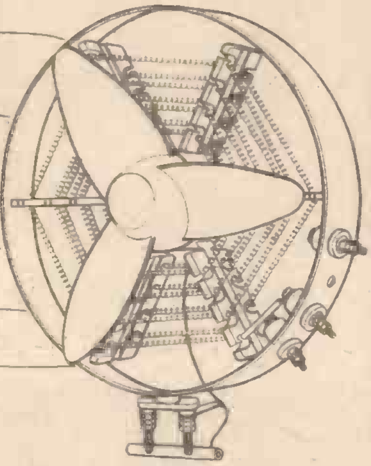

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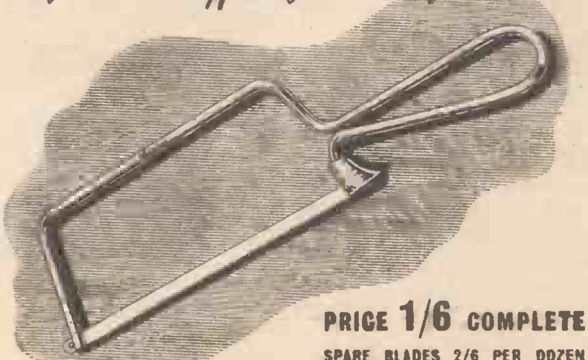

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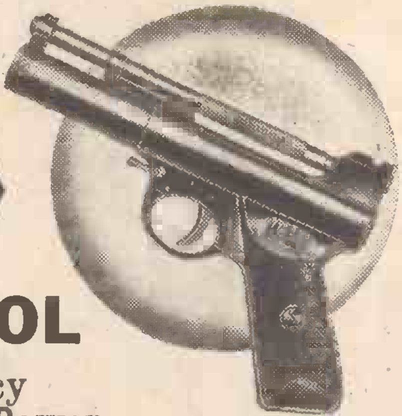

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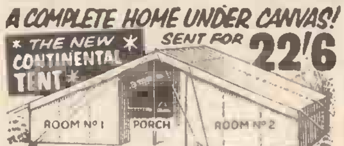

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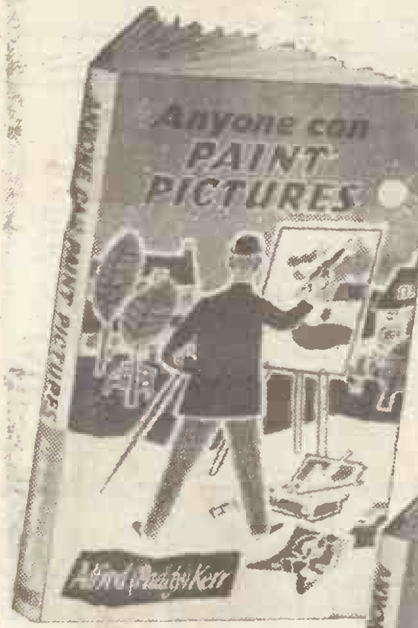

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