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EDITOR : F. J. CAMM

SEPTEMBER 1958

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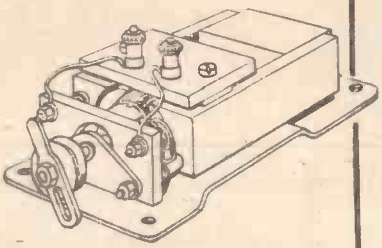

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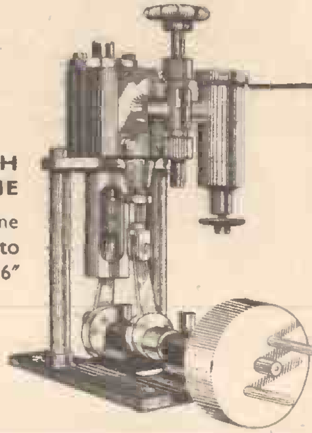

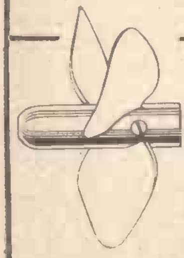

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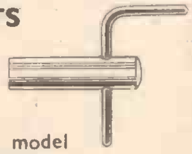

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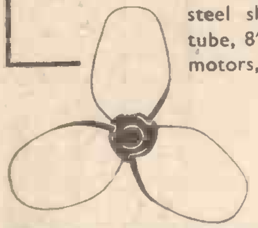

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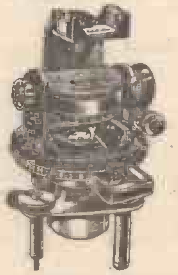

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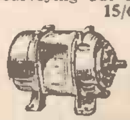

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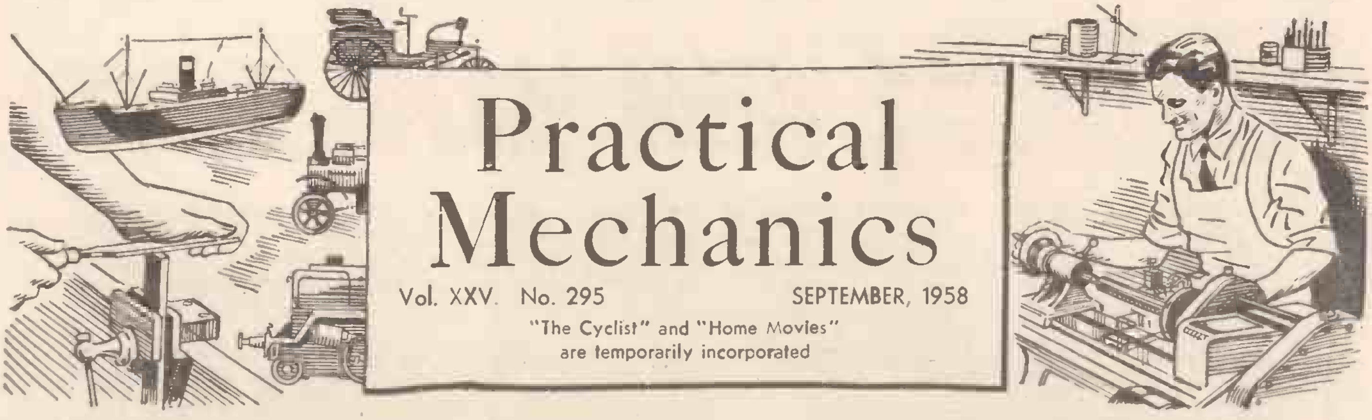

Practical Mechanics

Vol. XXV. No. 295 SEPTEMBER, 1958

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

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CONTRIBUTIONS

The Editor will be pleased to consider articles of a practical nature suitable for publication in "Practical Mechanics." Such articles should be written on one side of the paper only, and should include the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor, "Practical Mechanics," George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

FAIR COMMENT

ENERGY FROM THE SUN

FROM the earliest times of which we have record, the sun has always been regarded as the source of all life, indeed the sun worshippers, members of one of the oldest of the religious sects, consider it as *the* life giver.

The development of nuclear power, however, which does not depend on the sun for its generation must give cause for modification of the earlier concept. The sun and religion have always been interwoven and one old established body, the Rosicrucian Order, has devoted considerable attention to the subject, and indeed to artificial satellites and other scientific subjects. The dictionary defines a Rosicrucian as a member of an alleged secret society whose members made great pretensions to knowledge of the secrets of nature, transmutation of metals, elemental spirits, magical signatures, etc., affirmed to have been founded in 1459 by Christian Rosenkreuz. The modern followers of this Order have certainly devoted a great deal of time to scientific subjects. In our February issue, in which I dealt with the Satellite Era, I quoted extracts from an article which appeared in the *Rosicrucian Digest* giving the views of Ralph M. Lewis, Imperator of this Order, and with the views expressed I wholeheartedly concur. As with those interested in solar energy, as many religious bodies undoubtedly are, the Rosicrucians wisely separated religion from the subject of satellites. The plain fact is, as Mr. Harold Heyward pointed out in a recent lecture, solar energy is not a scientific pipe-dream, but it is here and under actual development, and those developments have proved that the sun is not the entire source of energy. It is well known that sources of energy such as coal are the result of natural concentration, as Mr. Heyward points out and the metamorphosis of living matter represents a concentration in time, just as power derived from mountain lakes, formed by the decomposition of water evaporated from the seas, represents a concentration in space. We are told that in fourteen days, the earth receives radiation, equivalent in heating value to the whole of the estimated world coal reserves. If we could discover some means of storing this solar energy so that it can be tapped off as required we should have solved the solid fuel and oil problem. Unfortunately, practical applications of solar energy must at present be confined to those areas in which there is a high proportion of sunshine the whole year round. Numerous experiments in solar energy have been going on for over a hundred years and a solar boiler steam engine was constructed in France towards the latter end of the last century. Several of the experiments made use of mirror systems and one successful solar prime mover drove a printing process at an exhibition in Paris. Bessemer in England built the Solar Furnace. The fact is that, notwithstanding a hundred years of experiment, we are a long way off making use of solar energy for power and heating, but experiments are being intensified in view of the difficulties with our coal and oil supply.

WANTED—SUGGESTIONS FOR ARTICLES

PLANS are now being made for feature articles to be published in our next volume which commences with our October issue. I should therefore welcome suggestions from our readers (a postcard will do) as to the type of article in which they would be interested. Whilst priority will be given to those for which there is the greatest demand, I shall endeavour to satisfy all readers' suggestions. Articles submitted for publication are also welcome.

OUR 25th BIRTHDAY

A REMINDER that the October issue (that is next month's issue) will celebrate our 25th Birthday, and there will be many special features to signalise the event. Make sure of it by ordering now.—F. J. C.

The October issue will be published on September 30th. Order it NOW!

CAMPING EQUIPMENT

Making Camp Furniture

By F. Hook

The Third Article of the Series Describes the Construction of Table, Chairs and Cooking Cabinet

Fig. 1.—Showing the finished cooking unit, table and chairs.

MANY people look upon camping as "roughing it." No doubt for the youngster this sort of camping has a great attraction. However, for those of us who have reached the family stage in camping, especially, simple comforts in camp life will make the holiday more enjoyable. Eating meals whilst sitting on the ground with no back support can be very trying for those past their youth. It is easier, too, to organise young children's meals if the youngsters are seated at a table.

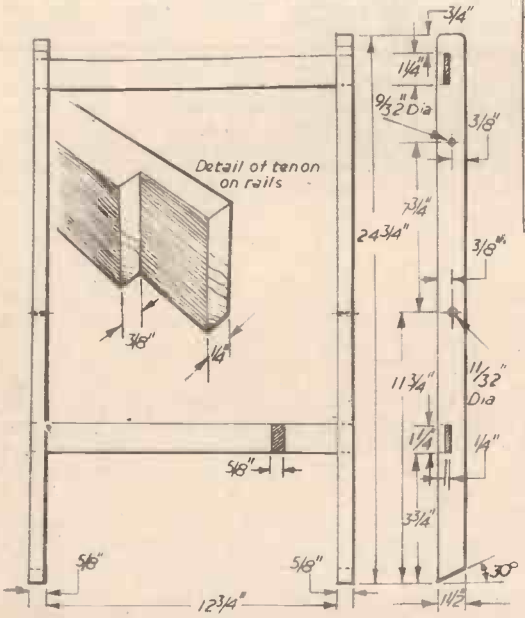


Fig. 2.—The main chair frame.

This section will, therefore, deal with the making of a simple set of folding chairs and a table which all fold flat and can be stowed on the car roof-rack or luggage grid or in the bottom of the trailer.

Plywood is used extensively, and it is recommended that resin-bonded plywood, or the variety that the builders' merchant refers to as exterior grade plywood, be used so that over the years the damp will not be able to penetrate the laminations and cause them to disintegrate.

Cooking meals at camp can be made easier and more enjoyable if adequate shelter can be provided for the pressure stove. Some stoves will keep alight in very high winds with little shelter, but, even so, much heat is lost down wind. The cooking unit described in this article is suitable for all types of stove and it has been used successfully in winds even of gale force. The author uses this unit under the flysheet extension described last month and it is shown in use in Fig. 1.

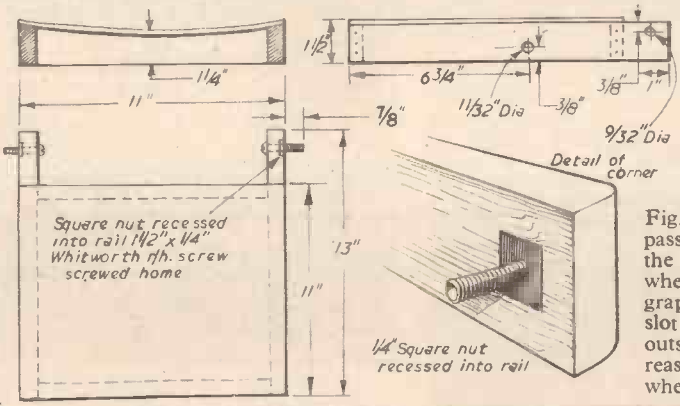


Fig. 3.—Details of the seat.

Making the Folding Chairs

This chair is made up of three separate frames shown in Figs. 2, 3 and 7 respectively, which give the necessary constructional dimensions. A timber such as beech is ideal for making the chairs, but quite a good chair can be made from parana pine.

Commence by making the main frame shown in Fig. 2. Mark out the position of the two mortises for the rails. They are $\frac{3}{8}$in. in from the front edges of the stiles and are $\frac{1}{4}$in. wide. When cutting out the mortises work from both sides so that the chisel will not break through and split the wood on the opposite side. The top of each stile is rounded and the foot is sawn off obliquely at an angle of 30 deg. as shown. Finally, the two pivoting holes are drilled at the centres shown, the top hole being 9/32in. dia. and the lower one 11/32in. dia.

When the frame has been fitted together satisfactorily it may be glued together after cleaning off all marks with the smoothing plane. Use one of the waterproof glues such as Aerolite so that the joints will not be disintegrated by damp. When the frame has been glued and tested for squareness the joints may be further secured with two brass nails driven from the edges of the stiles through the tenons. When the glue is dry any slight protrusions of the tenons may be cleaned off with the smoothing plane.

The Rear Support Frame

First of all make the mortise in each leg and tenon the ends of the rail to fit. Now mark and cut out the slot in each leg. In Fig. 7 the slot is shown passing right through the thickness of the leg, whereas in the photograph in Fig. 4 this slot is not visible on the outside of the leg. The reason for this is that when the chair shown

Fig. 4.—A completed folding chair.

in the photograph was made the slot was made only $\frac{3}{4}$in. deep. Some readers may find it rather difficult to cut this slot neatly when it does not pass right through the leg. When the slot is open both sides it may be cleaned up very easily with a flat file. Cut the bottom end of these legs to an angle of 10 deg.

Glue the frame together and test it to see that the legs are at right angles to the rail. Finally secure with some brass nails and set aside to dry. It is worth while dropping this frame now inside the front frame already made to see that they match up as regards "squareness." There is sufficient clearance between the two for a couple of steel washers.

The seat is made next as shown in Fig. 3. First of all make the frame. As shown, it is glued and nailed together. For those good at woodwork the front corners could be dovetailed together and the back rail housed in to make a first-class job.

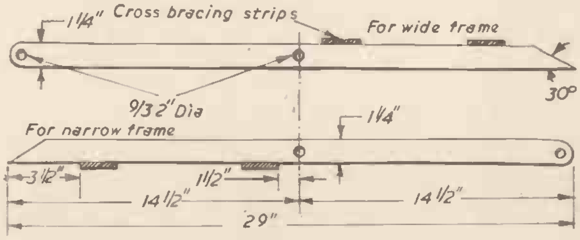


Fig. 5.—Details of the table legs.

If the front and back rails are left parallel it will be found that the seat will not be so comfortable as if they are slightly hollowed out as shown in the diagram. The seat of thin resin-bonded ply is glued and screwed to the frame. Start by screwing down at the lowest point of the curve and work out to the edges. Screws or nails can be used but it is advisable to use only those made of brass. If steel is used, in time they rust and the rust shows through the paint.

The holes are drilled for the bolts which form the sliding pins. Now screw the square nuts on and mark round them on the wood with a pencil mark. Then take off the nuts and make a recess with a chisel so that the nut will lie flush with the surface of the rail. Finally, reassemble the bolts and nuts and do up tightly with a screwdriver.

Assembly

When the three frames have been cleaned up and glasspapered they may be assembled. The seat is placed between the back legs quite easily with the screws in place if the seat is tilted sideways so that the Whitworth screws engage in the slots. Bolt the back legs on to the front frame, placing a washer between the leg and the frame and one under each nut. Screw the nut up temporarily, but at a later date the surplus screwed thread is sawn off and the end burred over so that the nut will not come off.

Now place the assembly down flat on the bench as it will be when collapsed for transport. Pass the length of 5/16in. dia. mild steel rod through the holes in the frame and the seat. The chair can now be tested for working freely in opening up and folding down. Make any slight adjustments that may be necessary. Finally, a washer is placed over each end of the rod and the rod is sawn off to length so that it protudes about $\frac{1}{8}$in. above each washer. Each end of the rod is then burred over sufficiently to prevent the washers coming off. The finished chair may be varnished or painted.

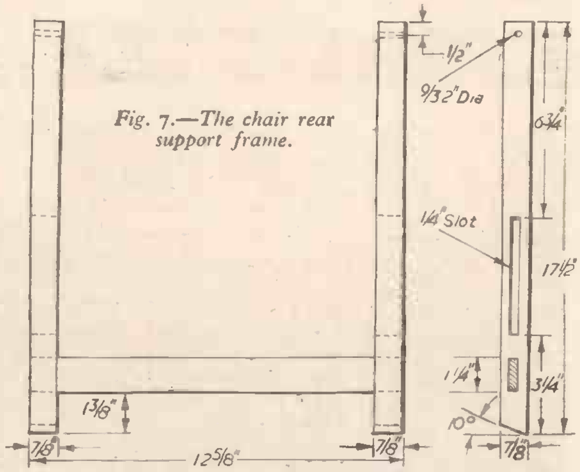


Fig. 7.—The chair rear support frame.

The Folding Table

This table consists of two folding frames secured to the table top by four small steel brackets. The inner pair of legs are permanently bolted to a pair of angle brackets by having the ends of the bolts burred over.

Fig. 8.—The table and chairs erected for use.

The outer pair of legs are secured to their angle brackets when the table is erected with a pair of bolts and wing nuts.

First of all prepare the timber for the legs from some parana pine or other wood such as beech, etc. The length of the legs is 29in., the width $1\frac{1}{4}$in. and the thickness $\frac{3}{8}$in. One end of each leg is spokeshaved to a half-round, and the lower end is sawn at an angle of 30 deg. The holes for the $\frac{1}{4}$in. bolts are drilled 9/32in. at the centres shown in Fig. 5.

Four bracing strips are needed each $1\frac{1}{4}$in. × $\frac{1}{4}$in. and length approximately 24in. It is better to saw off these strips to the correct angle after they have been glued and screwed to the legs.

The legs of the narrow frame are 18in. apart. Draw a pair of lines on the table top this distance apart and place the legs along the lines and on the outside of them, resting on their edges. Note that the elevations shown in Fig. 5 show the legs as they would be resting on the table top, therefore, the narrower pair will have to be reversed so that the cross bracers can be glued and screwed into place.

Having made the narrow frame, bolt on the pair of outside legs by the middle holes and then proceed to attach the cross bracers for the outer frame. Remember to place the $\frac{1}{4}$in. steel washer on the screw in between the two legs when bolting them together.

When the glue is dry, the end of the bracers may be sawn off flush with the legs.

Next make up the two pairs of mild steel angle brackets shown in Fig. 9. The holes are all 9/32in. dia. to give a small clearance for the $\frac{1}{4}$in. screws.

Bolt the legs to the angle brackets. Open out the frames as when the table is erected and place the brackets in position as shown in the plan in Fig. 6. Mark and drill the holes in the table top. Countersink the holes on the top so that the countersunk heads lie flush with the wood surface. Secure the brackets to the table top.

Now test the table for folding down correctly by removing the two bolts holding the top ends of the wider pair of legs to the angle brackets. When all is well the protruding ends of the screws may be sawn off and slightly burred over to prevent the nuts coming off. The table erected for use is shown in Figs. 1 and 8.

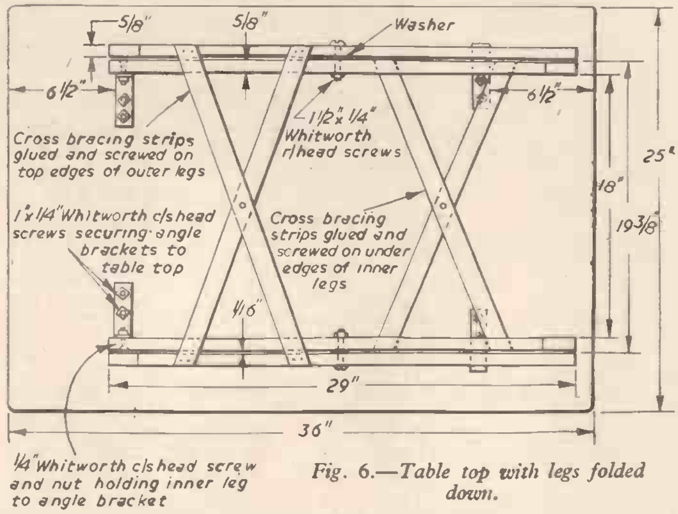


Fig. 6.—Table top with legs folded down.

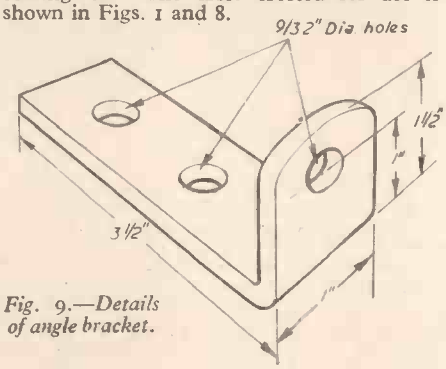


Fig. 9.—Details of angle bracket.

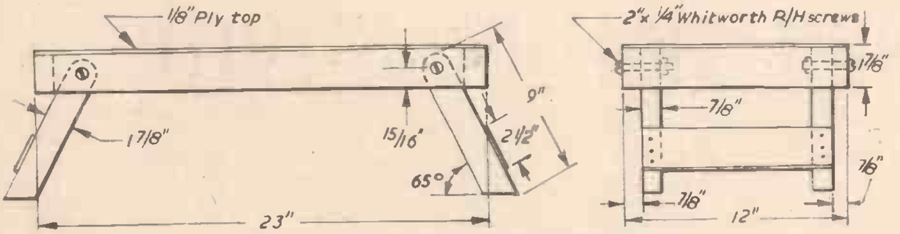


Fig. 10.—The base for the cooking cabinet.

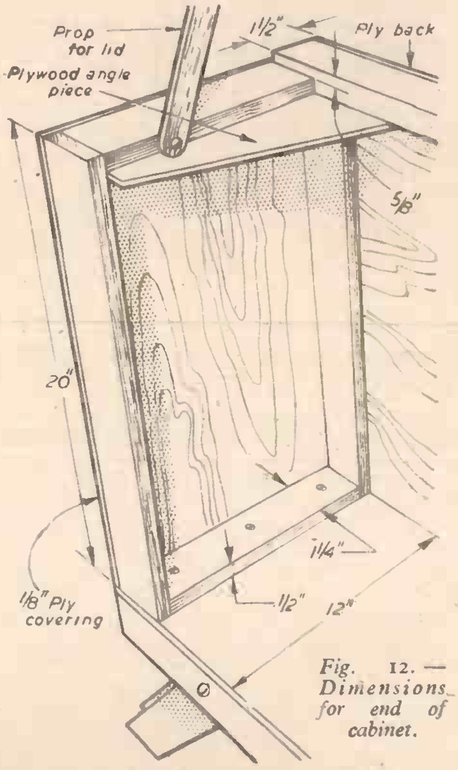


Fig. 12.—Dimensions for end of cabinet.

Finally, the table is given a priming of aluminium paint and a finishing coat of paint of any suitable colour. Instead of painting the table top, some self-adhesive plastic sheeting might be put on which would save the use of a table cloth.

The Camp Cooking Cabinet

This cabinet was made specifically to the the two-burner stove shown in Fig. 11, but it is not necessary for the reader to adhere strictly to the dimensions given, and they may be varied to suit any other stove that the reader may have.

First of all make the base of the cabinet with the pair of folding legs. These legs can be optional, but they are a boon in raising the cooking stove up from ground level and have proved a convenience when sitting at the unit on one of the folding chairs.

The Main Frame

This is made from some timber finished to $\frac{7}{8}$in. × 1$\frac{7}{8}$in. The corners can be dovetailed together or merely glued and nailed. The top is of $\frac{1}{8}$in. plywood and is glued and nailed on to the frame. The legs are made to the dimensions shown in Fig. 10. In the open position they bear against the end rails of the frame. Bolt the legs in position and fold them down when the plywood cross-pieces can be glued and screwed to them.

Next the ends of the cabinet are made. Their dimensions can be seen in Fig. 12. Here again the joints at the corners can be glued and nailed, and then the $\frac{1}{8}$in. plywood covering applied with glue and nails. The two ends are then placed on the base to which they are screwed.

The top back rail is made from a piece of timber 1$\frac{1}{2}$in. wide and 1$\frac{1}{8}$in. thick. A halving joint is made at each end so that the rail can be screwed to the top of the ends.

A piece of plywood is screwed on the underside of the back rail and side rail as shown. This serves the dual purpose of holding the side at right angles to the back rail and forms the ledge on which rest the $\frac{3}{8}$in. dowel rods which are used as a rack for warming plates, etc. Then the back of the whole cabinet is covered with a piece of $\frac{1}{8}$in. plywood, glued and screwed in place. Take care when fixing as described in the previous paragraph that everything is square

Fig. 11.—The cooking cabinet.

with only one or two nails partly driven home at first.

The Doors

It now remains to make a pair of doors for the front of the cabinet and a lid. In the illustration it will be noted that frames have been made and covered with plywood. This of course necessitates making a number of halving joints at the corners of the frames. If it is preferred to avoid this sort of woodwork then buy some $\frac{1}{2}$in. plywood and cut to size for the doors without the need for frames. If $\frac{1}{2}$in. ply is used for this purpose note that the $\frac{5}{8}$in. projection above the side of the top back rail would have to read $\frac{1}{2}$in. The $\frac{5}{8}$in. measurement shown allows for a $\frac{1}{2}$in. thick frame with a $\frac{1}{8}$in. ply covering for the lid.

The doors and lid are hinged in position with some 1in. back flap hinges. The two front doors are held in place at the bottom by two door catches such as are used on kitchen cabinet doors. At the top the doors are held secure for transport by two $\frac{1}{4}$in. dowel pegs which are glued into the lid and register in two $\frac{1}{4}$in. holes drilled in the top edges of the door.

A pair of simply made lifting handles are useful when screwed on to the sides of the cabinet near the top. Another useful accessory is the prop to hold up the lid of the cabinet as shown in Figs. 10 and 12.

It now remains to give the whole cabinet a coat of aluminium primer and then the finishing coats of paint to match the rest of the furniture. It is a good plan to use only aluminium paint on the inside of the cabinet as this is heat proof to a certain extent and will not blister.

'Phone Calls via the Moon

SOMEWHEN in the near future it is possible that the Moon will be used to "bounce" telephone calls, it is reported in America. Research has found that very shortwave radar or radio signals can be used to reflect voice transmissions from the Moon to a destination halfway round the world, without a noticeable deterioration of quality. At present the curvature of the Earth acts as a limiting factor for communication distances, but this will be overcome where both transmitter and receiver can see the Moon at the moment of communication.

The principle of using the Moon to reflect voice communications has been known for some time, but it has now been found that very short wavelengths of about 1in. give such improved results that a world-wide network of communications, using the moon as a reflector, is possible.

MODEL BOATS MADE FROM GUMMED PAPER

This Material Forms a Strong and Well-shaped Hull

Says Frederick T. Day

BEFORE describing the simple yet practical method of making up a tug-boat from moistened gum strip, a few words relative to the medium—the tape itself, its treatment in application—will prove of assistance. Gummed strip is available from any store in brown, white or a number of colours in small diameter rolls or large ones, approximately 1in. in width. The adhesive used to coat the tape is animal glue, a very strong adhesive, and it is best, therefore, to moisten the tape with a damper or sponge and not with the tongue. The adhesive is also tenacious and needs only just sufficient moisture to moisten it to make it stick fast. When applied two or three layers thick, it is almost untearable, and is completely so if sufficient layers of tape are used in the make up of any model.

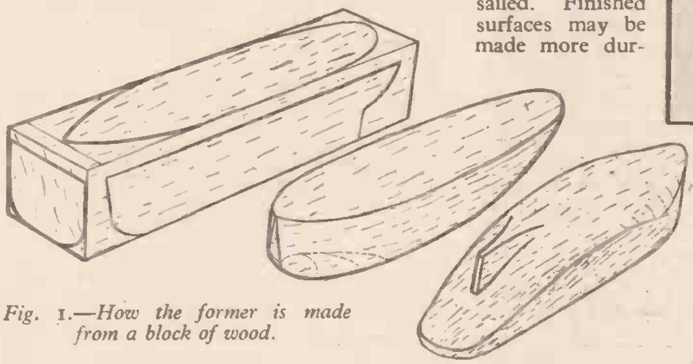


Fig. 1.—How the former is made from a block of wood.

Using a Former

All moulded work prepared for various kinds of models is based on the principle of layers of wet gummed strip applied to a base paper or tissue, which is first laid on to a moulded shape specially cut out or fashioned for the work. In the case of the very popular moulded ship or boat, as illustrated, a wood hull is first prepared then overlaid with tissue so that the moistened tape, when applied, does not adhere to the wood mould. On to this tissue the wet tape is built up in suitable layers, and when the tape is dried out, it will take the firm shape of the wood hull.

Some types of former or mould may be specially cut out from wood, or they may be modelled from clay. On the other hand, there are often articles to hand in the home which may be used to produce other kinds of models. Some suggestions are corks, pots, pencils, tins and boxes which may be used to serve as a basis for making toys and other models.

When moulded tape is left to dry out thoroughly, it becomes rock hard and may be handled, or in the case of the boat, sailed. Finished surfaces may be made more durable and waterproof by a coating of varnish or shellac.

Fig. 3.—The completed tug ready for water-speed tests.

Gummed strip is very pliable so that it may be pleated round various edges of curved work. The finished work may also be painted with one or two coats of any kind of paint, thus making it waterproof and attractive in appearance.

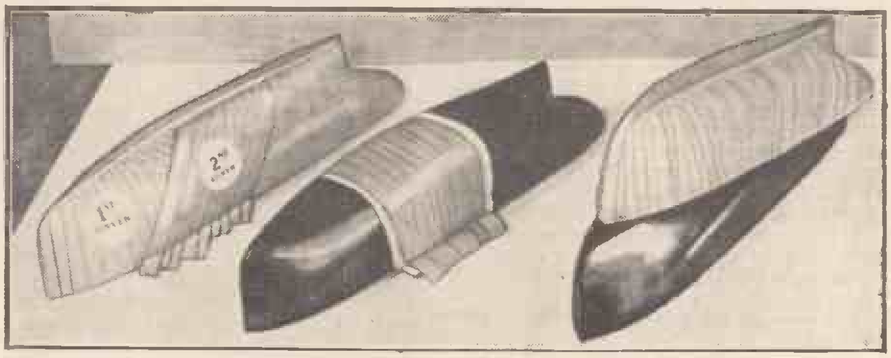


Fig. 4.—How the moistened tape is applied in layers over the former.

The strength of the finished model lies in the superimposition of layers of tape, and there is nothing quite so strong of the same thickness.

Model Tug-boat

This is one of the most interesting models to make up, and it is not at all difficult. The model may be fitted with batteries and a small electric motor, thus converting it into a real speedboat. While the tug-boat may be produced as an early attempt in this work for the newcomer to this handicraft, there are many other boat models, aircraft, locomotives and other working items which may be similarly carried out with the aid of a mould or former. In the case of the boat, various hulls may be authentically carved out to serve as the basis of boat production.

Fig. 1 shows how the former or original mould is made up from a wood block, large enough in length, width and depth to cover the overall dimensions of the finished model. Wood formers should be treated with sandpaper to render them smooth and they may, with advantage, be painted to give them a non-porous surface. This is most important where moistened tape is being used to make up a paper hull.

Fig. 4 illustrates the moistened tape applied in suitable layers over the former. Working from amidships, the hull former is covered with wet tissue paper and in this way it will hold to the shape of the former temporarily and thus prevent the first layer of tape applied from adhering to the wood mould or former. At this stage, the wet tape is applied in overlapping layers, as shown, and this gives added strength; ½in. strips of well moistened tape should overlap by about half the width of the tape.

When this section is completed, proceed in the same manner with the next, starting with a layer of wet tissue followed by overlapping strips of wet tape. At the bow and stern it will be found that the strips of tape will not lie parallel to one another, but this is not important; continue to cover the whole of the former, finishing the hull as shown. The bow, stern or bottom may be suitably treated with tape in an artistic fashion, giving a good finish to the work, and any additional strips will stiffen the work considerably. Any pattern may be produced to taste, giving a ribbed or square effect, the tape being suitably applied with this end in view.

The finished hull (Fig. 2) should now be

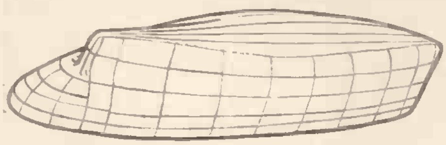


Fig. 2.—The completed hull with fitting for battery.

ready to be fitted with a battery if it is planned to produce a mechanical model for use on the water. This is shown with a fitted battery for the purpose.

Before this stage is reached, however, any necessary trimming should be carried out. For example, after the initial layer of gummed tape is practically dry, trim off the edges of the tape at the deck line and it will be found that not only does this add to the finished appearance of the model, but it will assist in easing the hull off the wood former. If a small part of the shape has stuck to the former, use a piece of fairly stiff paper, such as cartridge, between the hull former and the hull shape to separate the two. The hull should be dusted with french chalk thus preventing any subsequent tendency for the hull to stick to the former. The hull is then replaced on the former in order to build up the tape to the desired thickness, and this will have some relation to the size of the model being produced. A good standard to work is four separate layers of tape for a hull some 18in. long.

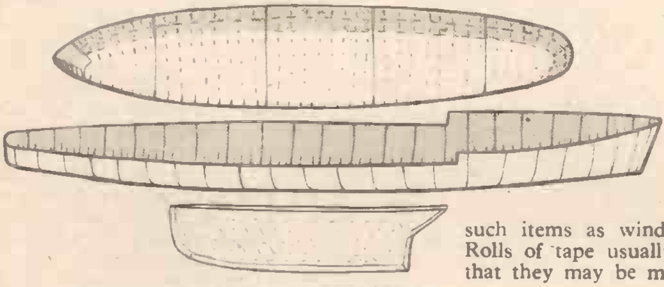


Fig. 5.—Moulded shapes prepared from formers.

The hull of the boat is perhaps the most important feature of the model and should have the necessary strength to sustain the battery, the deck and any superstructure work carried out. Where several models are being made up, the same mould, of course, can be used.

When the hull is finished in its final thickness, trim again at the deck line.

Fig. 5 shows the moulded shape finished off and taken off the former. The final layer of wet tape should be laid according to the type of hull shell required. These may be briefly outlined as follows:—

No. 1.—Plates overlapping for steamer hull.

No. 2.—Planks edge to edge for carvel hull.

No. 3.—Planks overlapping for clinker-built hull.

Some study of various models from illustrations may be helpful in the case of early work on these kinds of models.

When the taped hull is completed, as shown in the illustrations, a wooden deck must be made and the former or mould used for the hull may be used as a template to mark out the plan for the deck on a suitable piece of ply or hardboard. This is then cut out along the drawn line. A hole is cut in the deck thus produced to enable the power plant, stern tube and rudder post and other parts to be subsequently fitted. The deck is pinned and glued into position and when firmly fitted, the portion of the deck is shaped off above the curve of the deck line.

Suitably shaped cylindrical items may be used to produce the funnel and a tube of the diameter required may be used to wind round wet strips of tape, using the same method as described for the hull. The same strength may be obtained by layers of tape left to dry out. Plastic wood or some suitable adhesive will be useful to fix into position such items as the stern tube.

Figs. 3 and 6 show the fully fitted out tugboat, the latter illustration showing the completed job ready for water speed tests.

The accessories are added according to taste and perhaps some knowledge of the craft being produced. It is best to copy a suitable diagram or illustration from a reference book. The main feature of gummed strip modelling is that boats and other models may be produced that are strong, practical and usable in water.

Gummed Strip Modelling Aids

In the case of sailing boats, strong sails may be made up from lampshade parchment or plastic. Strong, thick cartridge paper has many applications in this craft. A sharp knife is useful for the tape. Where several models are being made up or large ones, the big commercial coils are best and more economical. These are obtained from the stationers in several widths, i.e., 1in., 2in. and 3in. wide. Gummed strip is also made in a transparent variety should this be required in certain models needing such items as windows and others panels. Rolls of tape usually have a centre hole so that they may be mounted on a spindle for easy handling and convenience in use.

Any model made up with gummed strip may be completely dropped in water and left to dry out when it will become firm and absolutely hard. This procedure stiffens the tape and when a coating of varnish is added, it will be completely waterproof.

In addition to ships and boats, lighthouses, masks and faces, aeroplanes and kites, toy and model furniture, bridges, model forts, steam rollers are among some of the fascinating and useful models possible for the beginner in this handicraft.

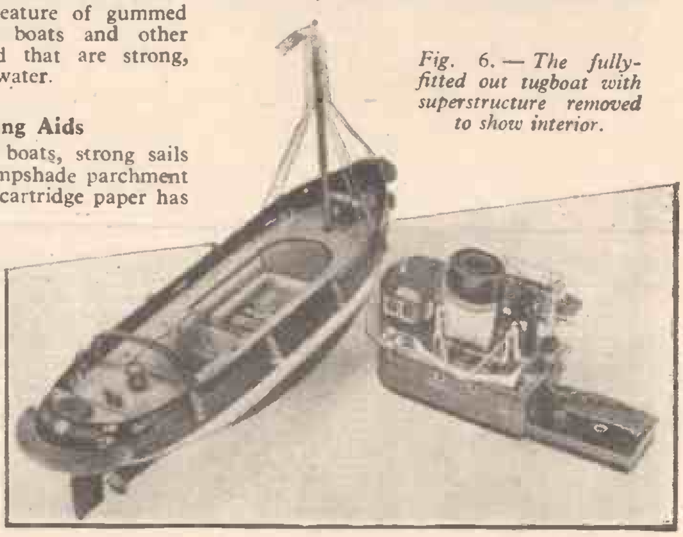


Fig. 6. — The fully-fitted out tugboat with superstructure removed to show interior.

Individual Rocket Motors

ARMY engineers in America revealed recently that it may soon be possible to "shoot" troops across rivers by means of individual rockets attached to their backs. The rockets will turn troops into "human grasshoppers" and the element of surprise which they will introduce to infantry warfare could be of tremendous value. Troops could approach the battle area using caution and then travel the last 80 to 100 yards at great speed using the rockets, launching a surprise attack immediately on landing.

The personal rockets have been named after an American strip cartoon character, "Buck Rogers," who uses a device similar to the rockets. They are designed to lift men for a distance of up to 100 yards at a height of not more than 20ft., although most "flights" will be about 50 to 80 yards at heights of less than 16ft., i.e., high enough to clear the majority of obstacles, but not high enough to cause injury on landing. Training similar to that at present given to paratroops is envisaged for the new rocket troops, as considerable shocks will be encountered on landing.

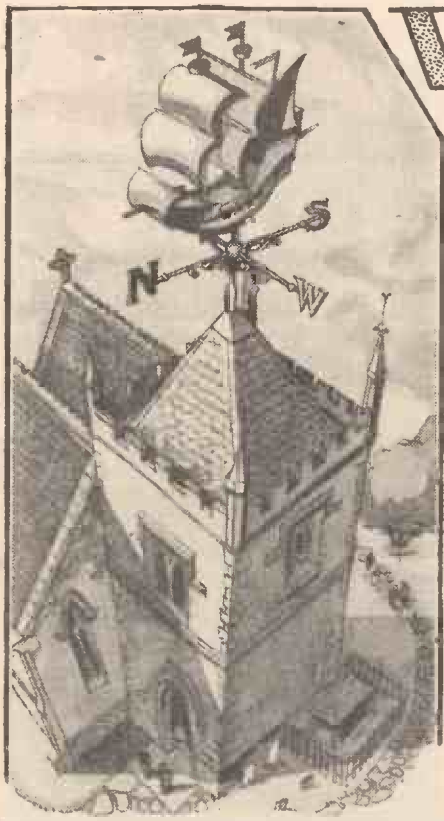
A solid propellant rocket thrust will be used to power the personal rocket and it is also anticipated that a modification of the rocket may be used to carry motor vehicles, tanks and other field equipment across rivers. Vehicles such as jeeps or tanks may have steel surfboards bolted underneath. They would enter the water at top speed and as soon as the vehicle began to slow the rockets would be fired and the rest of the journey accomplished skimming along the surface like an aquaplane.

The U.S. army is already developing personal helicopters which troops will wear with a harness, but it is possible that the new rocket motors will be more efficient and cheaper than the helicopters.

Weather Vanes

Several Attractive Designs are Described

By Ronald Lister



THE construction of an attractive weather-vane for garden, bungalow or house, is well within the capacity of the average amateur mechanic with ordinary workshop tools, and preferably a lathe, and the job gives scope for artistic expression and original design. There are, however, a few basic principles of construction and proportion which it is useful to know, and which will help in making a success of the first attempt. For example, a vane which appears successful on the working sketch, and on the bench, when finished and viewed from below at a distance may have the direction letters too small, or the arrow not sufficiently elevated above the arms to appear clear of the letters when seen from a low angle.

The photographs (Figs. 1, 3 and 5) show three vanes which have proved successful. The first is a very simple, small vane without ornament, made for the top of a garden summerhouse with a conical roof. Details of construction are indicated in Fig. 2. This vane was made of copper, with the exception of the central pivot rod and the other parts indicated on the drawing, which were turned out of a short length of brass bar. The letters and the vane of the arrow were cut roughly with a hacksaw from 1/16in. thick sheet copper and then file finished. The arrow head was cut from ⅛in. sheet to balance the weight of the greater area of the vane. It is desirable that the complete arrow should balance at the centre of rotation. If it is appreciably out of balance, the slightest deviation from the vertical will cause a bias and the sideways pressure on the bearings will result in increased friction and wear, so care should be taken to arrange the proportions of the arrow to obtain a reasonably good balance. The arms and arrow rod were slotted with a hacksaw to receive the vane and letters which were soldered and riveted and all screwed joints were also soldered to exclude rain and damp.

It is advisable to make a small, simple weather-vane of this nature as a first job. This particular one was gilded and looked very attractive when first erected. Another advantage is that this type runs "dry" (i.e., without oil), and this simplifies the construction. It is about 15in. over the letters and would also be suitable for a bungalow.

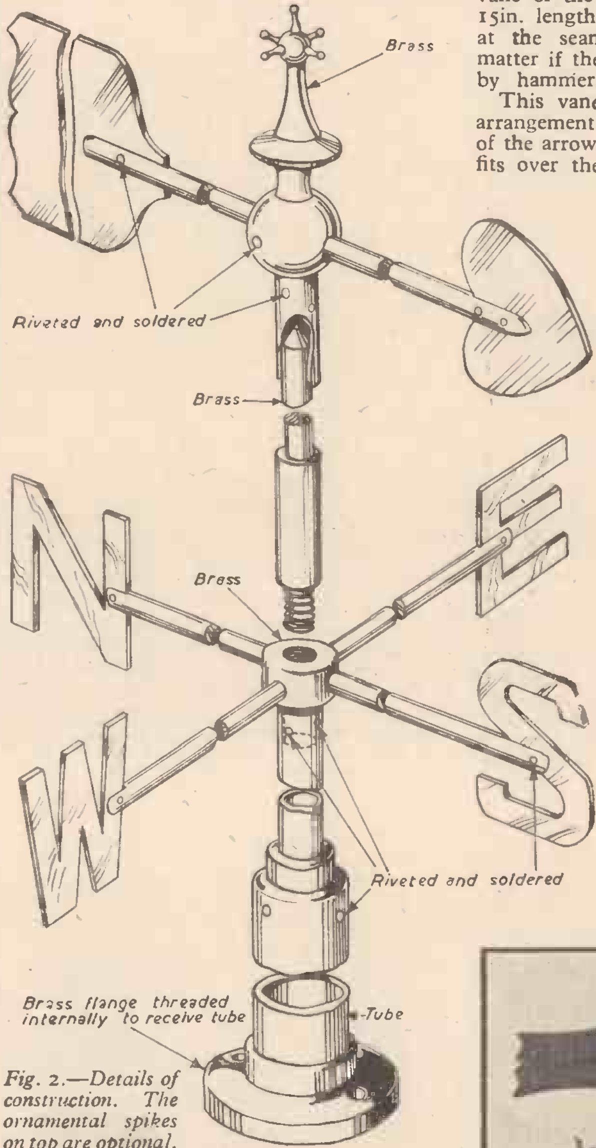


Fig. 2.—Details of construction. The ornamental spikes on top are optional.

A Larger, Oil-filled Type

Fig. 3 shows a rather more elaborate type, and the incorporation of some quaint device (in this case an old-time cyclist—always with the wind behind him) appeals to many people. Ships, galleons, peacocks, running foxes (in hunting country), horses (over stables), coaches, blacksmiths at the anvil, in fact an almost endless variety of subjects can be applied, but it should be remembered that the device will only be seen in silhouette, from below, and from varying angles.

The "cyclist" vane is all copper and is about 3ft. high and about 2ft. over the letters with a 2ft. arrow. This is quite large enough for the gable top of a two-storey house, or a 25ft. flagpole. A scrap metal merchant may be able to supply scrap copper and brass or tubing of various diameters and various turned pieces, at scrap price. The "cyclist" vane was made entirely from scrap metal, including the vane of the arrow which was made from a 15in. length of 2in. tube, cut longitudinally at the seam and flattened. It does not matter if the copper is soft as it will harden by hammering or working.

This vane works in oil and the bearing arrangement is varied accordingly. Instead of the arrow being mounted on a tube which fits over the centre pivot rod, it is carried on a rod which goes into a bearing tube which is sealed at the bottom and filled with oil. At the point where the rod enters the tube a weather seal is fitted to the rod, covering the open top of the tube like a narrow umbrella to keep out the wet. The principle is shown in Fig. 4.

The letters on the "cyclist" vane are a little more stylised and the arrow head has to be extra heavy to balance both vane and cyclist. It was turned in the form of a cone out of a short end of copper bar, but a cast lead arrow head would be quite as good. Because of the weight the shaft was doubled in preference to using a thicker rod and this preserved the general light, slender appearance. The vane was pierced with initials, using drill and files. The bicycle is a correct model with forks, hubs, handlebar, cranks and pedals. The wheels can be made from ⅛in. rod and the rider built up in layers, which is a rather difficult job.

The weather seal is the small ball just below the vane

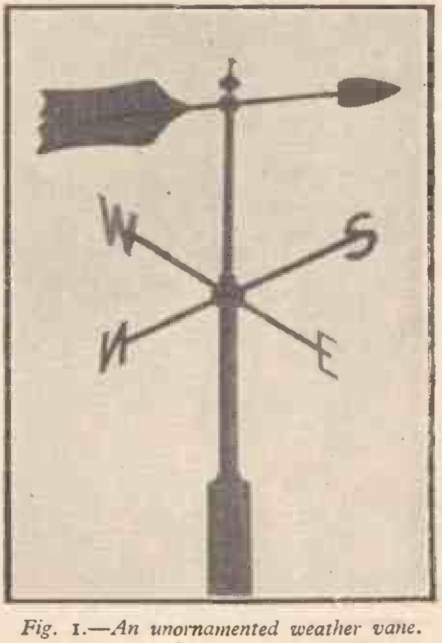


Fig. 1.—An unornamented weather vane.

(see Fig. 4). It is hollow and receives the open end of the oil-filled tube and is soldered to the rod and as in the previously mentioned vane all screwed and riveted joints are also soldered to keep out rain and damp.

A vane of this type was erected some years ago and when recently taken down for inspection, the oil was clean and in good condition and the copper had taken on a fine dark patina.

A More Imposing Design

Fig. 5 shows a more elaborate and ambitious job, which would suit a large three-storey house. It is about 4ft. 6in. high and 2ft. 6in. over the letters and was made of steel, as the cost of material to work in copper in this size would have been prohibitive. It works in oil on the same principle as the "cyclist" vane and the general proportions can be estimated from the photograph. Rods and tubes are mild steel and the vane arrow head and the letters are cut from sheet about 3/32in. thick; the scrolls and ring are made of $\frac{7}{8}$in. × 3/16in. strip, bent red hot in the vice, with big pliers, matched against a light hand-bent pattern. The crown in the design was built up from sheet and strip and the vane also carries a cut-out Lancaster rose.

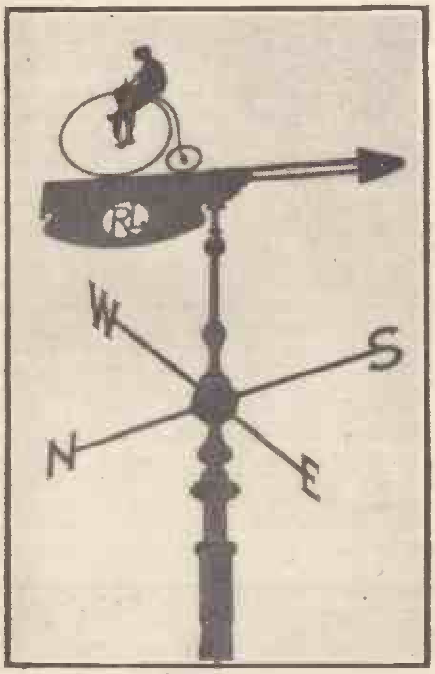


Fig. 3.—The "cyclist" weather vane.

The shaft of the arrow is made of tube, and a balance obtained by running in molten lead until the front is a trifle overweight, and then drilling some of the lead out until an exact balance is obtained when the arrow head is riveted in position. The whole job could be assembled by screwing and riveting but should you have access to welding tackle the joints could be bronze-welded. The completed job is then shot-blasted and zinc sprayed and given three coats of black paint which should make it practically impervious to rust. Finally the crown, weather seal, letters, and base can be gilded and the rose picked out in red.

In designing a weather vane do not overlook the method of mounting. If it is to be on a pole or tubular pillar the base should terminate in a suitable socket. If it is to stand on a flat surface it will require a flange drilled for coach screws or bolts. If it is to go on a gable apex, some form of bracket will be required, but whatever

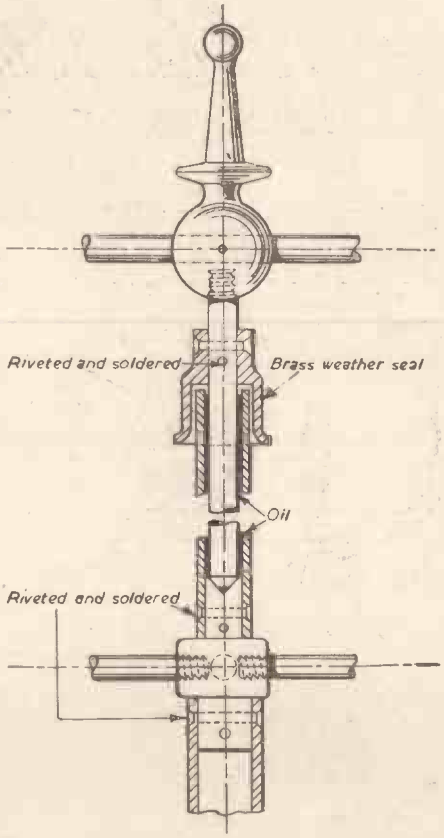


Fig. 4.—Constructional details of an oil-filled vane.

method of mounting is used the bolts or position of bracket should not be finally fixed until the compass points have been orientated. This can be done either by compass, allowing for the magnetic variation, or by reference to large scale ordnance survey charts showing your house, which can be seen at your library or the office of the local surveyor.

Detail dimensions have not been given, as within reasonable limits these can be varied to suit the available material, but in designing a weather-vane the following proportions will serve as a sound guide.

The pivot rod should bisect the arrow, that is, the dimensions from the tip of the head, and from the back edge of the vane, to the centre of rotation, should be equal.

The overall length of the arrow should be approximately equal to the overall length of a pair of arms including the letters.

The distance from the bottom of the base flange or socket to the arm boss, and the distance from the arm boss to the arrow should be approximately equal, and each of these distances should be at least half the length of the arrow—preferably rather more.

The centres of the letters should be equidistant from the centre of rotation, and as the letters are of different widths, this means that the arms must vary slightly in length.

Only the W will read correctly from both sides. N, S and E will read reversed from one side or the other so that it is immaterial which way they are mounted on the arms.

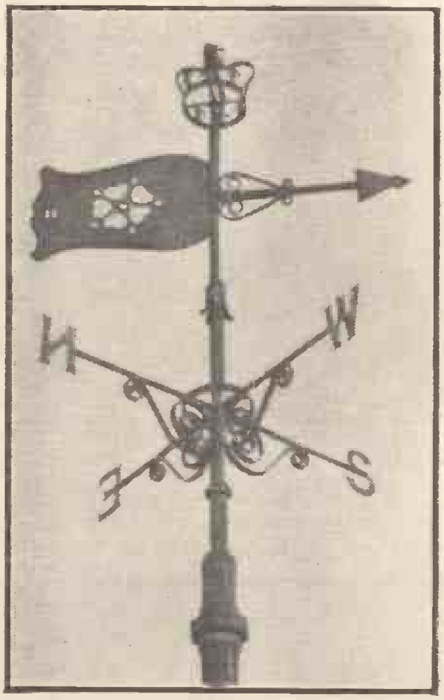
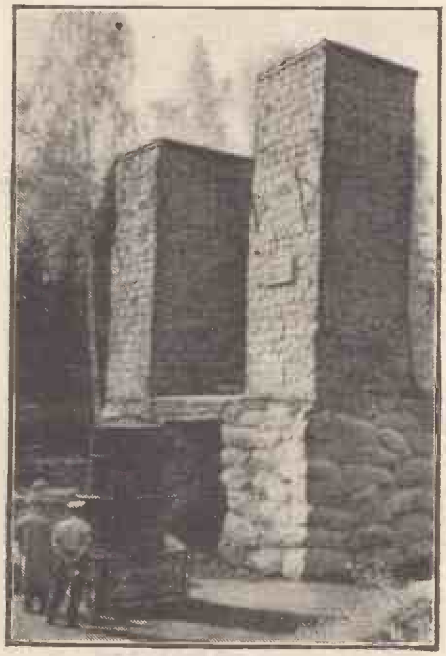


Fig. 5.—A more elaborate weather vane.



The original blast furnace.

Anglo-Swedish Centenary

THE birth of a new age started in Sweden in July, 1858. Steel was produced for the first time on an industrial scale by a Swede—Göran Fredrik Göransson—according to the Bessemer method, which was invented and patented two years earlier by an Englishman, Henry Bessemer. This Anglo-Swedish co-operation led the world in the technique of mass-produced ingot steel.

In theory the Bessemer method was highly promising, and had actually given good results in a number of single practical experiments. But so far as its exploitation on an industrial scale was concerned, it proved impracticable.

G. F. Göransson was first to overcome the difficulties of its practical application and to start a regular steel ingot production.

The Bessemer method consists of converting molten pig iron into steel by forcing a blast of air through it. Compared with other methods used up to 1858, it gave much larger quantities of steel in a single blast, using considerably less fuel.

The experiments led by G. F. Göransson were carried out at Edsken and the photograph shows the original blast furnace used. A ceremony was held recently to celebrate the centenary.

Whittle Carving

The Method of Producing These Artistic Ornaments

By Peter Watters and William Corke

Fig. 1.—Selection of possible models for future whittle carvings.

THE tools required are few and simple, namely: a sharp penknife or better still a craft knife, obtainable from any model shop, a coping saw with a fairly coarse blade, a tube of balsa cement and a few sheets of fine sandpaper.

Any close-grained wood may be used, for example: lime balsa, etc. which may also be obtained from the model shop.

Some examples of the type of work possible are given in Fig. 1.

In order to whittle carve the mallard duck and drake, as shown, a block of wood 3in. × 2in. × 4½in. will be required for each.

Making the Templates

This is not essential in whittle carving but will prove a great help to accuracy in form and balance, especially in the beginning.

First a tracing must be made from Fig. 2, and back-traced or carbon copied on to a piece of stiff card. Next press the marked-out card on to a smooth, flat board (not the dining-room table) and cut carefully round the outlines of the mallard with the craft knife. If this is done carefully, the template can then be used to mark out the block.

Marking Out the Block

Having cut out the templates, the next job is to position them on the block, which must have at least one corner squared-up. There is no need for meticulous accuracy so long as it is not obviously out of square. Place the top corner of your "elevation" template up to the squared corner of your block as shown in Fig. 3 and fix the inside part of the template by means of small tacks or drawing pins. Remove the outside part of the template, and draw round the outline of the mallard, which will now be correctly positioned on the block (Fig. 4). Repeat the process with the "plan" template, bearing in mind that you must position it against the same corner.

Fig. 3.—Positioning the template on the block, before marking out.

Cutting Out

Using a coping saw (Fig. 6), start the first cut at "A" (Fig. 5) and continue along the duck's back to point "B", taking care not to carry the cut beyond the point shown. Withdraw the saw and take your second cut from "C" under the belly of the duck to "D", again taking care not to exceed the indicated limit of cut. The next cut is taken from point "E" to "F", and the fourth cut from "G" to "H" again taking care not to sever the block. The fifth cut is taken completely through the block at the dotted line, and finally severs the block, which will now fall apart leaving the rough cut-out of the duck (see Fig. 7).

Whittling

Having removed the roughly shaped mallard from the block, whittling is commenced. The model should be held firmly in the left hand, with the knife held as shown in Fig. 8. Cut off small

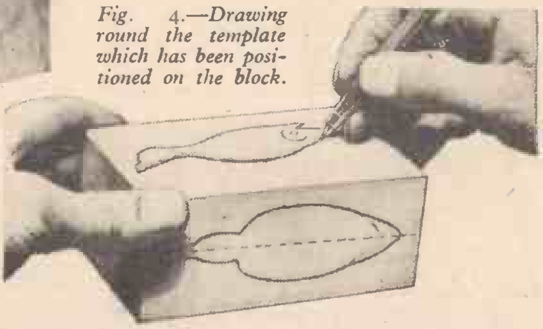


Fig. 4.—Drawing round the template which has been positioned on the block.

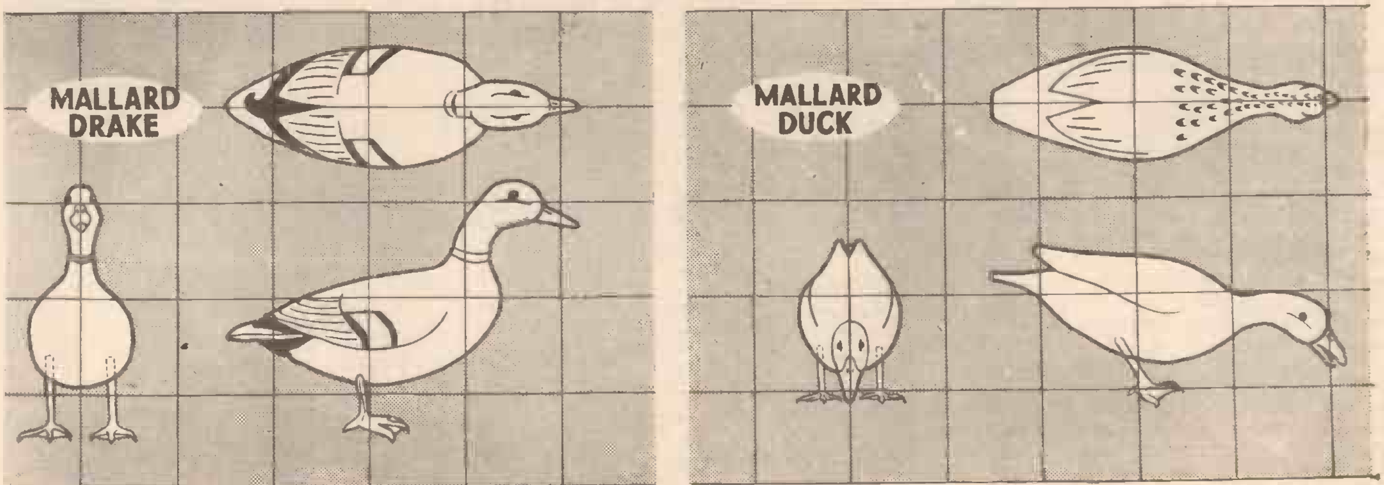


Fig. 2.—Scale drawings of the mallard duck and drake.

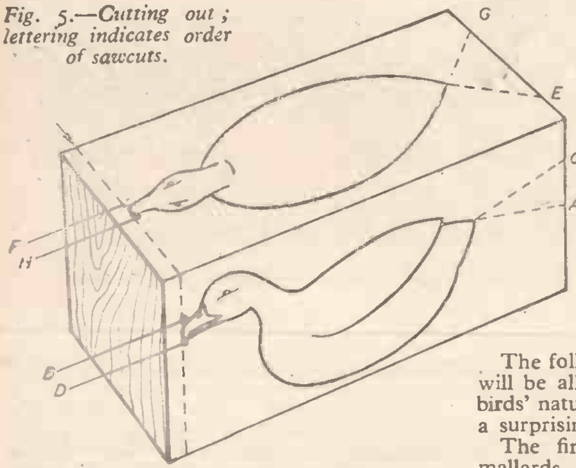


Fig. 5.—Cutting out; lettering indicates order of sawcuts.

slivers of wood with a round paring movement towards the thumb, cutting with the grain wherever possible. If you have made the templates as suggested you will be able to test your models as you go, remembering that they should not be able to pass through until you have smoothed off the whittle cuts and polished the whole thing with fine sandpaper. The mallard should pass smoothly through the template, but do not be alarmed if you have not attained precision at your first attempt.

Mounting the Models

The presentation of the finished models can vary considerably to suit individual taste. But for demonstration purposes they should be mounted on a piece of pine log. as they might be found by the edge of a stream or pond.

If, however, you merely want to mount them on stands or pedestals, the cut-away portions of the two mallard's blocks will serve very well, and as they are already cut out, will save a lot of time and hard sawing. These can be whittled into all manner of interesting contemporary shapes.

To make the legs, both of the duck and the drake, whittle dowels or strips of wood into the shape and length shown in Fig. 2. Two holes are then drilled into the body of the mallard, using a 1/16th in. drill, and two corresponding holes into the base. The legs are then fitted and glued into the body only; do not glue into the base yet as the mallard must be removed for painting, and the legs will provide you with a very useful means of handling. Position the legs in the base while the glue in the body is still tacky, adjust the posture of the mallard, and lay to one side to set firm.

Painting

This is perhaps the most fascinating part of the whole operation, as it gives life to the model, which ceases to be just a block of wood. To obtain this effect at its best make sure of getting the colouring and markings correct.

The following list of "artist's" oil colours will be all that is necessary to emulate the birds' natural colourings and give the models a surprisingly lifelike finish.

The first thing to do is to give both mallards an overall coat of flat white oil paint and allow to dry. Then proceed to colour the birds as follows, using "artist's" oil colours thinned down well with turps or turps substitute. The turps makes for quicker drying.

Fig. 7.—Cut block, showing pieces apart.

Drake (topside)

Beak: primrose, with touch of dark green.

Head: dark blue, with emerald spot on top of head and each cheek, blend where blue and green meet.

Neck: raw umber lightened with white, from white neck ring down to back.

Back: mix raw umber, black. and white, to make pale brown-grey.

Wings: same as for back, wing tips black, wing patch blue, black and white, as in Fig. 2.

Tail: curling tail feather black, rest white.

Drake (underside)

Beak: primrose with touch of black.

Head: dark blue, almost black.

Neck: raw umber lightened with white, from white ring down to breast.

Belly: pale mixture of burnt umber and white.

Tail: pure white.

When the head is dry paint the eyes in with gloss black, enamel will do, or a tiny spot of clear varnish over "artist's black.

Fig. 9.—The finished model after gluing and painting.

Duck

First paint all over with a pale mixture of burnt sienna and white, except for the area on the underside of the tail, which must remain white.

Then darken the sienna colour with a little burnt umber and blend this into the top of the head, along the underside of the wings and under the neck. Now, starting with the head, paint small "U" shapes over the whole of the back and on the underside of the beak down to the root of the tail, using burnt umber. Finish the underside and edges of the tail feathers in white and line in the top of the tail and the wing pin-feathers with burnt umber, as shown in Fig. 9.

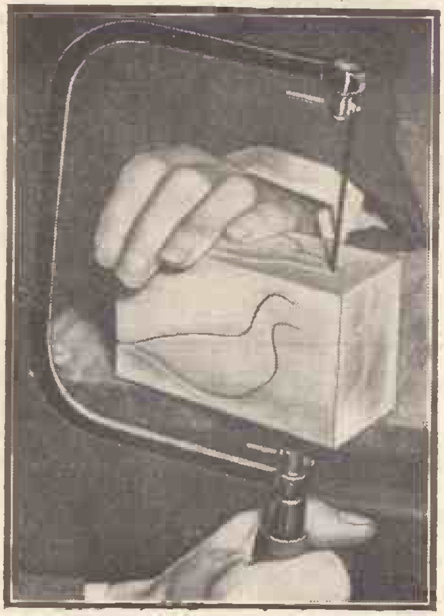


Fig. 6.—Method of sawing block with coping saw.

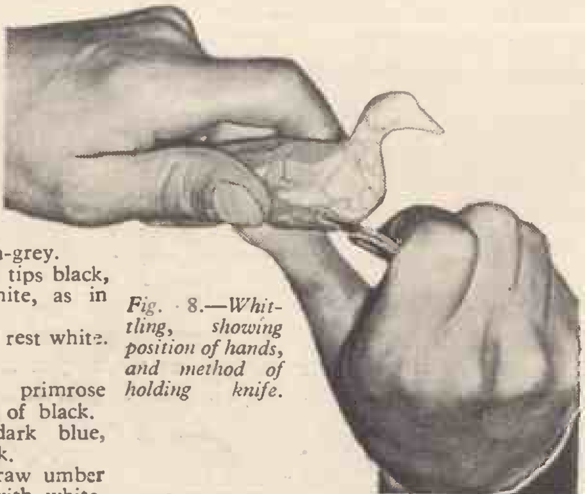


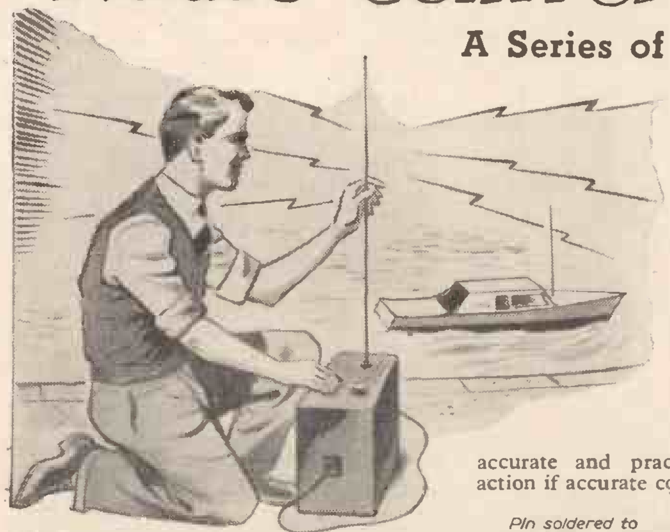
Fig. 8.—Whittling, showing position of hands, and method of holding knife.

Finishing

Having painted the bodies of both mallards, there remains the assembling of the model and the painting of the legs and feet. First glue the legs into the base, adjust both birds to a natural posture and allow to set.

The legs are then painted with orange toned down with a little black and the feet can either be moulded in plastic wood or painted on to the base in the same colour.

Radio Control for Model Boats



A Series of Three Articles Describing Equipment Necessary for the Complete Control of Model Boats

No. 1.—Simple Steering Control

By D. W. Aldridge

MOST boat and ship modellers, with aspirations to radio control start off with high ideals and hope to be able to steer, start, stop and reverse their models, to say nothing of controlling incidentals like anchors, lifeboats and guns, etc. It is usually found, however, that to carry out all of these functions multi-channel radio equipment is indicated and that this is considerably more expensive than the more usual single channel type. It is, however, possible to use simple radio equipment and it is the purpose of this series of three articles to show how apparatus can be built up which will progressively increase the scope of the control available. The basic control circuits given in this issue will be elaborated successively in the two articles to follow and it will be shown that it is possible to control from one receiver relay (operated by the single-channel radio) circuits which will produce as many control channels as the user is likely to require.

It is not intended, in this series, to describe the radio transmitter and receiver as these are standard single channel control items and numerous designs have been published for them in the past. In this journal designs were given in the issues of September and October, 1955, and these are now available in book form in F. J. Camm's "Radio Controlled Models" (price 12s. 6d., by post 13s. 6d.).

Experience has shown that the primary control function of a radio controlled model is steering. This must be positive, accurate and practically instantaneous in action if accurate control is to be achieved.

Steering Mechanisms

Fig. 1 illustrates what is probably the simplest type of steering gear which can be built up by an amateur having only "kitchen table" facilities. A small electric motor is used to provide the motive power and this drives a 4 B.A. screwed rod by means of a crank attached to one end. A brass pin soldered into a small hole drilled in the motor gear wheel engages with this crank.

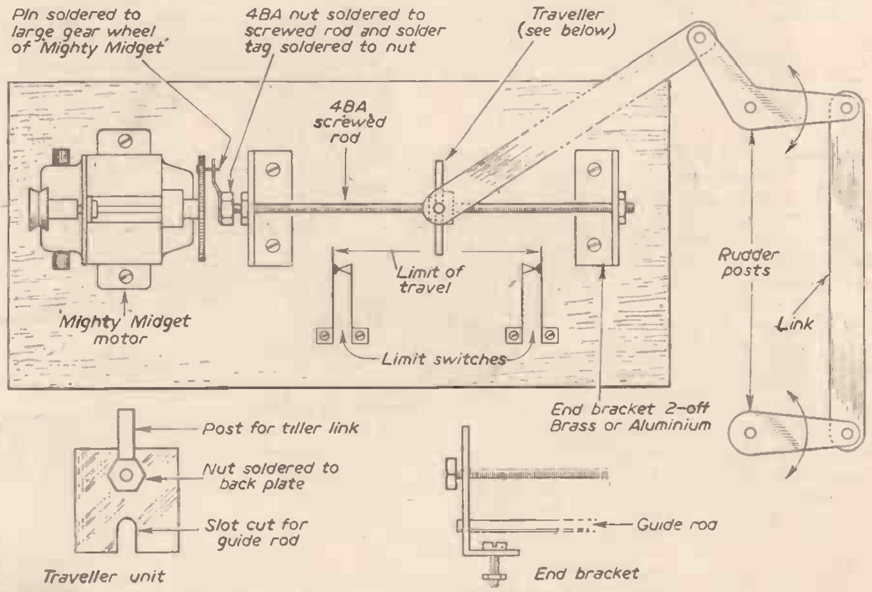


Fig. 1.—Simple screwed rod steering gear for boats.

A "Mighty Midget" motor is specified, and it is important to note that if any other type of motor is used a gear reduction is almost certain to be necessary. The "Mighty Midget" has this built in, and external gearing is avoided. A traveller unit is built up from junk box pieces and the general form should follow the illustrations. A 4 B.A. nut is soldered to the back plate and it is the action of the screwed rod rotating in this fixed nut which causes the traveller to move along the rod and hence to impart motion to the rudder or rudders through the link gear shown.

Limit Switches

To prevent the traveller from going too far along the screwed rod its travel is limited at both ends by means of "limit switches." These can be contrived from contacts taken from old relays or other pieces of equipment or they can be made from pieces of brass. The two contacts forming each switch are normally in touch with each other as illustrated and the action of the traveller is to force them apart thereby breaking the circuit and stopping the motion. The main requirement is that the two contacts should be held firmly together by their own springyness but that they should not be so stiff as to cause the

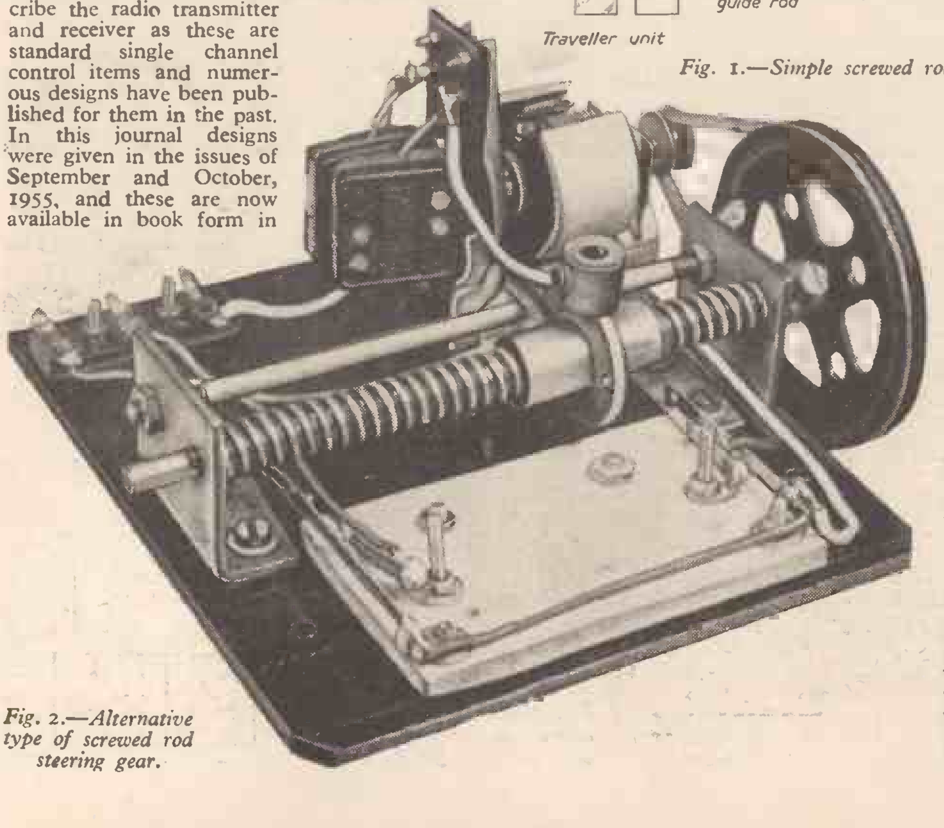


Fig. 2.—Alternative type of screwed rod steering gear.

traveller to jam when it reaches the limit positions.

Fig. 2 shows a variation of this system in which an electric motor drives a screwed rod by means of a rubber band reduction drive. Gears and pulleys from a well-known construction kit can often be used for building this type of equipment. A much more efficient type of steering unit is shown in Fig. 3. This uses a fully-geared drive and the gear ratios employed are as follows: 3 : 1 3 : 1 30 : 1 (worm gear). This gives a final reduction of 270 : 1 from the "Mighty Midget" drive. If a non-geared type of servo motor is used then an additional 3 or 4 to 1 will probably be required. The gears used to construct this piece of equipment were obtained from Messrs, Bassett-Lowke Ltd., Northampton. In this unit small micro-switches are used as limit switches. They are operated by a cam attached to the final drive shaft (seen just below the crank arm in the photograph).

Readers will see from these examples that steering gears can be constructed in a number of different manners and that there is plenty of scope for originality. It is, however, very important to ensure that the final speed of the rudder is correct.

Timing the Rudder

The time taken for the rudder to travel from full port to full starboard should be checked with a watch or stop watch, if available, and for satisfactory action it should be between three and four seconds.

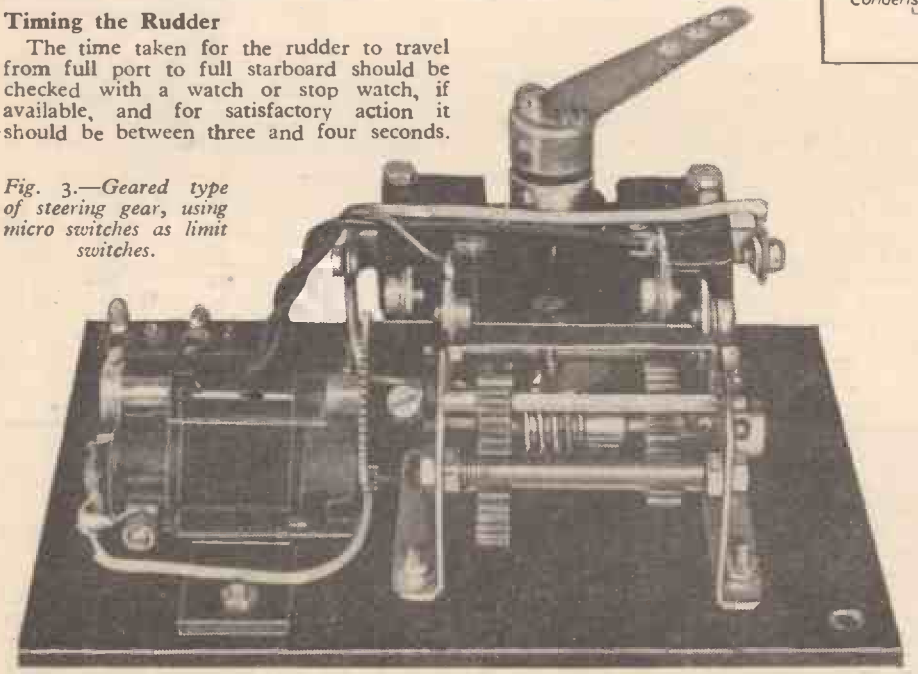


Fig. 3.—Geared type of steering gear, using micro switches as limit switches.

This time has been found by experience to give a reasonably fast reaction from the model and yet it is slow enough to permit accurate control. Extreme rudder angles are usually 30 deg. in full-sized craft, but for model purposes it has been found that up to 45 deg. can be used to advantage. These details are given relative to the use of electrically-powered boats and in the case of fast diesel-powered models much less rudder angle will normally be required.

The times specified above should be obtained with the motor using its normal battery supply voltage. In the case of a "Mighty Midget" a voltage of 4-4½ is preferred as this is normally adequate and causes less wear to the brush gear than the maximum permitted voltage of 6.

Having constructed a satisfactory steering mechanism the next problem is to find a suitable circuit to operate it, bearing in mind that the simple radio control equipment available can only be made to work as a remotely controlled switch (i.e., the receiver can only differentiate between whether the transmitter is switched on or off). The switch which the receiver works is, of course, the sensitive type of relay, common to nearly all these simple radio control systems, and quite a number of commercial relays are now on the market; these can be used quite satisfactorily. The writer uses the Siemen's high-speed relay, shown in the illustrations, which can be adjusted to the correct operating speed by means of the reed tensioning screw. For use as a receiver or anode relay a high resistance is required and a relay having 2 × 1,700 ohms coils should be obtained if of the Siemen's type. Alternatively, if a commercial relay is bought then a resistance of 5,000 ohms will be correct.

The Mark/Space System

The simplest circuit for radio controlling the steering of a model is that given in Fig. 4, and it will be seen that only two batteries are employed in addition to the steering gear and the receiver relay. The batteries are wired with reversed polarities, as shown, and the steering will, therefore, move from full port to full starboard when the receiver relay operates. The limit switches should prevent the traveller from reaching the ends of the screwed rod but it may be necessary to reverse the connections to the "Mighty Midget" to achieve this.

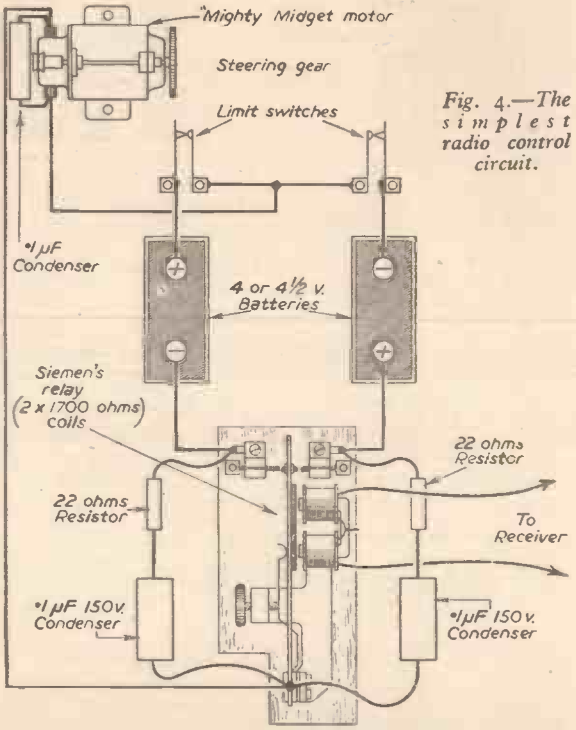
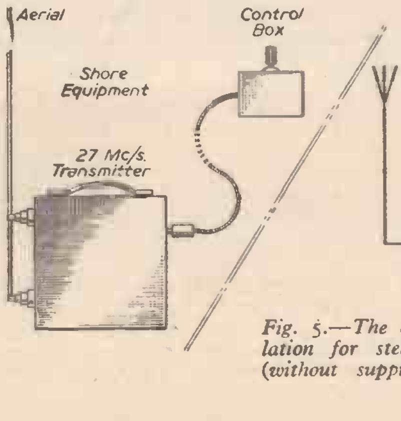


Fig. 4.—The simplest radio control circuit.

The full wiring for the equipment in the model is shown in Fig. 5, and the connections to the tuning meter and batteries, etc., are also given. The actual positioning of these pieces of equipment in the model is left to the individual constructor and is, in any case, probably dictated by the shape of the model. It has been found, however, that it is usually satisfactory to mount the receiver in the bow compartment together with the receiver batteries whilst the receiver relay, intergear batteries and steering unit are kept in the stern. Main propulsion motor and batteries will then be accommodated in the centre portion.

Steering Straight Ahead

As described so far the model can only circle to port or starboard, and the reader may be wondering how it is kept on a straight course. The answer is by the simple expedient of switching the transmitter slowly on and off. This means that the steering motor will also operate in sympathy and will oscillate to and fro about a mean position. It can, therefore, be made to hold any intermediate position between the two extremities



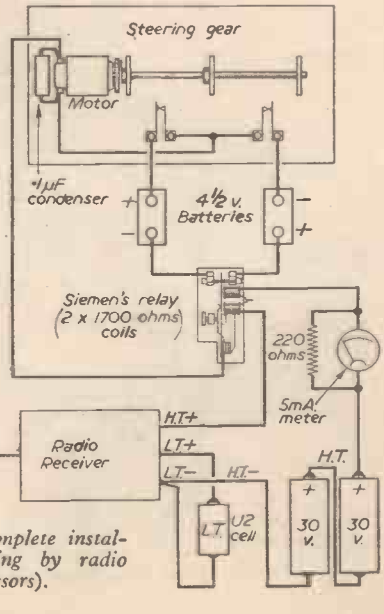


Fig. 5.—The complete installation for steering by radio (without suppressors).

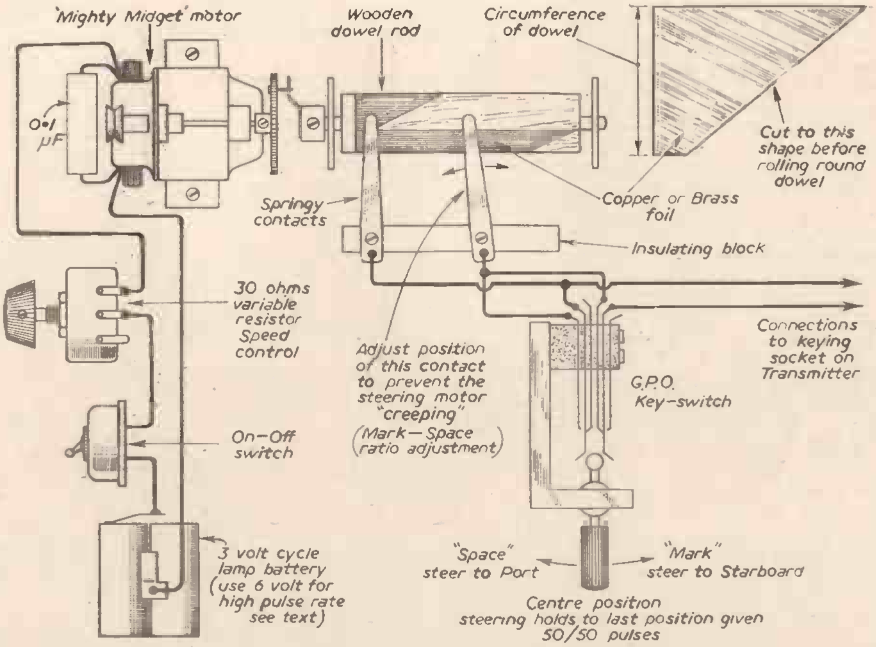


Fig. 6.—Details and wiring of the control box.

of travel. It has already been advised that the steering should take about three or four seconds to travel between limits and it will be found that by switching the signal on and off at a rate of about five times per second the movement imparted to the rudder by the oscillating motor is so small that the boat will hold a steady course and that the oscillating motion will be taken up by back-lash in the drive. This system is called Mark/Space because when the transmitter is on a "Mark" is said to have been transmitted and when it is off a "Space."

The ratio of the time the transmitter is on to the time it is off is important as the motor will not maintain a mean position and will creep to port or starboard if it is not correct. As this switching must be carried out with reasonable accuracy it is usual for the function to be performed by an automatic pulsing device. This device, together with the appropriate switch or switches to give port and starboard steering is usually assembled into a small hand-held wooden or metal box called the control box. This is linked to the transmitter by about 6ft. of twin flex terminating in a plug jack for easy connection.

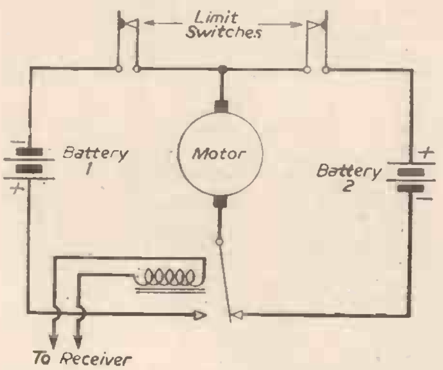


Fig. 7 (Right).—Circuit to illustrate the effect of delaying a relay by the use of a condenser.

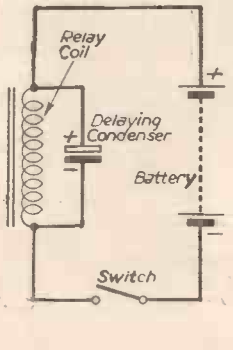


Fig. 8.—Theoretical circuit of simple Mark/Space steering system.

The Control Box

Full constructional details for making up a simple control box are given in Fig. 6. The basis of the system is the pulse drum made from a wooden dowel rod wrapped round with a shaped piece of copper or brass foil, as illustrated. The foil should be very thin and in a soft condition otherwise trouble may be experienced in wrapping round the dowel. "Evo-Stick" contact glue is useful for attaching the metal to the wood. Once again it must be stressed that unless a "Mighty Midget" motor is used it will probably be necessary to use reduction gearing to the drum. A speed of about five to eight revolutions per second should be aimed at and as a guide the ticking of a watch is at the rate of five per second. Several cases of difficulty known to the writer have been due to the use of pulse drums running much too fast for the system employed. A post-office key switch is shown as a steering control but this is optional and many suitable types of switches may be employed. Micro-switches are often used but the key-switch has the advantage of having a centre off position and the two side positions give steering control to port and starboard. The angled contact "wipers" should be bent almost straight so that the dolly or toggle of the key switch springs back to the centre position as soon as pressure is released. This means that as soon as a steering correction has been given, Mark/Space pulsing will at once be resumed and the rudder position maintained.

The adjustable contact finger bearing on the pulse drum should be readily accessible in the control box as it must be adjusted fairly critically to prevent the steering motor from "creeping." A small amount of adjustment can also be obtained by varying the relay adjustment in the case of a Siemen's relay.

Stage 2—Avoiding the Oscillating Motor

The system as described above is given as it is the simplest possible method of steering a model by radio and it is also a foundation upon which a more involved arrangement will be built. The next stage in the evolution of a complete radio control system is to cut out the oscillating motor. Whilst the former system does work well, it is wearing on the motor and in particular on the brush gear. A circuit is, therefore, preferred in which the steering motor is allowed to rest until it is necessary to move the rudder to a new position.

The basis of the new system is a method of delaying the opening of a relay after the operating current has ceased. Fig. 7 shows how a large condenser is shunted across a relay coil. When the switch is closed the current from the battery flows both into the relay, closing it, and into the condenser causing it to charge. If the switch is opened the condenser will then discharge into the relay for a given period, depending upon the capacity of the condenser and the resistance of the relay coil. Delays of several seconds can be obtained by this means.

Fig. 8 shows in theoretical form the steering circuit used in the simple Mark/Space system and Fig. 9 shows how the circuit is altered to incorporate two additional relays each with a delaying condenser. Pulsing of the receiver relay by the control box pulse drum (via radio link) will now cause current from the central battery to flow alternately into the two secondary relays.

Due to the delaying action, just described, the two secondary relays will hold on all the time providing that the correct delay times are obtained and that the pulse rate or frequency is correct. For this method of working a much faster pulse rate is desirable. In the final design a rate of 30 pulses per second is used but slower rates of about 10 to 15 are permissible for this stage. It should be noted that the *ratio* is not now of importance and that it is no longer necessary to adjust this critically as is the case with simple Mark/Space control. A simpler control box is, therefore, possible as it is not necessary to provide for ratio adjustment. The circuit is used as before but the pulse drum need only be long enough to permit both contact fingers to rest upon it. The shaped metal can be dispensed with and all that is required is a rectangular piece of foil to cover half the surface of the drum thereby making the circuit for 180 degrees of rotation and breaking it for the other 180 degrees. It is possible further to modify the pulse drum by fitting two contact foils, thereby giving two complete Marks and Spaces revolution. If this is done the pulse drum need only revolve at half the speed. For initial tests, however, the original control box can be used with the pulse drum running at full speed and using six volts instead of three to drive the pulse drum motor.

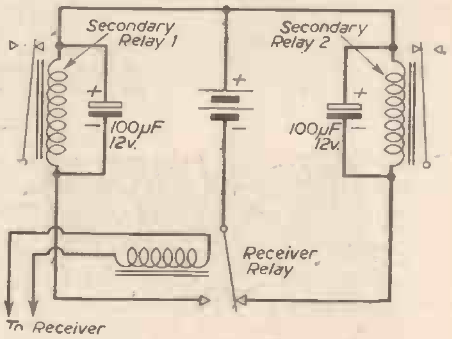


Fig. 9.—Theoretical circuit of second stage to avoid oscillating steering motor.

The Secondary Relay

No mention has been made so far of the type of relay used as a secondary relay in this circuit. The author has used Siemen's relays again for this purpose and the reed tensioning device has been found very useful in getting correct action. For secondary relays, however, it is necessary to use a much lower resistance as they must operate from a lower voltage. Relays having one coil (only) of 145 ohms are used and the originals were obtained from the Midland Instrument Co., Moorpool Circle, Birmingham. These may not now be available, but suitable relays are advertised from time to time in the pages of this journal and of *Practical Wireless* and *Practical Television*. If the correct coil resistance cannot be obtained, it will be found possible to get the circuit working with near values, i.e., a Siemen's relay having two coils each of 250 ohms can be wired with the coils in parallel, thereby giving 125 ohms. Take care to wire the coils with unlike colours together, otherwise it will not work. Relays should be tested before wiring into the circuit. They should close with a definite click on the voltage to be used (8 volts in this case).

The correct value of delaying condenser is related to coil resistance, operating voltage and relay tension. The value used by the writer is 100 μF 12 volts working (bias-type electrolytic) and this has been found to give the correct delay with 145 ohm coils. Experiments may be required if different relays are used. Larger values of capacitance give longer delay times whilst higher resistance relay coils need smaller value condensers and probably higher operating voltages. If a higher operating voltage is used be careful to watch the working voltages of your delaying condensers.

Wiring the Modified Circuit

Fig. 10 shows how the complete circuit is wired to the two steering batteries and to the steering gear. In the positions shown both secondary relays are held on by the rapid pulsing of the receiver relay and, therefore, the steering motor is not energised. If, however, a "Mark" is sent then the receiver relay will rest on one side holding on the associated secondary relay, whilst the opposite secondary relay will drop off after its delaying condenser has discharged. In practice the delay is only a fraction of a second and the action appears to be instantaneous. The steering motor will then run

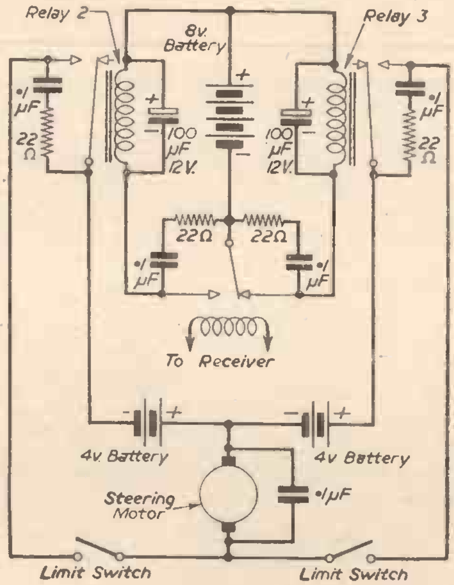


Fig. 10.—Full wiring plan of second stage.

in the direction dictated by the polarity of the battery. Resumption of pulsing will immediately stop its motion. The transmission of a "Space" will cause the opposite action to take place and full steering control is therefore possible without an oscillating steering motor. This method of steering control is extremely good and is recommended for all model boat work.

It should be noted the 8-volt battery, shown in Fig. 10, need not be a separate supply and that the power can be drawn from the two 4/4½-volt steering batteries. This will not apply, of course, if the secondary relays will not work on an 8-volt supply.

Interference Suppression

This is usually necessary and it is, in any case, good practice to avoid causing interference even if no trouble is experienced in the model. Television receivers can be affected by sparking contacts and brushes, particularly when testing the model at home. In addition to this, the use of suppressors prevents contact points from sticking and from wearing away. Suitable suppressors are simply 0.1 μF condensers (150-volt working) in series with 22 ohm resistors and these should be fitted where shown in Fig. 10. Servo motors (Mighty Midgets, etc.) are often more difficult to suppress and the writer usually earths each brush with a 0.1 μF condenser to a suitable piece of metal the model. Leads should be very short. This method is usually satisfactory if the simpler method of connecting a .01 or .1 mfd directly across the brush terminals fails.

In next month's article the system will be developed to include engine speed control with particular reference to electrically-propelled boats.

Rowing Stroke Meter

THIS meter, the circuit of which employs transistors, is connected to a small switch attached to the rowlock or oar of one of the crew so that the contacts close once every stroke. The cox is thus provided, after a few strokes, with a continuous picture of the number of strokes per minute. The meter is produced by Venner Limited.

Tin as a Crop Fungicide

LABORATORY research has resulted in the discovery that certain organic tin compounds are effective fungicides and suitable for agriculture. The most efficient are the tributyl- or tripropyltin compounds.

New Type of Wire

DEVELOPED in America, this is aluminium clad copper wire which has been developed to permit electrical equipment to operate at higher temperatures and for longer periods than ever before. The high electrical conductivity of copper, the superior oxidisation resistance of aluminium and the added protection of modern insulating enamel are thus combined.

Light Saving Device

THERE is on the market a photo-electric device which gives audible warning when there is enough daylight to enable artificial lighting to be switched off. It has been suggested recently that this device could be developed not only to give audible warning when daylight fades but also to switch the lights on and off automatically.

New Coal Getting Machine

A GOODMAN continuous miner which has been developed from a British machine in the U.S. has been purchased by the National Coal Board. Two large four-armed rotors and an outer cutting chain comprise the cutting mechanism, both rotors and chain being equipped with a number of cutting picks. The machine bores into the coal face at the rate of 10in. to 15in. per minute over an area of 7ft. 6in. × 13ft. 6in. wide. Simultaneously, the cut coal is automatically fed back through the centre of the machine to a discharge conveyor.

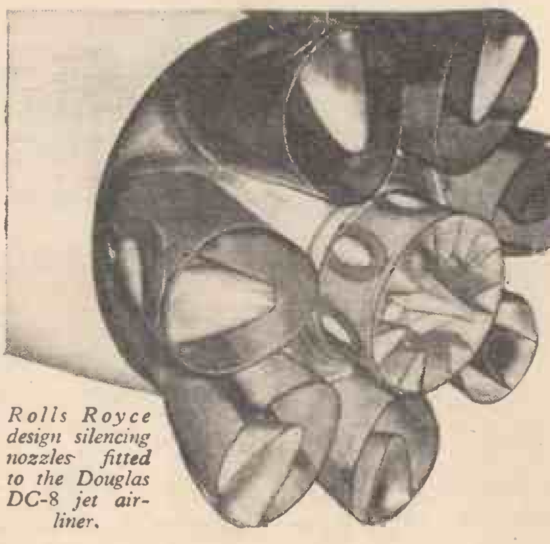
Higher than the Sun's Temperature

METEORS entering the earth's atmosphere at fantastic speeds are hotter than the sun's surface. This was reported in America recently together with other facts about extreme speeds. Typical of all cases, it was stated, is the conversion of the high energy of motion into extreme states, with temperatures of several thousand degrees frequently associated with ionisation of the gas involved

ROLLS-ROYCE NOISE SUPPRESSING NOZZLES FOR JETS

THE DOUGLAS AIRCRAFT COMPANY have fitted noise supressing nozzles of Rolls-Royce design to the Pratt and Whitney engines in the first D.C.8 airliner.

Production noise suppressors designed and made by Rolls-Royce are already fitted to the Avon engines of the De Havilland Comet and those airlines which have specified Conway engines for their Boeing 707-420's will have Rolls-Royce suppressors incorporated in the complete engine pod which is being built by Rolls-Royce. In addition, the Boeing Company's own noise suppression equipment which will be fitted to the other 707's is based on Rolls-Royce research, for the Boeing and Rolls-Royce Companies exchange all information on jet noise and its suppression.



Rolls Royce design silencing nozzles fitted to the Douglas DC-8 jet airliner.

A Serviceable Parrot Cage

By Jameson Erroll

The Method of Construction Described Here Could be Applied to Almost Any Type of Cage

Fig. 1.—The completed parrot cage.

THE construction of a parrot cage differs widely from that of the more ornate but less robust cages for budgerigars and other small birds. Apart from being much larger—which means it must be made of fairly strong but necessarily light materials —it must be constructed that it will withstand the demands of an agile parrot.

Fig. 1 is a photograph of the completed cage. It is 21¼in. wide, 19¼in. deep and

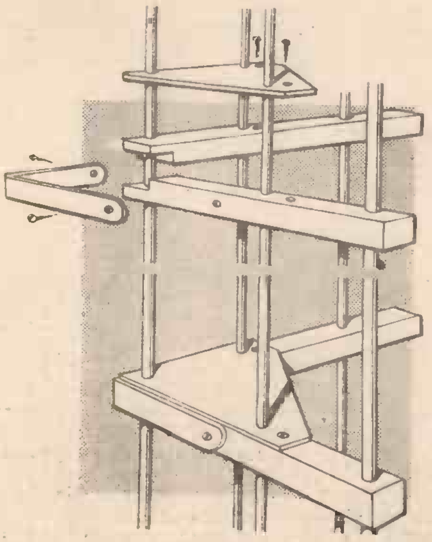


Fig. 2.—(Top) An exploded view of one of the corners of the frames and (below) an assembled view.

31in. high; the bars are of 11G. galvanised iron wire, the punchbars of either ½in. square or ⅝in. channel aluminium, the lower framework and crown-plates of 17G. sheet aluminium, and the tray of 24G. sheet and ¾in. angle aluminium. The bars are spaced at 1in. centres and the base is a piece of ⅜in. zinc-covered plywood. Size is, of course, a matter for individual taste, but the spacing of the bars should not be altered.

A list of materials for a cage of the above size is given in the next column.

The above are critical only as to the material employed, but when buying it is better to err on the liberal side as to lengths and areas and thus allow for trimming damaged edges and odd cutting mistakes which might occur.

The Frames

The four frames of ½in. square aluminium should be made up first. Fig. 2, which illustrates the construction of the corners of these frames, together with the photograph of the finished cage (Fig. 1) show that these frames are later slipped over the bars, being separated by lengths of the tubing used as distance pieces. The ends are halved as shown and strengthened with corner pieces and L-brackets of 24G. metal. Note that the screws fastening these strengtheners are so arranged that they do not foul the holes through which the bars will pass. A considerable amount of time will be saved and accuracy assured if a drilling template be made. This can be about 6½in. long and made from ½in. square iron or mild steel. Mark and drill this template very carefully with seven holes exactly at 1in. centres, using a No. 32 drill.

Before drilling the frames, one should be earmarked as the bottom one under which, in the centre front, the door will be placed. The six holes at this part (on this one frame only) should be drilled 3/32in. since they have to be threaded 6 B.A. to stabilise the bars which end at this point. When all the holes are drilled, the frames may be assembled, the corner strengthening pieces assisting in squaring-up. These, and the L-brackets, are secured with ¼in. 6 B.A. screws threaded into the frames. These completed frames may now be laid aside and work commenced on the lower framework (see Fig. 3) which is composed of ⅝in. channel and 17 G. sheet aluminium. Four lengths of channel are required—two 19¼in. (for the sides) one 20½in. (for the back) and one about 23½in. for the front punchbar, which is set 1½in. above the base, and will carry the front bars (leaving a space for the door), and is cut and turned over at each end as shown and screwed into the sides. This makes a firm job of this "floating" front which is otherwise unsupported except by the actual bars themselves.

LIST OF MATERIALS

- 8 pieces ½in. square aluminium each 21¼in. long.
- 8 „ ½in. „ „ „ 19¼in. „
- 1 „ ½in. „ about 2ft. „
- 1 „ ¾in. angle „ 5ft. long.
- 1 „ ⅝in. channel „ 8ft. „ (may be 2 at 4ft.).
- 4 „ aluminium tubing 2ft. 6in. x 3/16in. outside, ⅛in. inside.
- 1 „ 17G. sheet aluminium 2ft. square.
- 1 „ 24G. „ „ 21in. x 20in.
- 1 „ 24G. „ zinc (or aluminium), 24in. x 22in.
- 1 „ ⅜in. plywood. 22in. × 20in.
- 7 doz. 4ft. lengths of 11G. galvanised iron wire.

Drill all these channel pieces with holes at 1in. centres as for the four frames already made, but before commencing on the front punchbar take particular care to measure the exact distance from the turned-over ends to the first holes as these must align exactly with the frames. Note again that the holes in this front channel punchbar must all be drilled 3/32in. (not with a No. 32 drill) since the bars terminate (or rather start) here to allow the tray to slide in and out. Also, the centre six spaces will not be drilled at all as the door takes the place of the bars which commence at this point on the first frame just above the door. Tap all holes 6 B.A.

From the 17G. sheet aluminium cut six pieces 3in. wide. Two are then cut to a length of 19¼ in. (for the outside of the sides) and one 21⅛in. (for the outside of the back).

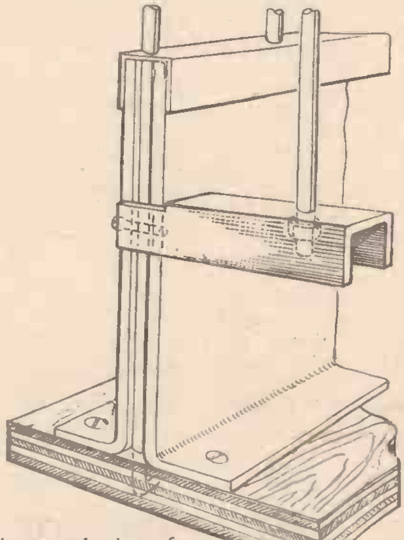


Fig. 3.—A view of the left-hand front bottom corner.

Along the bottom edge of these three pieces, about 3/16in. in, drill four equidistant holes to take No. 6 R/H wood screws. These drilled edges may now be bent up at right-angles to a depth of ½in. Now cut the remaining three pieces of such lengths as will permit them to form the inside walls of the lower framework. It will be found that

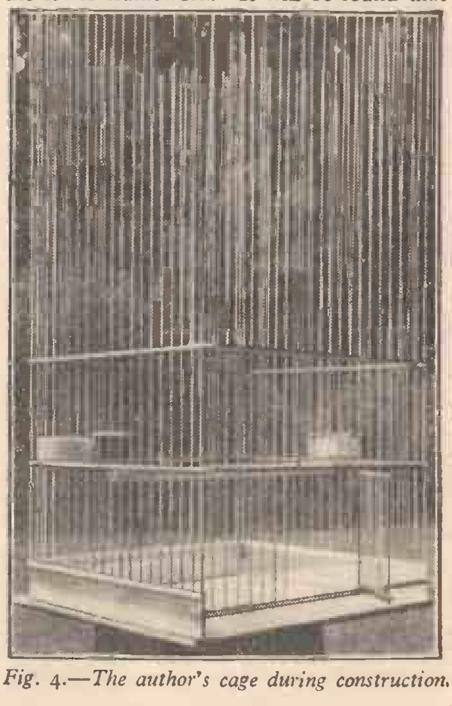


Fig. 4.—The author's cage during construction.

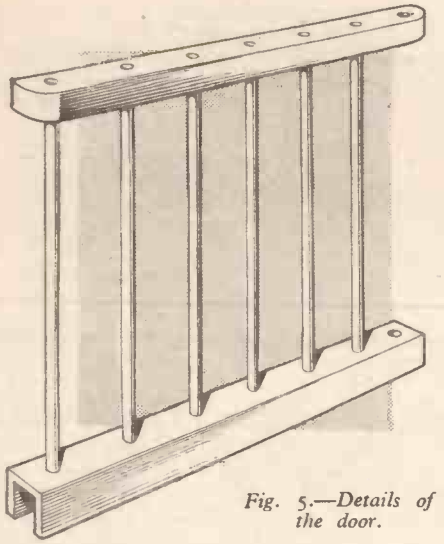
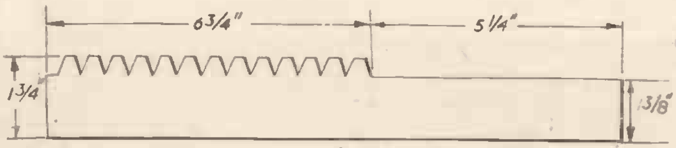


Fig. 5.—Details of the door.

if the outside walls are inserted in the channel and three or four random lengths of 11G. bar threaded through, the insertion of the inside walls will just about fill the channel. The side inside walls will therefore be approximately 19⅛in. long, while the back inside wall will be about 20⅝in. long. These three pieces may now be drilled and bent over as already described, but in this case the holes should be deeply countersunk.



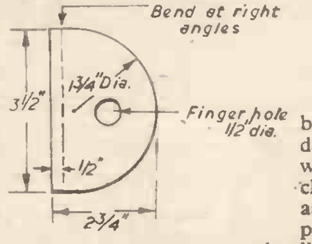


Fig. 6.—Plan for cutting feeder box side and bottom.

Preparing the Base

Cover one side of the plywood with sheet zinc, turning over the edges and allowing a little to turn under the base. It will not be necessary to fasten the zinc to the top of the ply, but a few pins along the edges are desirable.

At this stage it may be as well to explain the manner in which the bars join up with the base. They are turned over for about ½in. and pushed through from the bottom, a shallow groove being cut in the underside of the base to engage this turnover and to leave a perfectly flat under-surface. For neatness, this groove is later covered with a slat of 1in. × ½in. hardwood. It will be understood, therefore, that having positioned the lower framework on the base, holes must be bored to receive the bars. Once the location of the two front holes is determined, the template can be used with advantage. Having drilled these holes—from the zinc-covered surface of the ply—turn the base over and cut the grooves, each about 3/16in. wide and 3/16in. deep.

From the lengths of tubing cut eight pieces 7in. long, four pieces 6in. long and four pieces 5in. long. The ends should be cleaned off and squared, and care taken that each set of four is of exactly equal length.

Assembly

Before further construction can be carried out assembly must be started, and Fig. 4 shows how the cage will appear when this has been done.

Having placed the lower framework on the base, carefully aligning the holes in both, screw down the outer walls. The inner walls are in place, of course, but should not be screwed down until the bars have been inserted; this will allow a certain amount of movement which will greatly assist the threading of the bars. Prepare all the bars (there will be 80 of them) by turning over one end at right-angles for ½in. and slightly rounding the other ends with a file. Now thread the four corner bars and check that from all angles they are perfectly upright, i.e., at right-angles to the base. Threading may now be continued until the eighty bars are in place. The slats which cover the grooves may now be fixed with No. 4 C/S wood screws alternating on both edges.

The Door

This should be made next as it will be necessary to thread it over the appropriate bar on which it will hinge before adding the first frame. Fig. 5 gives details of the door and shows that the top punchbar is of ¼in. square aluminium into which are threaded (6 B.A.) the six short bars. The bottom punchbar is of ⅜in. channel and this is drilled with 7/64in. holes through which are passed the threaded ends of the bars. The cutting of a thread of 6 B.A. on these 11G. bars results in a small shoulder being left at the end of the threading; this shoulder will not pass through a 7/64in. hole and so, in this way, the ends of the bars may be passed through without damage to the threads, but the shoulder will form a stop and nuts inside the channel will tighten up this bottom assembly. The door should now be passed over the appropriate bar and allowed to fall to the level of the front channel punchbar.

Now pass four of the 7in. tubular distance pieces over the four corner bars and thread on the first of the four frames, i.e., the one earmarked and specially drilled to carry the bars which will commence above the door. The threading of this, and subsequent frames, calls for infinite patience and care. The springy tops of the bars are most elusive and the threading of one frequently upsets its adjacent member. When one corner has been started, say, with three bars threaded, fix it with a light cramp; move next to an adjacent corner, not an opposite one. If a bar has been missed or is already not more than a ¼in. higher than the frame, it may be sprung in, i.e., the bar grasped near the top and bent naturally until it springs into the hole—but do not attempt to "spring" more than ¼in. or so.

Once all the bars are threaded, the working-down of the frame will present no difficulties. It may be gently tapped in places with a small hammer, but approximate alignment all round must be maintained. When the frame is settled firmly on the top of the tubes, the inside walls of the lower framework may be screwed to the base and the four remaining 7in. lengths of tube slipped over the corner bars.

The Feeders

Before threading on the next frame, the feeder holders must be made and placed in position. Figs. 6 and 7 show the construction of these boxes, but before proceeding, the porcelain containers should first be bought. These may vary in size and shape according to availability or individual taste and the boxes to hold them must be varied accordingly. Those used in this cage were approximately 3⅜in. long, 2⅛in. wide and 1½in. deep and of the shape shown on the right of Fig. 7. After the 24G. sheet metal has been cut as detailed in Fig. 6, the straight-edged portion (1⅜in. wide) is bent back over a 1⅞in. length of tubing (which slips over the main bar and forms the hinge on which the boxes will swing outwards) and fastened with two small rivets. Do not forget that one holder will be right-handed while the other will be left-handed. The straight edge of the base shown on the right of Fig. 6 is bent at right-angles and riveted to the outside of the unserrated portion of the side of the holder. The notches are now bent at right-angles and the metal bent around the semi-circular base, with the notches underneath, and the ¼in. overlap bent sharply and screwed to the flat back. The notches may be soldered to the base if you fancy zinc or aluminium soldering, but this refinement is not necessary.

Fitting the Feeders

Cut off the three centre bars from each of the sides and file them level with the frame; slip the boxes over the appropriate bars and, if necessary, tap the tubes slightly to avoid the base of the boxes fouling the frame. Over each opposite bar drop another 1⅞in. length of tubing so that the short punchbar to be shortly inserted will lie parallel to the frame. Cut two 4½in. lengths of ¼in. square aluminium and drill with the template, noting that the two outside holes should be made with the No. 32 drill while the three inside holes require to be drilled and tapped 6 B.A. Pass these over the appropriate bars, thread the ends of the six bars which were cut off, and screw them into the tapped holes.

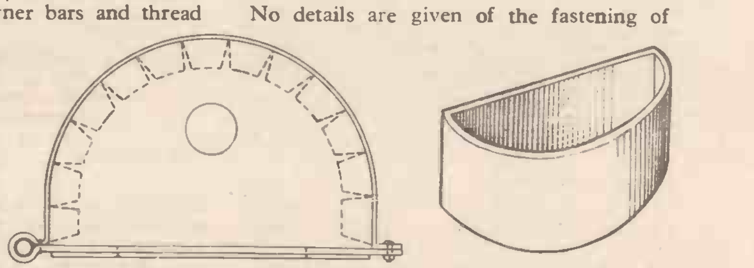


Fig. 7.—Plan of one of the feeder boxes to hold the porcelain cup (shown in perspective.)

Door Fastening

No details are given of the fastening of the door or of the feeder boxes since the constructor will doubtless have his own ideas. The writer used, for the door, a stop to prevent it swinging inwards and two bent catches firmly wedged over 1in. lengths of tubing which, of their own weight, fall into position when the door is

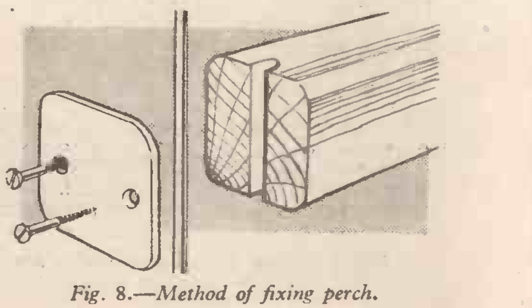


Fig. 8.—Method of fixing perch.

closed and have to be lifted and turned when the door is opened. The idea of two catches, one top and one bottom, is to prevent the parrot from working out its own method of egress.

The second frame may now be threaded on and when it is finally tapped down and rests snugly on the distance tubes, the four 6in. lengths of tubing may be dropped over the corner bars.

The Perches

Before proceeding further it will be necessary to put into position the two lower perches—one from side to side immediately under the feeder boxes, and a diagonal one resting on the second frame which has just been threaded. This perch in particular *must* be fixed at this stage as it will be exremely difficult to accomplish later.

Fig. 8 shows that parrot perches should not be round; they should be square with well-rounded corners, and may be cut either from a dowel flattened on four sides or from a square section rounded at the corners—and they must not be smooth! This is most important. The feeder perch should be made from 1in. material and has a slot cut in each end which, while being wide enough to admit the 11G. bar, is shallow enough to leave a small part of the bar projecting, i.e., the groove can be ⅛in. wide, but only 3/32in. deep. Over each end, outside the cage, an aluminium cap is screwed which, when tightened up, firmly fixes the perch to the bar.

The diagonal perch, of similar or only slightly smaller section, should have grooves cut as already described but they must be wider and deeper since they engage with the corner distance pieces; they can be 3/16in. wide and about 5/16in. deep, the perch being a wedge fit and overhanging about a ½in. at each end. This, and any other perch which rests on one of the frames, will not need outside metal caps.

The third frame may now be threaded over the bars and, when the 5in. tubular distance pieces have been passed over the corner bars, the fourth and last frame may be added. Tap the top frame rather firmly at the corners to ensure that all frames are well seated and run a straightedge along the punchbars in turn as some of them may have bowed slightly in the assembling process.

Wooden Template

Before attempting to bend over the remaining lengths of the bars (about 20in. will be left above the top frame) another template must be made, this time of wood. Obtain a 2ft. length of ex-3in. × 1in. and well round one long edge—the " round " should be a quarter-circle of 1in. diameter. Since the finished thickness of 1in. nominal timber is just under ⅞in., it will be found that this template will just slide between the bars as shown in Fig. 9. Place it on any side to begin with and clamp it to the end bars; run two diagonals of string from the four corners of the cage so that the centre—where they cross—can be kept in view; and the bending may be commenced.

Each bar is, in turn, bent to a right-angle over the rounded edge of the former and directed towards the centre of the cage. There is nothing difficult about this, but cramp each bar (with a light G-cramp) before bending and exert pressure only over the template; if pressure is applied towards the ends of the bars they will not bend over the template as desired but will find their own irregular bending point—and this must be avoided. As each wire is bent, cut off the surplus so that each bar finishes about 1in from the cage centre. Do not worry at this stage if some of the bars tend to spring back a trifle while others have been bent slightly past the horizontal—the crown-plates will adjust this. Near the centre of the sides it will be found that the bars crowd together as they are bent forward and it may be necessary to cut back one or two more than the specified inch in order to avoid overlapping, but the crown-plates are of ample size to allow for this.

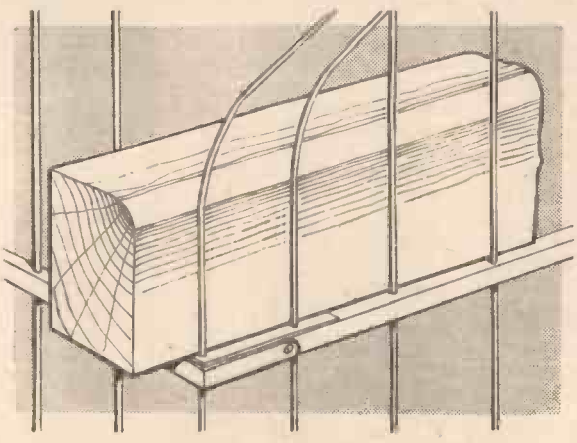


Fig. 9.—Using a wooden former to bend wires to centre of cage.

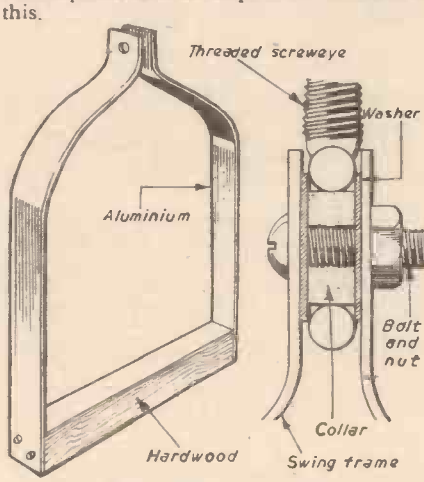


Fig. 10.—Swing details with close up section of screweye and swivel.

Crown-plates

The crown-plates should now be prepared and the swing constructed. The former are used to bind the bars together over the centre of the cage and are cut from 17G. aluminium. There are two of them—one inside the cage and one outside—and each is 6in. × 5in. They have a ¼in. centre hole bored in them and, for the purpose of accurate drilling, are fastened together at this stage with a short ¼in. bolt and nut. All round, at ¼in. from the edges, are bored a number of 7/64in. holes which will admit of the 6 B.A. bolts which will bind them together. Bore one of the corner holes first, give it a distinguishing mark on both plates, and fix a 6 B.A. bolt and nut through them. Do the same at the opposite corner. The remaining holes may now be drilled without fear of the under plates moving out of alignment. The 6in. sides should have, including the corners, seven equidistant 7/64in. holes, and the 5in. sides, excluding the corners, three equi-distant holes. The plates may now be separated and the burrs cleared from the holes and the drill run through them again to clear any surplus matter.

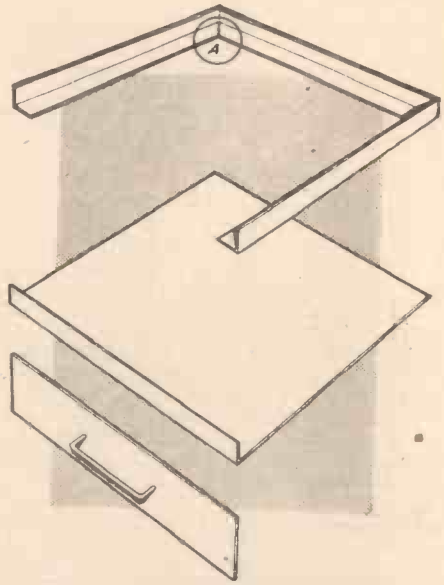


Fig. 11.—Details of tray and supports.

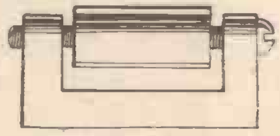


Fig. 12.—One of the rollers underneath the tray.

The Swing

This is an optional refinement. Fig. 10 shows how it is constructed. The sides are of 24G. aluminium ⅞in. wide and the perch of ex-1in. hardwood. The swivel centres on a ¼in. threaded screweye through which passes a sliding-fit collar of a thickness (or length) only slightly in excess of the thickness of the eye. Two ¼in. steel washers give stability and prevent the aluminium sides from coming in contact with the screweye; and the fitment is completed by the addition of a ¼in. Whit. bolt and nut. The swing will move freely in the " eye " without undue lateral movement. Since it will be suspended by means of the threaded portion passing through the centre holes in the crown-plates, it will help at this stage to tie a piece of thin string loosely to the eye, place the swing in the bottom of the cage, and pass the other end of the string through two of the bars at the top of the cage. The whole contraption can then be pulled up when required.

Final Assembly

Pass the lower crown-plate through the bars to the inside of the cage and with a small cramp or two hold it roughly in position. Pull up the swing and pass the screweye through the hole in the plate, remove the string, lay on the top crown-plate and secure loosely with a nut taking care that the two marked corner holes are in alignment. Some of the bars at this stage are bunched together while others are at varying distances apart.

The first step is to take the two marked corner holes and, ensuring that the corner bar is on the left of the holes, pass a 1in. 6 B.A. bolt through both holes and fix a nut to prevent it falling out. This bolt can easily be passed through the underside crown-plate by means of a pair of long-nosed pliers. Now go to the opposite corner and pass through those two holes another

(Concluded on page 581)

A Full Si

The Guitar Needs No Skiffle and Folk Song. Solo Playing or Accom its Own

THE instrument to be described can be strung with either steel or gut strings depending on the choice of the reader. If the instructions are followed and the work is not rushed, no difficulty should be encountered in turning out an instrument that compares favourably with a professional job.

Construction

Ideally the instrument should be made from solid wood, mahogany or white chestnut being the most popular. However, some difficulty may be found in getting solid wood in ⅛in. thickness so ⅛in. mahogany-faced ply-wood was used with very encouraging results.

Make a start by squaring up the drawing shown in Fig. 1. This should be done on a large sheet of paper that will allow the full size shape to be drawn. The back of a length of wallpaper is ideal. Make the squares 2in. × 2in. Absolute accuracy is not essential at this stage as long as the general shape is adhered to. The important thing is to avoid jerky curves. Having enlarged one side, carefully fold the paper down the centre and make a rubbing of the remaining half.

MATERIALS AND PARTS REQUIRED

Body
2 pieces mahogany-faced plywood, 21in. x 16in. x ⅛in.
2 pieces 34in. x 6in. x 1/16in. plywood.
83in. x ⅜in. x ¼in. deal.
2 blocks 3¼in. x 3in. x 1in.

Neck
One block 21in. x 4in. x 3in. mahogany.

Finger board
1 piece, 19in. x 3in. x 3/16in. mahogany.

Bridge
1 piece 7in. x 1in. x 1in. mahogany.

Accessories
1 yard of fret wire.
Machine head (for use with steel strings)
Stretcher (for use with steel strings)
1 set of guitar strings.
All the above accessories can be obtained at any musical instrument shop.

Using carbon paper transfer this shape to the ⅛in. plywood, then with a fret saw cut around the outline and then tidy up any divergencies from the line with sandpaper. It is important to ensure that the edge is at right angles to the face of the wood to ensure a good gluing surface later.

Once satisfied with one panel, use it as a template for the second and proceed as before. At this stage select the panel with the most pleasing grain and mark this for use as the top panel.

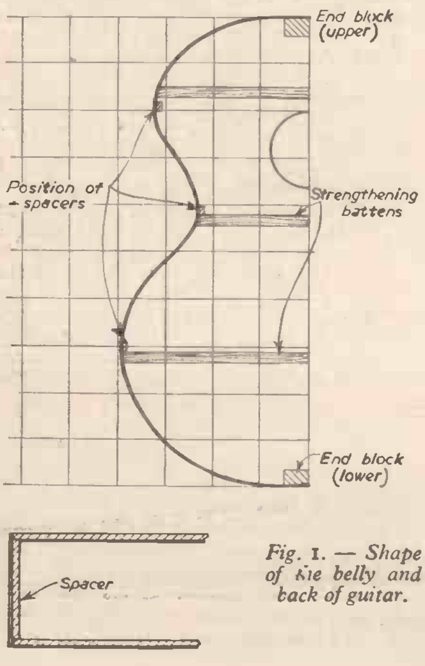


Fig. 1. — Shape of the belly and back of guitar.

The Sound Hole

This is cut in the top panel. The centre should be marked off from the full-size drawing and the hole cut out accurately with a fret saw. The edges of the hole should be rounded to give the completed instrument a more professional appearance.

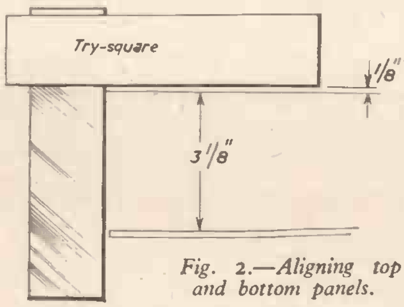


Fig. 2.—Aligning top and bottom panels.

The strengthening battens should be cut to size and glued in position on the top and bottom panels.

Aerolite 306 was used as the adhesive in the original and proved to be excellent. Any glue can be used as long as it is space filling. Avoid quick-drying glues as there is a temptation to rush positioning before it sets.

The spacers can be added to the lower panel. Make sure that these are held vertically during drying and this can be done by "chocking" with some square blocks, such as children's building blocks.

Before positioning the end blocks mark a centre line on each of them. Apply glue liberally and carefully locate the blocks on the centre line of the body. The two panels should now be placed to one side to dry.

Once the glue is dry, the top panel can be glued on to the bottom panel. Do this very carefully, ensuring that the top panel is directly over the bottom. A simple way of doing this is to lay a try-square on the top face and see that the edge of the blade coincides with the bottom panel at a number of points. See Fig. 2.

Sides

Take one of the 1/16in. plywood sides and trim one end so that it is at exact right angles to the length. Sharp scissors will cut this thickness of ply easily. Pin the edge along the centre line of the lower end block, using panel pins. Bend the side around the shape of the body and make sure that there is an overlap above and below the body. Satisfied, remove the side and apply glue liberally to the end blocks and along the edges of the body panels. Locate the panel pins in the original holes and bend the side to the shape of the body. The ply can be held in the centre by binding with string, while the end is secured with panel pins until the glue dries. Allow to dry thoroughly before removing the string and starting on the second side.

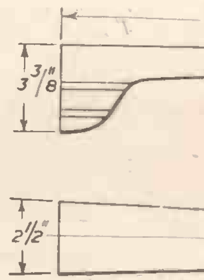


Fig.
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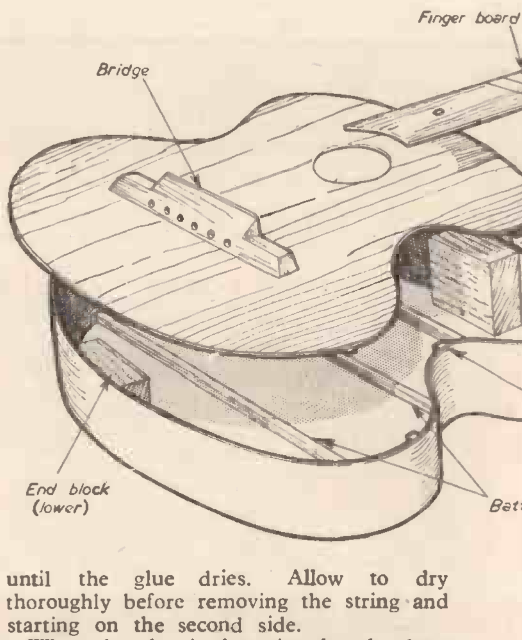
When the glue is dry trim the ply along the centre line of the top block. The second side is glued in place in the same way as the first, making the join at the top block along the centre line. This join will be covered by the neck and need not be absolutely accurate, but the lower one should be done neatly.



When dry, trim the overlap down to the surface of the body faces. The body should

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Introduction in This Age of
As an Instrument for Either
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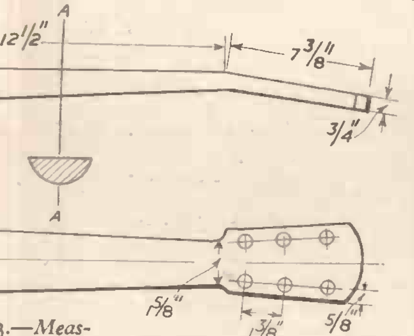
By A. B. Orr

now be sanded and any surplus glue removed.

Neck

This is cut from a block of mahogany measuring 21in. × 4in. × 3in. This is the most difficult part of the whole project as it is slow work cutting through this weight of mahogany. The block should be carefully marked out as shown in Fig. 3 and then, if possible, taken to a box-maker or a cabinet-maker who will run it through a band saw for a few shillings. Not only does this eliminate a lot of tedious work, but the neck will be much more accurate. If this is not possible then the job should be done with a stout coping saw.



3.—Meas-
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We now have the neck "in the square" and it only remains to round it off and drill the holes in the shoulder. A coarse rasp is a great help in the rounding process.

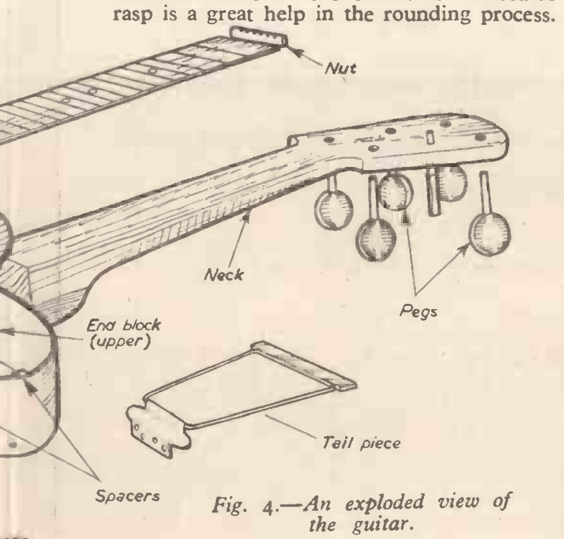


Fig. 4.—An exploded view of the guitar.

This should be followed with sandpaper until the neck is smooth and devoid of humps and hollows.

Before drilling the holes for the pegs, it should be decided whether the finished instrument is to have steel or gut strings. If gut is to be used then wooden pegs will suffice to tune the instrument. If, however, steel strings are to be employed, a machine head will have to be used, as wooden pegs often shear under the strain of steel strings. If it is decided to use steel strings then the head will have to be drilled to suit whatever machine head is used. Fig. 4 is an exploded view of the guitar.

Fig. 5.—The finished guitar.

Join the neck to the body. Glue should be liberally applied to the end block of the body (actually to the ply covering it) and the end of the neck. The screws should then be inserted and carefully screwed into the end block. When the neck is tight against the end block, check that the top face of the neck is absolutely level with the sound board (top panel) on the body. Lay a steel ruler along the length of the body and neck and make sure that there is no dip or rise at the join. If there is then it will be necessary to insert a sliver of wood at the appropriate place between the neck and the block before screwing tight. Fig. 5 shows the finished instrument.

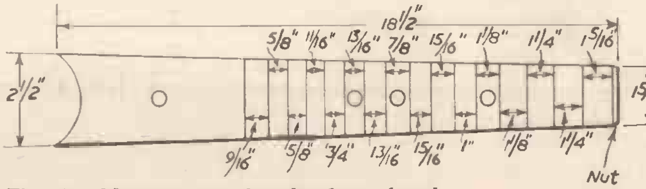


Fig. 6.—Measurements for the finger board.

The Finger Board

This is made from ⅛in. mahogany measuring 19in. × 3in. When the neck and body join is dry, lay the piece of mahogany along the top of the neck and mark the shape of the neck on it. Considerable care should be taken at this stage as a fault will make the finished instrument difficult, if not impossible, to tune. The finger board should now be marked off as shown in Fig. 6, taking great care in this part of the work. When all the fret positions have been marked in, the board can be cut to the shape of the neck. Cut it out a little oversize so that it can be trimmed flush with the neck when finally in position.

With a fine tenon saw carefully cut along the pencil marks to a depth of 1/16in. This is to take the fret wire. Before pressing the fret wire into place the board should be secured to the neck. This is done by means of four screws in the positions shown in Fig. 6. Countersink the heads and cover with plastic discs. The sides of the board should now be sanded flush with the neck and the fret wire added.

The Bridge

Carve this from a piece of mahogany to the shape shown in Fig. 8. If gut strings are to be used then the holes shown should be drilled. The gut strings will be secured by inserting the ends in the holes and pushing home small plugs cut from dowelling.

If steel strings are to be used then an attachment can be bought that screws on to the lower end of the guitar and acts as a spreader for the strings. The bridge is located 24½in. from the nut.

The Pegs

These can be bought or can be home-made to the dimensions shown in Fig. 7. They should be given a slight taper and should be made from really hard wood.

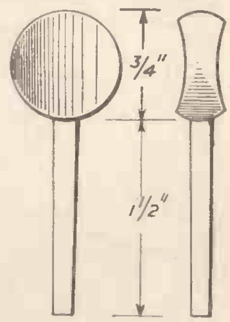


Fig. 7.—Details of the pegs.

Finishing

The nut should be carved from a piece of bone and notched to take the strings. It should be glued in position at the end of the neck.

The original guitar was french polished and this proved both durable and easy to apply. Apply the polish with a soft brush until the wood has soaked up all it can. Only when the polish begins to dry on the surface and form a skin should it be applied with a pad. Between applications rub the surface down with a fine sandpaper. In this way a really hard and lasting surface will be obtained.

The instrument could be painted but unless this is very well done the entire job could be ruined.

Our Spanish Hawaiian Guitar

Readers interested in the construction of musical instruments may also like to know that a fully detailed article describing the construction of a Spanish Hawaiian guitar appears in our first Practical Mechanics How-to-Make-It Book, which costs 12/6d. or can be obtained from this address for 13/9d. including postage. Also in this book are descriptions of a steel stringed ukelele and an electric organ.

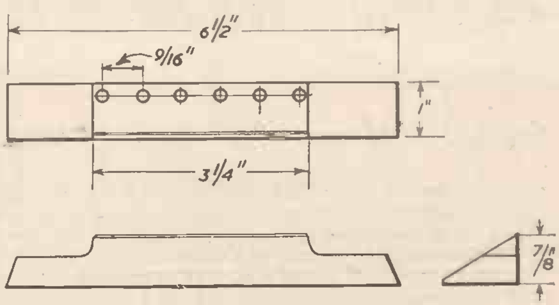
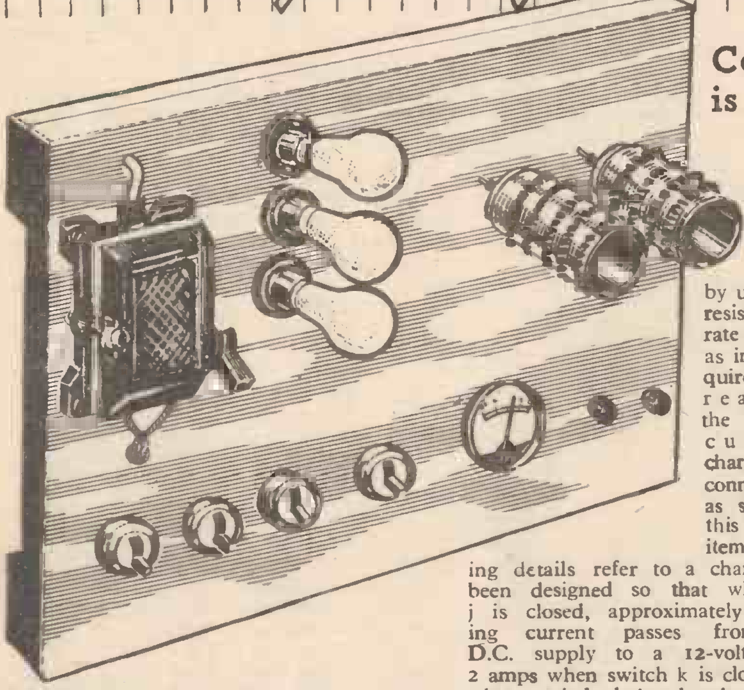


Fig. 8.—Measurements for the bridge.

Battery Chargers for D.C. Supplies

Construction of the Various Types is Discussed

By J. L. Watts



(Left) Typical Battery Charger Panel.

FOR charging an accumulator a direct current (D.C.) supply is required, which should be about 2.7 volts for each lead-acid cell to be charged in series. Thus a supply of about 16.2 volts D.C. is advisable for fully charging a 12-volt (six cell) battery, and about 8.1 volts for charging a 6-volt (three cell) battery. Such D.C. voltages are readily obtainable from an A.C. supply of any voltage through the medium of a static transformer and a rectifier. However, a static transformer cannot be used to step down the voltage of a D.C. supply so that other means must be adopted to reduce the voltage if this is greater than the required value.

Resistor Calculations

The simplest method is by connecting a resistor in series with the battery to reduce the voltage, the resistor being designed to restrict the charging current to the required value. The ohmic value of the series resistor should be equal to the difference between the supply voltage and the battery voltage, divided by the required charging current in amps. As an example if it is required to charge a 12-volt accumulator at 2 amps from a 230-volt D.C. supply the series resistor may have a resistance of $\frac{230-12}{2}$ ohms, or 109 ohms. The resistor must be large enough to carry the 2 amps current without overheating. The same series resistor could be used to charge a 6-volt battery from the 230-volt supply, the charging current then being equal to $\frac{230-6}{109}=2.05$ amps. If the same resistor is used to charge a 2-volt battery the charging current would be equal to $\frac{230-2}{109}=2.1$ amps. It will thus be seen that where the supply voltage is several times greater than that of the battery it makes little difference whether a 12 or a 2-volt battery is being charged. If it is required to be able to vary the charging current a variable series resistor is needed.

A battery charger can be constructed by using a few fixed resistors with separate control switches as in Fig. 1. If required, an ammeter, reading up to the maximum current of the charger, can be connected in circuit as shown, although this is not an essential item. The following details refer to a charger which has been designed so that when the switch j is closed, approximately 1 amp charging current passes from a 230-volt D.C. supply to a 12-volt battery, with 2 amps when switch k is closed and 4 amps when switch l is closed. Thus 3 amps charging current also may be obtained by closing j and k, 5 amps by closing j and l, and 6 amps by closing switches k and l, with 7 amps charging current when all three switches are closed.

The resistors have been designed so that only two sizes of wire are required, i.e., 23 and 26 s.w.g. Eureka wire. The resistor shown at d in Fig. 1 consists of 83 yards of 26 s.w.g.; resistors e, f and g each consisting of 73 yards of 23 s.w.g. The wires may be wound round a rod of about ½in. dia. to form them into spirals. When the rod is removed the spirals are carefully looped around a piece of asbestos board about 15in. deep × 18in. wide, passing through shallow grooves at the top and bottom of the asbestos. The spirals can also be secured at intermediate points by means of asbestos cord threaded through holes. The ends of the spirals can be secured by looping through small holes in the asbestos board. The resistors should be fitted in a well-ventilated metal case which could be constructed of expanded metal.

On the front of the case can be mounted a double-pole combined switch and fuse-box having a rating of at least 10 amps. together with three 5-amp. single-pole tumbler switches, j, k and l. The resistance elements can be connected to porcelain shrouded brass connectors having pinch screws, from which connectors 3/0.036 V.R.I. insulated wires pass to the switches, etc., as shown. In the switch-fuse may be fitted fuse wires rated at no more than 10 amps., the metal casing being connected to a reliable earthing point.

Checking the Connections

It is very important that the "live" side of the supply be connected to the resistors with the neutral side connected directly to the output terminal if one pole of the D.C. supply is earthed. This may be checked by connecting two long leads to a lamp-holder, in which is placed a mains-voltage lamp to act as a test lamp. One of these leads is connected to a reliable earthing point, such as a main cold water pipe, the other lead being placed in contact with each of the two available supply terminals in turn. If the test lamp lights when the lead is in contact with one terminal but not when in contact with the other terminal, this indicates that the terminal which does not cause the lamp to light is the (neutral) earthed terminal, whilst the terminal which lights the test lamp is the "live" terminal. The "live" terminal would then be connected to X in Fig. 1 after first switching off the supply, of course. The neutral terminal would be connected to Y.

It is essential that the polarity of the output terminals be checked and clearly marked before connecting up a battery. This may be done as follows. Connect two *copper* leads to the output terminals B and C and stick these a small distance apart into a raw potato. Then switch on at the switch-fuse and at the switch j. After switching off a few minutes later the wires are removed from the potato and examined. One wire will be found to have a green copper deposit and the terminal connected to this wire should then be marked +, the other output terminal being marked −. The + terminal must be connected to the + terminal of the battery to be charged, the negative terminal of the battery being connected to the − output terminal.

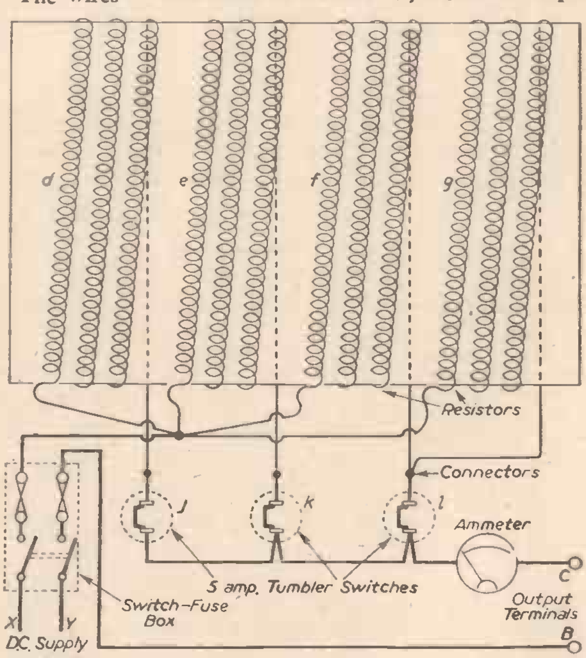


Fig. 1.—Arrangement of a D.C. charger using wire resistors.

The charger can be used to charge either 12-, 6-, 4- or 2-volt batteries at approximately 1, 2, 3, 4, 5, 6 or 7 amps. It can also be used to charge several such batteries connected in series, i.e., with the + terminal of one battery connected to the – terminal of the next, and so on. When extra batteries are thus connected the same charging current will pass through all the cells, although the charging current passed on each switch is slighty reduced.

Use of Charger on Lower Voltage

This charger is suitable for lower supply voltages than 230 volts if required, although on lower voltages the charging current passed on each switch is reduced practically in proportion to the supply voltage. Thus on a 110-volt supply the total charging current which could be passed to a 12-volt battery would be approximately 3.2 amps. However, if the supply-voltage is appreciably lower than 230 volts it is better to reduce the length of wire used for each resistance element aproximately in proportion to the supply voltage. This will enable a smaller charger to be used for the lower voltage, with a total charging current of approximately 7 amps.

Power Loss in a D.C. Charger

One rather serious drawback to the use of a series resistor for charging a battery from D.C. mains is that there is a considerable waste of power in heat in the series resistor. The power loss in watts is equal to the product of the volt drop across the resistor and the charging current in amps. Thus, if a 12-volt battery is charged at 7 amps from

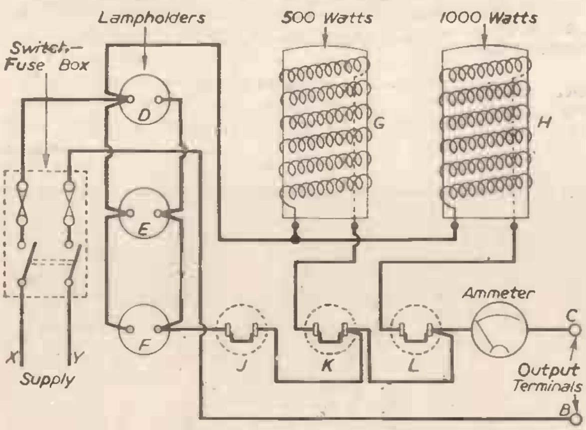


Fig. 2.—Another arrangement of a D.C. charger.

a 230-volt D.C. supply the power loss in the resistor is equal to 218 × 7 watts = 1,526 watts. The heat generated in the series resistors will thus be almost as great as that given by a two-bar electric fire. With 7 amps charging current about 10 hours would be required to fully charge a discharged 70 amp-hour battery, during which period the total power loss in the resistors would be 15,260 watt-hours, or 15.26 k.W.H. During this period the total power taken from the supply would be equal to 230 × 10 × 7 = 16,100 watt-hours, or 16.1 k.W.H., or 16.1 units. Thus, if the electrical power costs one penny per unit the cost of charging the battery would be just over 1s. 4d.

A Charger Using Lamps and Electric Fire Elements

It is possible to use smaller resistors than those detailed above to build a charger having approximately the same output. A 230-volt 75-watt lamp takes a current of approximately one-third of an amp. Thus, three batten-type lampholders may be connected in parallel, as in Fig. 2, to the first 5-amp tumbler switch J, and this switch will pass about 1 amp. charging current from a 230-volt supply when a 75-watt lamp is placed in each lampholder. A 230-volt 500-watt heating element G may be connected to the second tumbler switch K, and will pass about 2 amps. to a 12-volt battery from a 230-volt supply. Similarly, a 230 volt, 1,000-watt electric fire element H, may be connected to the third 5-amp. tumbler switch L to pass about 4 amps. charging current. The same precautions regarding connecting up the "live" pole of the supply and marking the polarity of the output terminals must

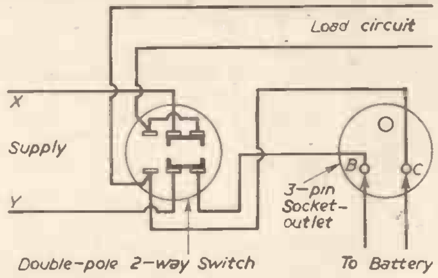


Fig. 3.—A simple and economical charging circuit.

be observed as in the case of the charger indicated in Fig. 1. The lamps and heating elements will become practically as hot as when used for their normal purpose, consequently it is advisable to space these items about 6in. apart and they must be adequately ventilated.

Single-rate Chargers

A much simpler arrangement is possible if it is merely required to charge a battery at one rate of current. For instance, a battery could be charged at approximately 1 amp. from a 230 volt. D.C. supply by simply connecting three 230-volt 75-watt lamps in parallel between the "live" pole of the supply and the battery, with the neutral pole of the supply connected to the other terminal of the battery, with battery connections of correct polarity. Similarly, a 500-watt 230-volt fire element will pass 2 amps., a 750-watt 230-volt element will pass 3 amps., and a 1,000-watt 230-volt element will pass 4 amps. charging current from a 230-volt D.C. supply.

On a 110-volt D.C. supply, three 75-watt 110-volt lamps in parallel will pass about 1.8 amps., and a 500-watt 110-volt fire element will pass about 4.1 amps. charging current. On a 110-volt supply a 500-watt 230-volt fire element will pass about 0.9 amp. charging current, a 750-watt 230-volt element passing about 1.4 amps., and a 1,000-watt 230-volt element will pass about 1.8 amps. The advantage of using elements of higher voltage than that of the D.C. supply is that the elements will operate at much less than their normal working temperature, although the power loss per amp. charging current is unchanged.

Load Circuit Chargers

It is, in fact, possible to charge a battery without any waste of power if the power taken by the series resistors can be usefully employed. This can be done by simply connecting the battery in series with a circuit which is in normal use. In this case, of course, the charging current will depend entirely on the current taken by the circuit, and charging will only occur when the circuit is in use. Fig. 3 shows how a double-pole two-way switch can be connected in place of a single-pole switch fitted on an existing circuit, the two-way switch having an "off" position also. When the two-way switch is moved to the left the circuit is switched on normally and no charging current flows through the battery. When switched to the right current to the load circuit passes through the battery. In the "off" position no current flows through either the load circuit or the battery.

The "live" pole of the supply is X and the neutral is Y; and the polarity of the output terminals of the socket output must be correctly determined as described previously. A three-pin socket-outlet is provided for connecting up the battery so that the plug can only be inserted into the socket-outlet one way, the battery leads connected to the plug being marked so that the positive pole of the battery is always connected to the positive pole of the socket-outlet. When the battery is on charge, the voltage applied to the load circuit is slightly reduced by the amount of the battery voltage, but in most cases this will be of little or no significance.

Motor-generator Chargers

Where it is required to charge a battery, or batteries, at will from a D.C. supply of much higher voltage than that of the battery the most economical way is usually to employ a mains-voltage D.C. shunt motor, or compound motor, to drive a suitable low-voltage dynamo. It is often very convenient to use a motor car or motor cycle dynamo for this purpose. A 12-volt car dynamo can thus be used to charge a 12-volt battery, two 6-volt batteries in series, three 4-volt batteries in series, or six 2-volt batteries in series.

The dynamo should be driven at a speed equal to the maximum speed shown on the dynamo, or at a dynamo speed corresponding to a road speed of about 40 m.p.h. Either a two-brush or a three-brush dynamo may be used. The dynamo may be direct coupled to the motor if the speed of the latter is correct for the dynamo, or may be driven through a vee belt. In the latter case if N_m is the motor speed and it is required to drive the dynamo at a speed of N_d r.p.m. the effective diameter of the vee pulley used on the motor should be equal to $\frac{N_d}{N_M} \times D_d$, where D_d is the effective diameter of the vee pulley fitted on the dynamo.

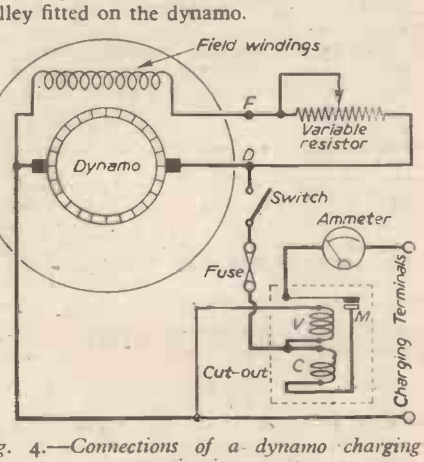


Fig. 4.—Connections of a dynamo charging circuit.

In the case of a two-brush dynamo a variable resistor should be connected between the F and D terminals of the dynamo, as

(*Concluded on page 570*)

Making a Tellurion

A Device for Demonstrating the Rotation of the Earth Round the Sun

By P. P. Hassam

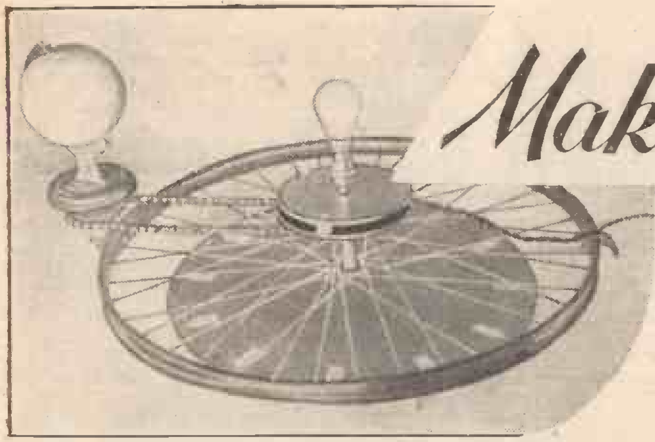


Fig. 1.—The completed Tellurion.

THE device shown in Fig. 1 was originally made to demonstrate to a class of schoolchildren how the earth's rotation brings the four seasons in turn. It was made with no thought towards appearance only the utilitarian aspect being considered.

MATERIALS REQUIRED

- An old bicycle wheel (the free wheel sprocket need not be serviceable).
- An old tea chest and a strip of wood 2in. x 2in. approximately.
- An electric light bulb with socket and flex.
- An old cycle chain.
- A hub from an unserviceable wheel, with fixed or free wheel sprocket.
- A piece of metal tubing into which the hub will just fit.
- A strong spring-clip bolted to rim of wheel to hold the metal tube.
- A small globe, costing 2s. 6d. from one of the large stores.
- Twelve screws 1½in. long and 3 rubber door stops.

Construction

Clean the bicycle wheel with paraffin and remove the free wheel sprocket. Heat it in the fire to remove case-hardening and when cool saw a shallow notch in the top rim. A fixed sprocket could also be used.

From plywood mark out and cut a circle as near as possible to the circumference of the wheel. Drill through the centre of the plywood circle, or use a hot poker, until the spindle of the wheel passes through. Replace the wheel nut and washer. Four small feet must be fitted to prevent the wheel nut from touching the table and to steady the base (Fig. 2).

Mark out and cut two discs of plywood, slightly larger than the diameter of the free wheel sprocket.

Bolt one of these to the top side of the wheel after making a centre hole as for the base. Pierce a hole in it the same distance from the centre of the spindle as the notch made in the free wheel sprocket, so that any ordinary wood screw can pass through and bed its point in the notch (see Fig. 2). The top plywood disc will have a centre hole through which will pass the electric light flex.

Fix the light socket in position and also three screws and door-stops as spacers (see Fig. 2).

Bolt the spring-clip to the rim of the wheel with two B.A. bolts and clip the metal tubing in position.

Saw the spare hub from an unserviceable wheel complete with free wheel sprocket and remove spindle, cones, etc. This being hollow will allow a tapered piece of wood to be driven down into it.

Mark and cut a plywood disc of diameter equal to that of the globe base (approx. 4½in.) and secure this to the tapered length of hardwood with a centre screw, after the correct height (judged by an electric light bulb) has been ascertained. Fit the end of the sawn cycle hub into the metal tube on the cycle rim.

Fit the length of bicycle chain to the teeth of the centre sprocket, adjust the length and join with a spring link.

After testing that the globe's axis is, in all positions, pointing north, all that remains to be done is to dismantle the apparatus for final painting and marking off the solstices, equinoxes, etc., on the plywood base.

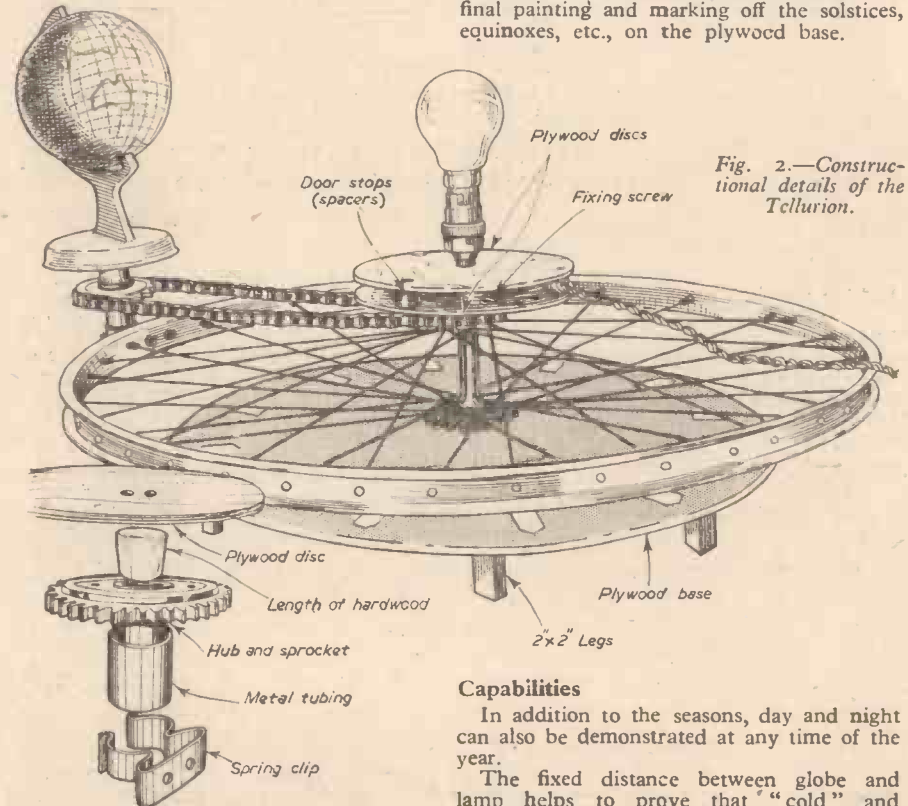


Fig. 2.—Constructional details of the Tellurion.

Capabilities

In addition to the seasons, day and night can also be demonstrated at any time of the year.

The fixed distance between globe and lamp helps to prove that "cold" and "heat" are governed by the rays of the sun being more, or less, oblique as the case may be. We do not, in any real sense, draw nearer to the sun in summer.

Battery Chargers for D.C. Supplies

(*Concluded from page 569*)

indicated in Fig. 4. In the case of a three-brush dynamo the third brush should be removed from its holder, and the variable resistor connected between the third (field) brush holder and the output terminal of the dynamo. It is suggested that the variable resistor be capable of carrying about 2 amps. without overheating and that it have a resistance of about 6 ohms if the charger is to be used only for a 12-volt battery or batteries. If the charger is required also to be capable of charging a single 2-volt battery it is suggested that a variable resistor of about 36 ohms be used. A car cut-out should be connected in circuit to avoid any risk of the battery discharging by motoring the dynamo in the event of the supply to the motor being cut off. In Fig. 4 the voltage coil of the cut-out is shown at V and the current coil at C.

A motor of about 1 h.p. may be required to drive a dynamo giving a 10-amp. charge to a 12-volt battery. However, such a motor only takes about 4.3 amps. from 230-volt D.C. supply mains, compared with 10 amps. taken by a series resistor with the same charging current. Thus the cost of charging a battery from 230-volt mains may be halved by using such a motor-generator combination in place of a resistor, although there would be little saving in using a motor-generator set to charge a 12-volt battery from 110-volt D.C. mains.

A Sensitive Barometer

Make This Instrument for Your Home by Following the Instructions Below

THIS barometer is of the "pediment" type. It consists of a straight tube filled with mercury, the mercury tube being suitably mounted and permanently secured on a wooden board. The height of the mercury column is read off by means of a simple form of indicator against a scale, an accurate reading of the barometric pressure of the atmosphere thereby being attained.

Sensitivity

There can be no more sensitive form of barometer than one consisting of a column of mercury the height of which is governed directly by the prevailing pressure of the atmosphere. Such a type of barometer possesses no pivots, wheels, cranks or levers to become dirty and to stick. Once calibrated, it will go on working almost indefinitely without attention.

The Board

The dimensions for the board are given in Fig. 1 and are to be regarded as being approximate only. They may, within reason, be varied by the indiviual constructor to suit his own purpose and ideas.

The choice of the wood used for the making of the barometer board is, again, a matter for the individual, but well seasoned oak, mahogany or walnut will look best.

The Protecting Box

It will be noted from Figs. 1 and 3 that the lower end of the barometer board terminates in a box-like enclosure in which the lower end of the mercury tube is enclosed. This protecting box is fitted with an upwards sliding front in order that the lower end of the mercury tube can be inspected from time to time. In place of a sliding front, a hinged door can be provided or, indeed, any type of protection may be devised for the vulnerable lower portion of the mercury tube so long as it is serviceable, efficient and not, in appearance, out of harmony with the rest of the instrument.

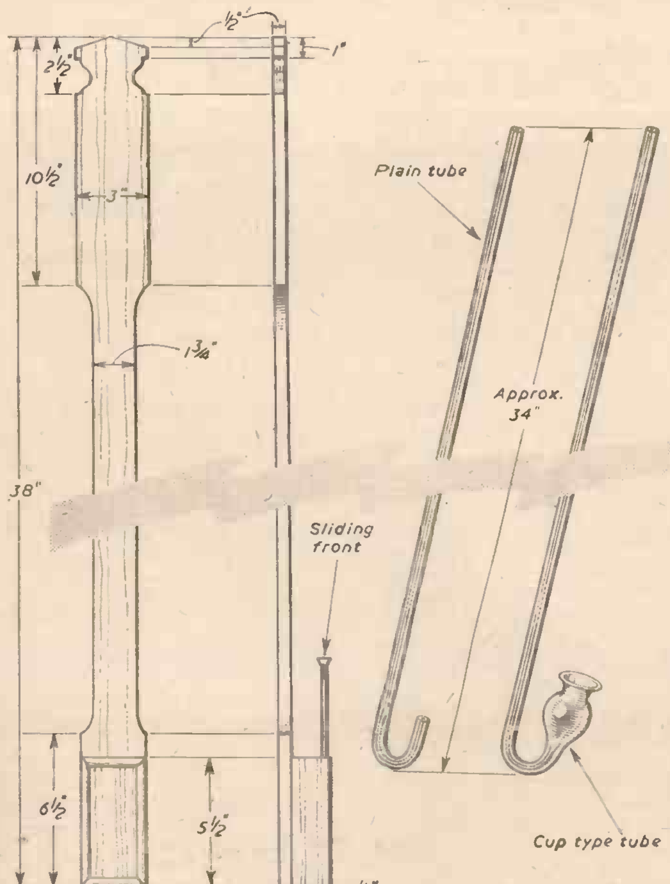
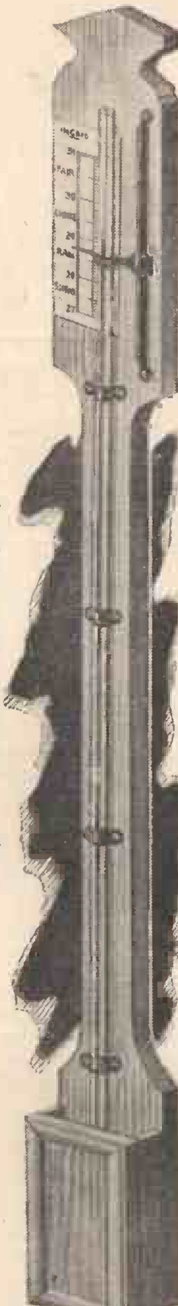


Fig. 1.—Details and dimensions of the barometer board and the two types of tube.



Having constructed the barometer board, the next thing to do is to stain and polish it in accordance with individual taste. An oak board would be best stained, lightly shellacked and then wax polished, whilst a mahogany board would usually be finished by means of some french polishing and staining process.

The Barometer Tube

If the amateur has facilities for glass bending he can make a "plain" barometer tube for himself merely by sealing the end of a length of thick-walled glass tubing and then by bending the other end into a "U" shape, the short limb of the "U" being about 1½in. in length. It is better, however, to purchase a ready-made barometer tube having a mercury "cup" at its lower end. These may be procured from most laboratory furnishers and scientific supply stores. The barometer tube should be approximately 34in. in length. It must not be less than 31in. The tube should have a 3/16in. bore. A wider bore tube will tend to make the barometer slightly more accurate, but, on the other hand, it will necessitate the use of a greater amount of mercury.

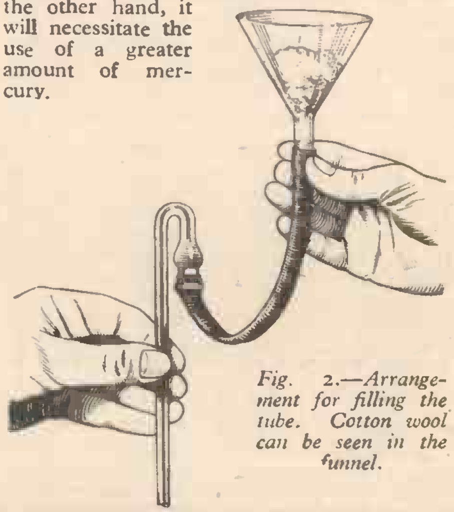


Fig. 2.—Arrangement for filling the tube. Cotton wool can be seen in the funnel.

"Re-distilled" Mercury

A 34in. barometer tube having a 3/16in. bore will hold about 2oz. of mercury, but for ease in filling the tube with mercury, about 4 or 6oz. of this metal should be obtained. The purest mercury available should be used and it will be found advantageous to purchase "re-distilled" mercury, which, at the present time, may be obtained from chemical supply firms at the price of 7s. 6d. or 6s. per 100 gm.

Having obtained the barometer tube and the necessary amount of mercury, we may now proceed to the filling of the tube. For this we require a small enamelled or, better still, a glass funnel and a short length of rubber tubing. A metal funnel must not be employed, since it might contaminate the mercury.

The interior of the barometer tube must be scrupulously clean and dry as also must be the mercury iteslf. It is advisable to place both the tube and the mercury in a warm cupboard for a few days in order to make sure that all traces of dampness are driven off them.

If the mercury is "dirty" and leaves "tails" when drawn along paper it may be cleaned by forcing it through a chamois leather bag pierced with a needle hole. Even so, however, such mercury may be contaminated with other metals, in which case it will be absolutely useless for barometer work. It is always best, therefore, to use for barometer filling freshly purchased "re-distilled" mercury.

The method of filling the mercury tube will be made clear by Fig. 2. The tube is

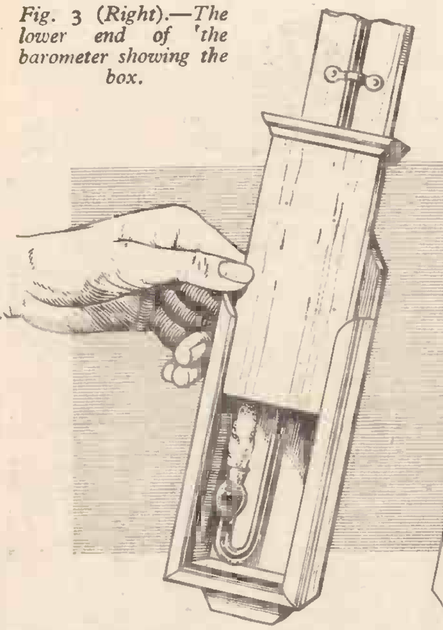


Fig. 3 (Right).—The lower end of the barometer showing the box.

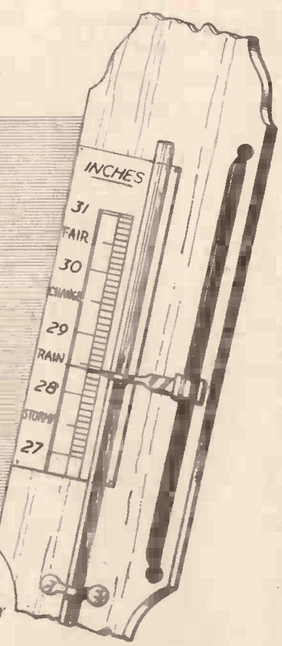


Fig. 4 (Right).—Top end of the barometer showing scale and simple pointer.

inverted so that the short arm or cup of the tube points downwards. A short length of rubber tubing is attached to the open end of the cup and at the opposite end of the rubber tubing a glass or enamelled funnel (not a metal one) is secured. Make sure that the funnel and the tubing are perfectly clean and dry and that there is no loose rubber powder within the rubber tube. To make certain of this latter it is best to pour a quantity of scrap mercury several times through the rubber tube in order to carry away all loose particles. This mercury, of course, must not be used for the actual barometer filling.

Filling the Tube

The barometer tube is filled by holding it in the left hand whilst the funnel is held in the right hand, the funnel and barometer tube being connected by the rubber tubing, as shown in Fig. 2. All the available clean mercury is now poured into the funnel and a tuft of clean cotton wool is then loosely packed into the funnel in order to prevent the escape of any mercury. Holding the funnel always at a higher level than the inverted barometer tube, the latter is given a series of quick vertical movements or jerks. By this procedure, mercury will be shaken round the bend of the tube, and, falling to the bottom of the latter, it will displace the contained air. When the long tube is completely full of mercury, the rubber tube may be removed and the long tube restored to its normal upright position. The mercury within the tube will not run out. It will sink about 3 or 4in. from the top of the tube and then remain stationary. A little more mercury is then poured into the cup at the lower end of the tube and the latter is then closed by means of a cork through which a small hole has been driven or else with a tuft of cotton wool.

It is a good plan to conduct the filling of the barometer tube over a newspaper-lined household bath so that if any mercury is lost during the process it may easily be collected again.

The "Vacuum Hammer" Test

Before securing the filled barometer tube to the wooden board, it is advisable to apply to it the well-known "vacuum hammer" test. This is done by slightly inclining the upper end of the mercury tube so that the column of mercury rises and hits the end of the tube. At each impact of the mercury with the upper end of the tube, a peculiar metallic thud will be heard. This is the so-called "vacuum hammer," and its presence is a sign that an effective degree of vacuum has been secured above the mercury column.

The mercury tube is now fixed to its board. This is effected by means of two or three small metal bridge-pieces.

The barometer must now be left for a few hours in order that the mercury in the tube may attain an even temperature.

In order to calibrate the instrument and to render it suitable for use, draw a scale similar to the one shown in Fig. 4. This scale is best executed in Indian ink on smooth white paper. The scale must be very accurately drawn in inches, each inch being divided accurately into tenths.

The weather indications (Fair, Change, etc.) may then be written on the scale in the approximate positions seen in the Illustration.

The scale should now be pasted down on the left-hand side of the upper end of the barometer board, care being taken to see that the right-hand blank margin of the scale is slipped under the upper end of the barometer tube in order that the mercury level in the latter may be rendered clearly visible. The scale, after its adhesive has dried, is then varnished over, or covered with a strip of celluloid or glass, in order to protect it from atmospheric contamination. If such a scale is carefully drawn and covered with glass, it will be almost indistinguishable from an instrument scale which has been silvered in the orthodox manner.

Finally, the barometer must be "set" or calibrated. Suppose, therefore, that we know the height of the barometer in our district to be, say, 29.6in. Loosening the bridge-piece which holds the barometer tube fast to its board, we move the tube up or down until the top of the mercury column is exactly level with the reading 29.6 on the barometer scale. We then tighten up the bridge-piece which secures the tube.

Reaching Towards Accuracy

ABSOLUTE accuracy in our measurements is obtainable only by happy chance. For the most part we must content ourselves with approximation, and for the practical affairs of life approximation suffices. You have never drawn a real line, however fine a point on your pencil; for a line is length without breadth, and under the microscope your line is a broad, black groove. You have never made a point on your paper, either, for a point has position but no magnitude. Yet your lines and your points serve well enough in practice.

It is the inadequacy of our powers and of our most exquisite drawing instruments that constrains us to be content with approximation. The inadequacy is well brought out in this, at first sight, puzzling conclusion. You describe a circle on the diameter X Y (Fig. 1): the circumference is π times X Y. You describe two circles on the two halves of X Y. Then the total curve of the two equals the circumference of the first, equals,

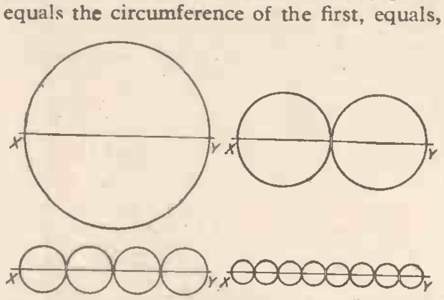


Fig. 1.—Diagrams illustrating the problem of circles and circumferences.

that is, π times X Y. You proceed further to smaller subdivisions, four, eight, and so on. The length of the curve remains constant.

But you come to such a division as makes the curve merge into the straight line. It would almost seem that the length of the curve has shrunk to less than a third of its first length, that π equals 1. But, of course, that is only because the limitation of our powers prevents us from discerning the circles that are yet there; our so-called "line" has the breadth of a diameter of a circle.

Even when you get what you call an exact method of division, absolute accuracy is not there. Here is A B, a 2in. line (Fig. 2).

You trisect it by marking off three equal divisions on a line at an angle and by drawing parallels. And Sir Oliver Lodge declared that your measurement of the length of each third cannot be expressed with infinite accuracy in figures; for figures go by jerks, by stops, whereas a line is continuous. "No measurement of length," he said, "could ever be expressed as a whole number of inches, nor yet as a whole number plus a definite fraction of an inch." You may get accuracy to two places of decimals; you are skilled far above the ordinary if you get accuracy to three places, which, of course, is 10 times the accuracy. You

Fig. 2 (Above).—Trisecting a line.

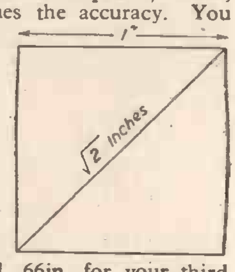


Fig. 2 (Right).—What length is the diagonal ?

may be able to read .66in. for your third part; you are very unlikely to read .666in.

We must reconcile ourselves to the existence of incommensurables in our mathematics. There are measurements that we cannot, whatever our skill and our patience, express in terms of another measurement. Here, for example, is a 1in. square (Fig. 3).

What length is the diagonal? It is $\sqrt{2}$in.; but how many inches is that?

You patiently work it out to 1.414 perhaps, even to 1.414214; you then re-echo Macbeth's exclamation, "What! will the line stretch out to the crack of doom?" It will, indeed.

The Junior Mechanic's Tool Box

A Chest to Keep Your Tools Handy and Safe

By "The Skipper"

WHEN designing the tool box one must bear in mind the approximate size of the largest tool the box will be required to house. This may possibly be the hacksaw if the chest is to hold only metal-working tools. However, the box can be used for various woodworking tools as well until the need is felt for a special chest for them.

Fig. 1.—The completed tool box.

Having measured up a hacksaw it was decided that a drawer about 18in. × 9in. would be required. It was decided too to have a deeper drawer at the bottom, 3in. in depth, and four shallower drawers each 2in. deep at the top (see Fig. 1).

Making the Carcase

First of all the carcase or outside of the tool box must be made. This is made from timber finished to ½in. thickness.

Materials Required

1 top 19in. × 11in. × ½in.
1 bottom 19in. × 11in. × ½in.
2 ends 13in. × 11in. × ½in.
1 back 19in. × 13 in × 3/16in. plywood.

The traditional way of joining up the carcase is to use dovetails. If you are not yet able to make such a wide set of dovetails it is suggested that a simple butt joint,

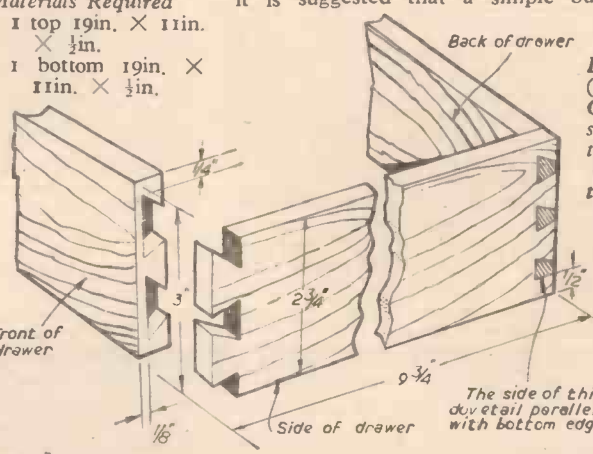


Fig. 3 (Left).—Construction of a dovetailed drawer.

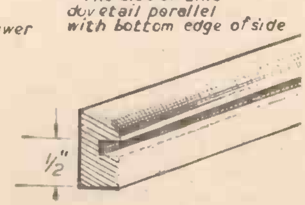


Fig. 4 (Right).—Drawer slip.

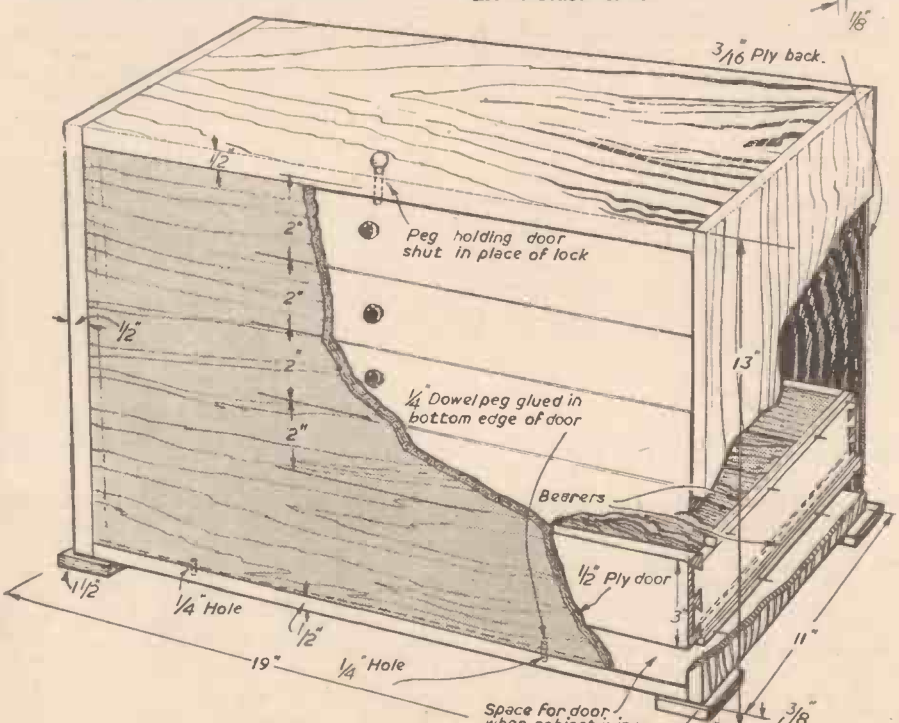


Fig. 2.—Cutaway perspective view showing dimensions.

glued and nailed together, would be an easier alternative. Use 1¼in. oval nails and punch the heads below the surface and fill with plastic wood or other filler. If the butt joint method is used, then the top and bottom will need to be only 18in. long.

When the carcase is fixed together, test it for squareness. If it is measured from corner to corner, the two diagonals should be equal. Screw on the plywood back with some ½in. × No. 4 countersunk head screws. Set aside to dry overnight and then skim up the outside of the box with a finely set smoothing plane. Finally scrape and glasspaper the box to a good finish.

The Door

The door can be made from a piece of ½in. thick plywood. This must be carefully sawn to size and planed up to be a good fit into the front of the cabinet. A slight chamfer (about 1/16in.) can be planed on the front edges.

Into the bottom edge of the door two short pieces of ¼in. dowel rod are glued into place 3in. from each end. Two corresponding ¼in. holes are drilled into the bottom of the carcase to take these pegs when the door is dropped into place. These holes can be drilled through from the outside of the case.

The top edge of the door can be held in place by a drawer lock so that the cabinet can be locked to keep out younger brothers or sisters. A simpler method would be to use a small hasp and staple with a small padlock but this is a little unsightly.

Four small feet 1½in. × 1½in. × ⅝in. or ½in. can be screwed on to the bottom of the cabinet.

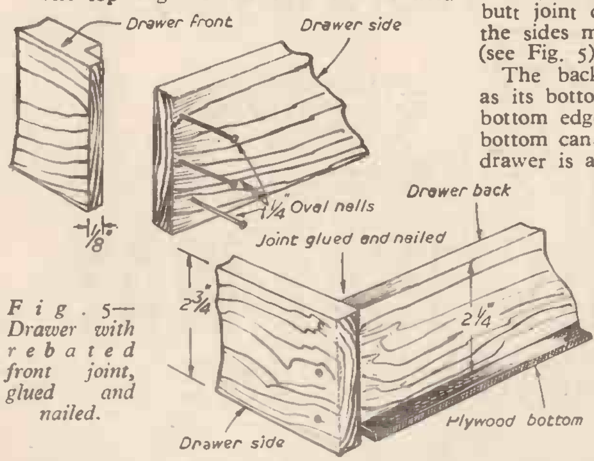


Fig. 5—Drawer with rebated front joint, glued and nailed.

The Drawers

Start with the bottom drawer and prepare the drawer front first of all; it should be 18in. × 3in. × ⅝in.

The length of the sides will depend upon the method of construction. If a lapped dovetail is used at the front and a through dovetail at the back, then an exact overall length of 9¾in. would be required (Fig. 3). The width of the sides is 2¾in. because the top edge is set down a ¼in. to slide under the bearer which supports the drawer above. (See the ends of the drawers revealed in the perspective view, Fig. 2).

Alternatively a rebated joint or simple butt joint can be used and the length of the sides must then be altered accordingly (see Fig. 5).

The back of the drawer is 2¼in. high as its bottom edge is set up ½in. from the bottom edges of the sides, so that the ply bottom can be pushed into place after the drawer is assembled.

Glue up the drawer and test it for squareness. When the glue is dry, the bottom can be fitted and is held in place with three strips of grooved wood called drawer slips which may often be purchased from the local handicraft shop. If you have access to a plough plane then you could make some drawer slip yourself (Fig. 4). First fit a length of the slip to the front of the drawer and then fit the two side pieces. Glue and nail into position.

The plywood bottom can then be sawn to width and slipped into place leaving a ¼in. overhang at the back to butt against the back of the cabinet when the drawer is closed.

Fitting the Drawers

The drawers slide on ¼in. × ¼in. bearers. Fit the first two bearers ¾in. from the bottom of the cabinet. The length of the bearers is 9⅜in.

Now slide the bottom drawer into place in the cabinet. Make any slight adjustments with a finely set plane so that it will move in and out smoothly.

With the drawer in place the next two bearers can be fitted into place along the top edges of the sides. So that there will be a slight clearance between the drawer and the bearers above, place a strip of paper between the bearer and the edge of the drawer whilst fixing the bearers in place.

When the bottom drawer has been fitted, the four shallow drawers above may be made and fitted in a similar way.

One important point to bear in mind when making drawers to fit in any cabinet is that they are not "winding." This effect can best be described by looking at Fig. 6 which shows that the sides of the drawers must have their top and bottom edges at right angles to the front face of the drawer front.

When all the woodworking is finished,

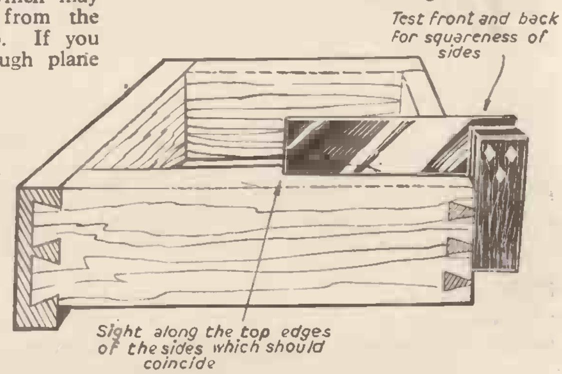


Fig. 6.—Sight along the top edges of the sides which should coincide.

the cabinet can have its final glasspapering and may then be stained and varnished. Finally, so that the tool box may be carried about easily, a suitable carrying handle may be screwed on the top in a central position.

Call Up Your Card

Mystify Your Friends With This Conjuring Trick

THIS is probably the most popular of all card tricks. Three cards having been chosen and returned to the pack, the pack is then placed in a glass. The chosen cards are called for one by one and they mysteriously rise from the centre of the pack.

How is it done? There are several hundred different ways of doing this

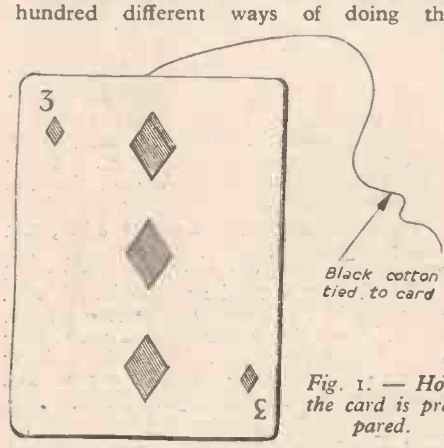


Fig. 1. — How the card is prepared.

particular trick. Some of them need very expensive apparatus, and a good many call for a moderate amount of skill. Here is a simple method.

Prepare one card, any card you like, by tying one end of a piece of fine black cotton to it as shown in Fig. 1. Place this card face downwards on your table and lay a handkerchief loosely over it. Measure off a piece of thread, the exact length you must work out yourself when you prepare the trick. Tie a pin or a needle to the free end of it and stick the needle in the tablecloth near the back edge.

That is all the preparation needed. The rest is all in the way it is done.

Start by handing out a pack of cards to be shuffled and have three cards chosen. Do not have the cards replaced but lay the pack face down on the table immediately on top of the prepared card. To do this you must, of course, pick up the handkerchief, and this action hides the fact that you are putting the pack on an extra card. Now use the handkerchief to polish the glass. This gives an excuse for its presence. Pick up the pack and drop it into the glass. The extra card will be facing the audience and you secretly arrange the cotton across the top of the pack from front to back.

The next thing to do is to take the chosen cards and push them down into the pack. Each card goes behind the one just inserted, and each card carries down with it some of the cotton. You must keep your fingers on top of the cards to prevent those first pushed down from coming up when the others are inserted.

You are now ready for the magical appearance of the cards. Have them named, remembering that the last card you pushed into the pack will be the first to appear.

Hold the glass in your hand and gradually move it forward until the cotton is

Fig. 2.—The rising card trick ready to be performed. The cotton goes down behind the card and up in front of it and is invisible at a moderate distance.

pulled tight. As you continue this gradual and imperceptible forward movement of the glass, the last card inserted will gradually rise out of the pack. When it has risen about half-way take it out and have the next card called, making this rise in the same way. Fig. 2 shows how the cotton is arranged. Use black cotton.

AUTOMATIC COLOUR LIGHTS FOR MODEL RAILWAYS

This Ingenious and Simple Arrangement Will Add Realism to Your Model Railway Layout

THE line is divided into as many sections as required, each the length of three standard rail lengths, at the end of which is a signal post with the three coloured lights, red, yellow and green.

Normally the green light is in operation; as the train goes on to the section, by means of contacts below the rails the green light is replaced by the red; the train proceeds and the yellow caution-light takes its place; finally, the yellow is extinguished, and again the green all-clear shines.

The Baseboard

The materials required are a board about 31in. long, 6in. wide, and ¼in. thick; three

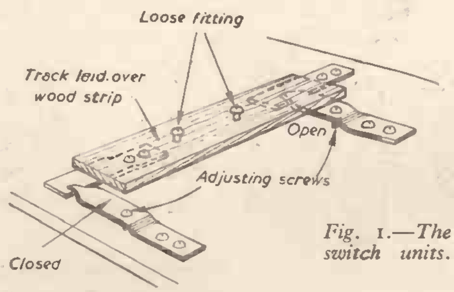


Fig. 1.—The switch units.

pocket-lamp bulbs of the required colours together with screw-down holders; a dry battery or accumulator; four springy brass strips and some thin wire.

Two switch units are constructed as Fig. 1, the brass strips being about 1½in.

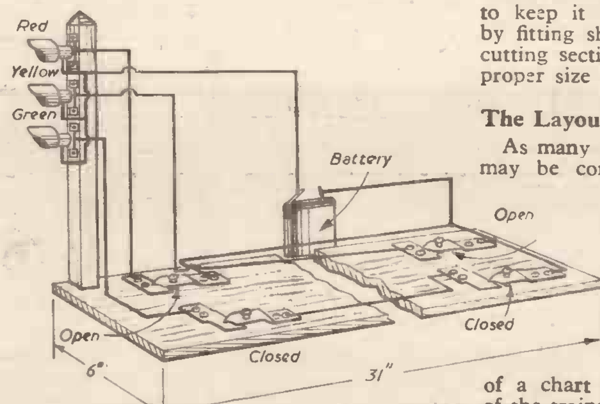


Fig. 2.—The completed unit showing wiring.

long and carefully bent to shape. The two screws in the ends are for the purpose of fastening down, and one of them may be used to secure the connecting wire. On the part of the strip which is bent up a third screw will be seen, and this makes it possible to adjust the contacts within very fine limits. By means of these adjusting screws one side of the unit (marked "closed" in Fig. 2), is so arranged that the strips are in light contact, while on the other side ("open") the two strips should be 1/16in. apart.

Finally, a thin wood strip is laid over the two switches and attached to the baseboard with two loose-fitting screws. It is essential that this is able to move freely up and down, so that the weight of the train presses equally on both switches, opening the closed one and closing the open. After it has passed, of course, the spring in the brass strip brings both back to normal.

The Signal Post

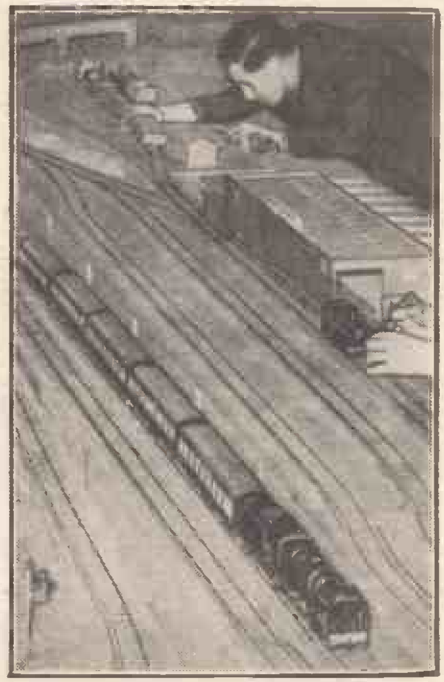
After these units have been fixed to the baseboard, one at each end, the signal post may be erected with the bulb-holders attached. Fig. 2 will make the wiring plan clear, and it should be carried out carefully with the wires neatly stapled down to the baseboard. Insert the bulbs in their correct places, connect up the battery and test the contacts by pressing down on the wood strips. If a light fails to come on, or stays on when not required, a touch on the adjusting screws will put matters right. Now the track may be laid in place and fastened to the baseboard loosely by means of screws through the sleepers. Sometimes it will be found necessary to put a small block under the track between the switches to keep it level. Appearance is improved by fitting shades over the lights, made by cutting sections off a cardboard tube of the proper size to slip over the bulbs.

The Layout

As many sections as are thought necessary may be constructed, and a very realistic effect on an oval layout is obtained with four, especially if more than one train is moving and the room is darkened. In this case one battery may be used to work them all.

A natural extension to this system is the fitting of a chart indicator to show the positions of the trains on the system. It may be very easily carried out as Fig. 3, for an oval track of four sections. Make a shallow box out of thin wood or cardboard and divide into four sections with a bulb mounted in each.

The top should be of glass with a piece of black paper pasted on the underside,



cut away to expose a narrow oval of plain glass ⅛in. wide to illustrate the plan of the track. Now, we want the chart to show the position of the train on the section, that is, when the red light of the section is glowing. All there is to do is to run an extra wire from each terminal of the red bulb on the post to terminals of the bulb in the chart indicator. Connect up each of the four red bulbs to its appropriate companion in the indicator, and then as the train travels round so will the sections of the indicator light in turn, going dark as the train passes over.

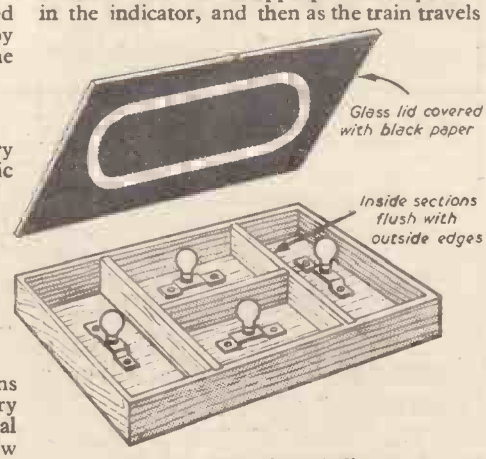


Fig. 3.—The chart indicator.

An Electrical Game of Skill

A SIMPLE and amusing game of skill can be made with a few easily obtained components. It could be called a "steadiometer" and is used to test the steadiness of the competitor's hand.

Construction

A wooden baseboard is required, about 6in. wide, ½in. thick and a little over 3ft. long. A 6in. high post is fixed at either end so that the distance between them is 3ft., and between these two posts a long brass rod is fixed. At each end a short piece of rubber sleeving is passed over the rod.

A wooden tool handle is obtained next, and into the position where tools usually fit a screweye is fixed. The rod is passed through this screweye and the handle taken along to one end and hung on the portion of the rod covered with rubber sleeving.

A light metal clip is used to secure a four-volt dry battery to the baseboard, and beside this is fixed a cheap electric bell. The bell and battery are connected together and the spare terminal on the bell is connected to the shank of the screweye in the handle. Finally, the other battery terminal is connected directly to one end of the brass rod, at the point where it is fixed to one of the wooden posts.

It will be found now that if the handle is moved along the rod and the screweye comes into contact with it, the bell will ring. The idea of the game is to pass the ring from one end of the rod to the other without touching the rod and without ringing the bell. If required, a small flashlamp bulb can be used in place of the bell.

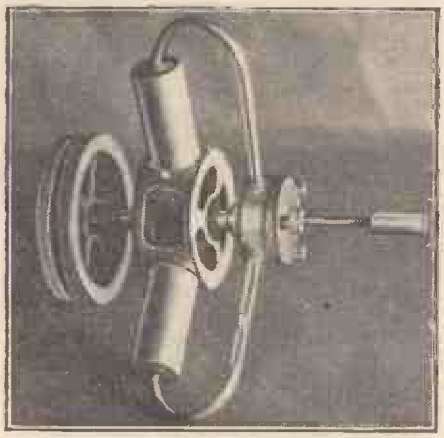
Letters to the Editor

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

Compressed Air Aero Engine

SIR,—Enclosed is a photograph of my compressed air aero engine which I am sure you will recognise.

It was built from the plans and instructions from your "Model Aeroplane Handbook" and took about a month of my spare time. All the turning was done by me on my Super Adept 1⅜in. lathe. The crankcase is a 1½in. dia. brass tube from the scrapbox and the three cylinders, the only purchased ready-made parts, are brass lipstick containers.



Mr. Alook Akong's engine.

It will work by blowing through the inlet with the mouth and is one of my most up-to-date engines. — ALOOK AKONG (Trinidad).

Cash Carrying Safeguard

SIR,—The recent attacks on cashiers and other people carrying large amounts of money seem to present a problem which nobody can do much about, or is it that no one has really tried? I am sure if readers of PRACTICAL MECHANICS put their minds to it an answer could be found and I put forward the following device as a starting point. It is to be used as a deterrent rather than a prevention.

Inside a case is contained a cylinder of liquid dye under pressure; from the cylinder would be a pipe with outlets along its length; this pipe would pass down the centre of the case containing the money, the notes being packed each side. Interposed between the cylinder and the pipe would be a relay operated valve; this valve would be held shut by energy passing through the relay coils from a battery on the case-carrier's person, and connected through a plug and socket; thus if the case was snatched the circuit would be broken, the dye released, resulting in a lot of useless and easy to trace notes. A safety catch would hold the valve shut when the case was not in use.—L. G. ELVIN (Beccles).

Improving the Electronic Flash Outfit

SIR,—May I suggest a few improvements to the Electronic Flash Outfit described in the July, 1958, issue?

In Mr. Hucklebridge's circuit it is possible to remove the flash head whilst the condensers are still charged, in fact while the power pack is still switched on. In the event of a shock, a voltage of 270 backed up by condensers could (and probably would) prove fatal.

It is quite a simple matter to arrange the circuit so that on switching off the condensers are automatically discharged. In the extension lamp part of the unit a resistor of value of 5-10 MΩ ½ watt should be wired across the connections A B of the socket. On the main lamp, resistors 5 and 6 should be increased to 5 MΩ each (or the "preferred" value of 4.7 MΩ) and a resistor of 10 MΩ ½ watt wired across connections C D. These resistors automatically discharge their respective condensers in a period of a few minutes after switching off; they have negligible disturbing effect whilst the circuit is in operation.

To conserve power when running from accumulators and using the main lamp only, it would be an advantage to fit a single-pole single-throw on-off switch in the lead between R3 and the rectifier.

The power of the main lamp is either 50 or 100 joules; the set would be much more useful if the power of both lamps could be varied over a greater range. This is easily accomplished by using condensers manufactured by Plessey having values of 1,500 μF and 500 + 1,000 μF, no great extra cost being incurred. The circuit shown in Fig. 1 uses these condensers and is my own personal preference.

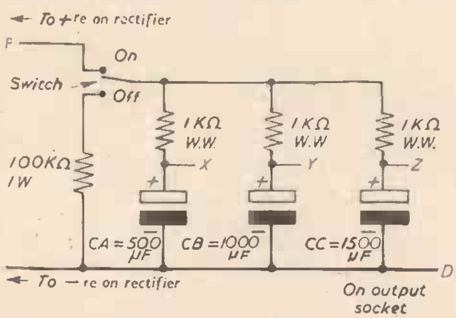


Fig. 1.—Circuit using Plessey condensers.

When the switch is in the "off" position the condensers discharge through the 100 KΩ resistor. The 1 KΩ resistors should be rated at about 2 watts and should preferably be wire wound. The output from the condensers is taken via a three-pole six-way rotary switch, the connections of which are shown in Fig. 2.

The wiring of the extension lamp unit is identical to that of the main unit.

The above system is very flexible indeed, the output being altered at the flick of a switch. This circuit is believed to be subject to patent application by one of the manufacturers of electronic flash outfits.

The use of accumulators, even of the unspillable type, in a position other than vertical is not to be recommended and it would be advisable to arrange the case so that they are vertical.

The efficiency of a vibrator power unit is a very theoretical 60 per cent., whereas that of a dry battery pack is nearly 85 per cent.; the constructor may therefore consider the idea of using a battery power pack, this being made up of three series-connected 90v. batteries, type B126, or similar. If this latter course is followed it would be advisable

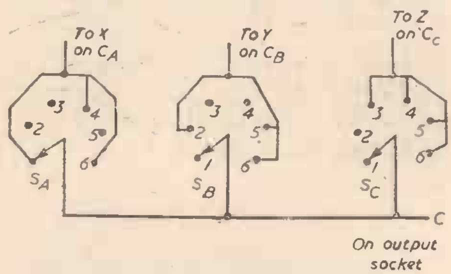


Fig. 2.—Rotary switch connections.

Switch position	Capacity in circuit μF	Output to lamp Joules
1	500	17
2	1,000	33
3	1,500	50
4	2,000	67
5	2,500	83
6	3,000	100

to insert a 1.5 KΩ 2 watt resistor between the batteries and point P on the wiring diagram.—J. R. TILSLEY (Rugby).

Velocity of Light

SIR,—Mr. Thos. H. Webster, in your June issue, states the velocity of light as being assumed, and explains at length why he holds this view.

I should like to point out that several well-known scientists, Michelson, Pease and Pearson, in 1929-30, by using an evacuated tube of length about one mile and a series of nearly three thousand experiments found the velocity of light *in vacuo* to be 186,000 m.p.sec. and so the neglect of the change of velocity in air and vacuo was proved virtually insignificant as far as astronomical observations were concerned.—B. A. KING (Broadway).

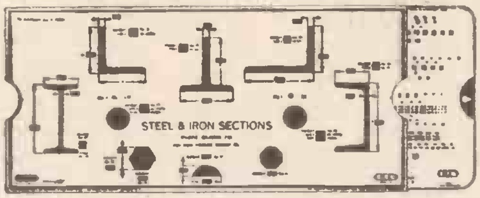
Lawn Spraying

SIR,—*Re* the problem of your correspondent K. J. Style, who wishes to spray his lawn with amm. sulphate solution ("Your Queries Answered," May, 1958).

His requirement would best be met by one of the small suction gadgets sold for emptying washing machines, etc. If it proved difficult to obtain one of these devices it should be possible to make one. The idea is cheap and being used in place of a T/piece would avoid the necessity for a tank on wheels.—M. J. GALSTER (Surrey).

(*Continued on page 581*)

OMARO SLIDE RULES

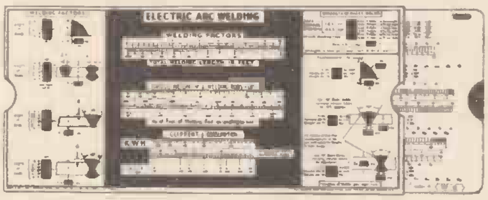


Model P.1

Principal dimensions and weights per foot or square foot of steel and iron sections, sheets etc.

Model L.2

Ratios of Cutting Speeds, Diameters, Number of Revolutions, Feeds, Time for Machining, etc.



Model W.2

Electric Arc Welding

Model M.1

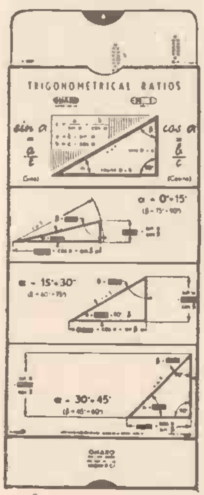
Trigonometrical Functions

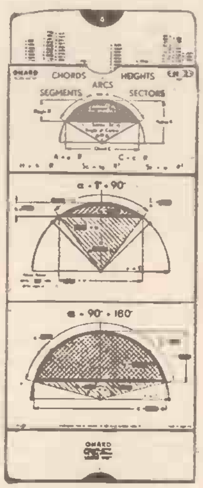
Model M.2

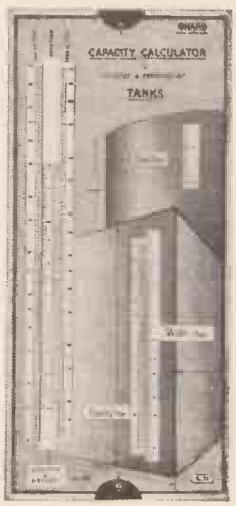
Arcs, Chords, Heights, Segments and Sectors

Model L.11

Capacity Calculator







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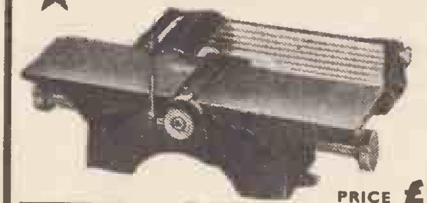

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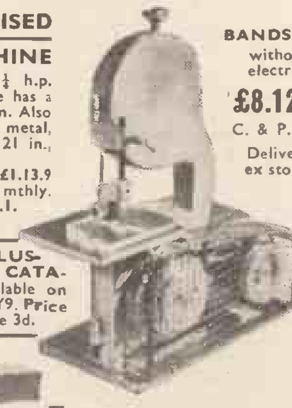

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SEPT/58 IC 137

Letters to the Editor

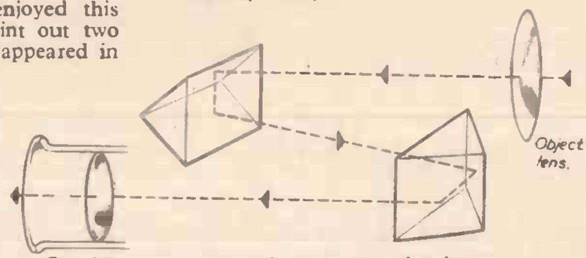
(Concluded from page 578)

A Reader Comments on our Recent Article "About Binoculars"

SIR,—Re "About Binoculars" (page 479, July, 1958), I read and enjoyed this article but I would like to point out two slight mistakes, both of which appeared in the diagrams.

The first mistake was an error in the placing of the prisms in the diagram of the prismatic binoculars, as the prisms serve the dual purpose of shortening the instrument and erecting the image, which is inverted in the astronomical telescope arrangement of the lenses (see sketch).

The other mistake was in Fig. 2 where I think it is true to say that the arrangement of the lenses is not as shown but in the form of a Galilean telescope, that is, using a concave or diverging lens as the eyepiece. The arrangement of lenses shown would make it necessary to use either an erecting prism or an erecting lens, the latter increasing the length of the instrument still further.—B. A. K. (Worcs).



Arrangement of prisms.

A Serviceable Parrot Cage

(Concluded from page 565)

1in. bolt at the same time ensuring that *that* corner bar is on the left of the holes. Repeat this procedure at the other two corners. Now take the four centre holes on each side of the plates and do the same thing again, being careful to see that the centre bars are on the left of the bolts. Similarly, divide up the remainder of the bars between the various holes in the plates, ensuring that each division encloses its proper number of bars. Now tighten up the nuts, each one in turn a little at a time to keep the plates in approximately the same plane and, when the two plates begin to bite on the bars, hold the latter in position and tighten sufficiently to hold them fast. When you are satisfied that all the bars are neatly and equally spaced, tighten up finally, cut off the surplus bolt lengths and file smooth.

The screweye bolt may now be tightened up, the swing being held in the correct position while doing so. Finish off here with a ball-nut for the sake of appearance. It is not advisable to contemplate any form of hanging hook—parrot cages are not intended to be hung.

The Tray

This consists of a framework of $\frac{3}{4}$in. angle aluminium, the tray proper of 24G. aluminium sheet and a strengthening front of 17G. aluminium (shown in Fig. 11).

The frame is mitred at the corners as shown at "A" (Fig. 11) and then bent at right-angles. It should be an easy sliding-fit in the lower framework but should not have too much side play. The tray floor is then cut to size allowing for the front edge to be bent up $\frac{3}{8}$in. This is secured to the framework by a number of $\frac{1}{4}$in. 6 B.A. bolts and nuts, the tray resting on the flats of the angle with the bolt-heads uppermost. The front is similarly secured and is of such a depth (about $1\frac{3}{4}$in.) that the top edge reaches almost to the top of the front channel punchbar and the bottom edge overhangs the plywood base about $\frac{1}{4}$in. The handle is of the same substance as the bars, i.e., 11G., and is threaded 6 B.A. at both ends. 7/64in. holes are drilled in the front and the handle pushed through them up to the shoulder formed by the threading and nuts screwed on the inside.

Rollers

An extra refinement to the tray, which you may not consider worth while, was the addition of six small rollers (see Fig. 12), on which the tray can slide in and out. They have the advantage of raising the framework clear of the base and also furnish support to the tray in general, being set about 3in. to 4in. from the sides.

Perches

One final word on the subject of perches, *they must not be smooth.* Roughen them up as much as you like and dig a number of longitudinal, haphazard grooves in them. Within reason, they cannot be too rough for the bird. The point is stressed because a parrot absolutely refuses to use a smooth perch.

PUZZLE CORNER

The Links

THERE is a chain that is in six pieces, each piece consisting of four links. Somebody, for reasons unknown, wants to join the six pieces and make one long chain of them. The obvious thing to do is to go to a blacksmith and ask him what he would charge to do the job. "Well," says the blacksmith, "my charge for cutting and joining each link is 4d." What is the least the blacksmith will charge for joining up the chain?

Answer

Here, in fact, is what the blacksmith did. He cut each link of one of the pieces of chain, leaving five pieces of chain to join together. The four links served to do this. Thus the sum resolved itself into four links at 4d. which equals 1s. 4d.

Door to Door

THERE is a row of houses in a street numbered consecutively from 1 to 60. How many fours are needed to number the row? Do it in your head and see if you can get the right answer first time.

Answer

Most people give the answer as fifteen and some even give it as six. The correct answer is sixteen. Do not forget that No. 44 requires two fours.

The Painted Cube

A CUBE with edges 5in. long is given a coat of paint. It is then cut up into 125 small 1in. cubes. How many of the small cubes have one face painted?

Answer

Fifty-four cubes would have one painted face.

BOOKS Received

Fasteners Handbook, by Julius Soled. 430 pages. £5 net. Published by Chapman & Hall.

SPECIFIC information about many types of currently available fasteners forms the contents of this book, and data, illustrations and full page descriptions are included on standard and proprietary fasteners from all manufacturers. The most up-to-date types are dealt with and the whole range of sizes and type of materials available described. Sections are included on rivets, inserts, screws, bolts, studs, nuts, washers, retaining rings, pins, nails, metal stitching, quick release fasteners, masonry anchoring devices, and hose clamps. A Manufacturers' Directory and an Index are also included.

"Automobile Brakes and Brake Testing," by Maurice Platt. 97 pages. 15s. net. Published by Sir Isaac Pitman & Sons Ltd.

MORE and more emphasis is being placed in these times on reliable brakes for motor vehicles, particularly with regard to the various road safety campaigns and the new reliability tests for older cars. It follows that the average motorist will wish to extend his knowledge of the braking system and this is the purpose for which this book was written.

A Review of New Tools, Equipment, etc.

Home Scaffold Kit

TO meet the demand from handymen, estate owners, market gardeners and other domestic users for a safe, easy to erect, working platform, Mills Scaffold Co. Ltd., Trussley Works, Hammersmith Grove, London, W.6, has entered the do-it-yourself market with three lightweight scaffold kits. The new equipment, known as Bantam Self-Lock, is based on 1in. dia. tubular steel "H" frames, which, when assembled, form rigid towers suitable for all decorating and repair work inside and outside the house. The frames incorporate a patented sleeve and socket fixing, no bolts or tools being required for erection. The scaffolding can be stepped to fit a staircase.

Three kits are supplied. They are:

The "Popular" (*Retail price* £15 15s.),

Scaffold kit in use.

which can be erected to form a tower 8ft. in height by 4ft. 3in. long by 2ft. wide.

The "Household" (£27 10s.), from which a tower 14ft. in height by 4ft. 3in. square can be erected.

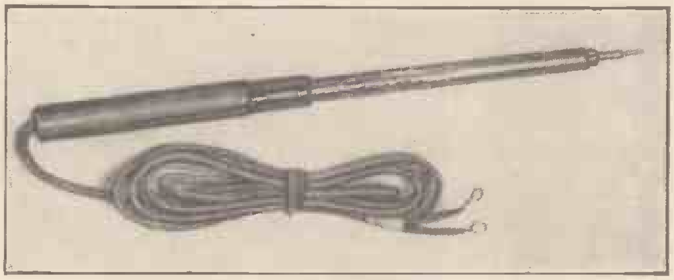
The "Handyman" (£32 10s.), which is the largest and most versatile of the three kits. When erected this makes a tower the same size as the "Household" kit, i.e., 14ft. by 4ft. 3in. square, but contains a number of extra items including 2ft. square frames, thus making it possible to erect short towers with small base areas.

Improved Fire Cement

PURIMACHOS PLASTIC FIRE CEMENT has been available for many years for the repair of fireplaces and stoves and now the makers, Purimachos, Ltd., Bristol, have improved it. It will be known in future as Kos, but prices and containers are unchanged.

NEW SOLDERING IRON

OF particular interest to the radio and electronic constructor, the Browleco pencil iron weighs only $1\frac{1}{2}$ oz. Its smooth barrel is 5/16in. in dia. and 8 in long.



The Browleco pencil soldering iron.

The low voltage element is wound on to an insulated copper alloy bit holder into which various size copper bits can be fitted. Heating up time is approximately two minutes and the standard working voltage is six or twelve, although the iron can be specially wound for up to 50 volts. Loading is 18 watts and the iron is suitable for working from a battery or a double wound transformer. The price, including $\frac{1}{8}$in. bit and two yards of flex is 19s. 6d.

Abrasive Materials for Grinding Telescope Mirrors

THOSE who have read our recent articles on grinding telescope mirrors and have had difficulty in obtaining the necessary abrasive materials will be pleased to know that they are now available from The General Optical Company, 224, Goswell Road, London, E.C.1.

Electrical Catalogue

BRITISH CENTRAL ELECTRICAL CO. LTD. have announced that they have available a limited number of their cloth-bound, 256-page, electrical catalogue. This is thumb-indexed and divided into twelve sections for easy reference.

Copies will be sent *free*, postage paid, on application to: British Central Electrical Co. Ltd., 6-8, Rosebery Avenue, London, E.C.1.

COLLARO PRODUCTS

MESSRS. COLLARO LTD. have sent us details of their new stereophonic gramophone equipment, and the Mark IV tape transcriptor.

For the stereo version of the well-known "Conquest" record changer a variety of pick-up arms is available (all equipped for stereo and monaural playing), both one-piece and plug-in types, including the stereo counter-balanced arm.

Other special features of the stereo "Conquest" include dynamically balanced motor rotors and super-honed finishing of the rotor spindle for power with low noise level. A new, ultra light, automatic stop mechanism and modified pick-up enables stereo records to be played with very low side thrust. This, together with lower stylus pressure, means prolonged life both for stylus and for records. The stereo "Conquest" gives complete automatic playing of all records from 6in. to 12in. dia. without the hazard of size selecting fingers which might damage records. Provision is also made for single record playing with automatic stop.

The well-known 4T200 transciption unit (complete with transcription pick-up arm) is now equipped for stereo, and also the new 4TR200 transcription unit fitted on a smaller, square unitplate, without pick-up, to allow for the independent mounting of any other type of pick-up.

Collaro "Conquest" record changer.

READERS' SALES AND WANTS

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

FOR SALE

AIR COMPRESSORS, single cylinder, double action, 2½ cu. ft. at up to 400lb. pressure, condition as new, but slightly soiled, cost over £10, bargain at 35/- each. N. Cooper, 10, Fowler Street, Nechells, Birmingham, 7.

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

CHEMICALS AND APPARATUS.—Free booklet of 100 Experiments with orders over 15/-. Send 3d. stamp for catalogue and details of special offers. Scientific & Technical Supplies (Nottm.) Ltd., Dept. M. 9, Wellington Circus, Nottingham.

COMPRESSORS FOR SALE.—Twin Piston with tank, 2½ c.f.p.m., £4. Single Cyl., £2. All types Motors. S.A.E. for list. Wheelhouse, 13, Bell Road, Hounslow (HOU 3501.)

1OZ., 2/3oz and ½oz. hand-operated, 2 Bench-Type Thermoplastic Injection Moulding Machines for Hobbies and Industry. Dohm Ltd., 167, Victoria Street, London, S.W.1.

FOR SALE (Continued)

MAINS FROM 12v. CAR BATTERY. American Dynamotor Unit, runs 200/250 AC/DC radios, televisions, tape recorders, etc., from 12v. car battery, continuous duty, perfect, cost £25. 80/-; s.a.e. full details. Scientific Products, Cleveleys, Lancs.

REFRIGERATION SIMPLIFIED. Send postcard for particulars. Robert C. Scutt, 52, Hadley Way, London, N.21.

CIRCULAR GLASS DISCS for grinding Astronomical Mirrors. Smoothed and edged, per pair with abrasive 80, 180, 280, 320, 400, 600, superfine finisher. Swedish Pitch, Wax, fine Rouge. 6in. x 1in., £2/15/-; 8in. x 1in., £3/15/-; 8in. x 1½in., £5/15/-, post paid. H. Gibbs, 75, Portmanmoor Road, Cardiff, S. Wales.

UNOWOT WHISTON'S SELL. S.A.E. catalogue. K. R. Whiston (Dept. M.P.S.), New Mills, Stockport.

HOW TO USE EX-GOV. LENSES and Prisms. Nos. 1 and 2, 2/6 ea.; Vertical Enlarger Plans for 35mm. to 2¼in. sq., 3/6 ea.; Optical Condensers and Achromatic Lens to suit, 33/-. Lists s.a.e. H. W. English, Rayleigh Road, Hutton, Essex.

PHOTO-CARDS (including colour photogravure). Famous liners, yachts. Send 1/9, list, specimens. Elder, c/o 38, Westview Road, Barrow-in-Furness.

"ASTRO TELESCOPE MAKING." Standard Ramsden Push-in Eyepieces, ¼in., ½in., ¾in. focus, 35/-; s.a.e. list. Object Glasses from 10/6; Eyepieces from 15/6; Newtonian Mirrors, Focusing Mounts, Tripods, also complete Terrestrial Telescopes and Microscopes. W. Burnet, Grand Sluice, Boston, Lincs.

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SAWBENCHES, 8in. to 30in., from £9; Motorised, £13; Petrol Portable, £44. Planers, Bandsaws, Lathes, Saw Spindle and Planer Assemblies, Logging and Firewood Machines. Chain Saws, Engines, Motors; deferred terms. Send 1/9 for handbook-catalogue and bargain offers. List free. Beverley Products, Sturton-le-Steeple, 20, Notts.

5IN. Tru-plane, £18/15/-; 9in. Tru-Plane, £37; Mortise Attachments, £12/18/-; h.p. terms. Wragg Bros., Chapel Street, Leabrooks, Derbyshire.

S.G.S. Woodworking Machinery.—Saw Bench Units; "Empire" (for saws to 12in.), £3/6/-; "Royal" (16in.), £5/3/-; "Empress." (20in.), £5/15/-; "Monarch" (30in.), £11/18/6; ½in. Drill Chucks, 14/- extra. Planer Units fitted with high-speed ball bearings; 4½in. £4/15/-. 6in. £6/15/-, 8in. £8/10/-. Wood Turning Combination Lathes: 18½in., 24in. or 30in. centres from £9/19/6. Obtainable from ironmongers, tool shops, etc., or write direct to: S.G.S. Engineers, Dept. 14, Old Costessey, Norwich, Norfolk.

FIBREGLASS

PHOTOGRAPHY

PHOTO-ENLARGER Castings and Bellows for 35mm., 2¼in. x 2¼in., 2¼in. x 3¼in., 35/- per set; s.a.e. for details. V. J. Cottle, 84a, Chaplin Road, Easton, Bristol, 5.

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

ADOX FILMS (Fresh).—R21 620, 120, 2/10; KB17 127, 2/6; KB17 35mm., 20 exp., 5/11. Neofin Blue Developer, 2/1 per bottle. Any two films post free. Jenkins, Church Walk, Trowbridge, Wilts.

GLASGOW. If buying, selling, or exchanging modern Cameras, Enlargers, Equipment, Tape Recorders, etc., for the best deal, call or write to Victor Morris, 406, Argyle St., Glasgow, C.2. (Central 8958.)

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ILLUSTRATED CATALOGUE No. 13. Containing over 450 Items of Government Surplus and Model Radio Control Equipment, 2/2, refunded on purchase of goods; 2/6 overseas sea-mail. Arthur Sallis Radio Control Ltd., Department P.M., 93, North Road, Brighton.

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BUILD YOUR OWN two-berth Cabin Cruiser. Kits supplied, also for Runabouts, Dinghies, Canoes, Water Skis. Illustrated brochure on request. Wyvern Boats (Wessex) Ltd., 10F, North Street, Milborne Port, Sherborne, Dorset.

MISCELLANEOUS

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"FORTUNES in FORMULAS," 900-page American book of formulæ. American technical hobby and other books covering every interest. Stamp for lists. Herga Ltd. (Dept. P2), Hastings

SUPERTONIC SUNLAMPS, listed £7/10/-, 80/-; s.a.e. brochure. Scientific Products, Dept. 1, Cleveleys, Lancs.

BUILD YOUR OWN Refrigerator. Everything to make Built-in or Cabinet Refrigerator. S.A.E. for Sealed Unit List and Schematic Diagram, or 1/- (refundable) for 32-page catalogue, including details of free 4 cu. ft. Cabinet Diagram offer. Hire purchase available. Wheelhouse, 13, Bell Road, Hounslow. (Phone: HOU 3501.)

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(Continued on next page)

(Continued from previous page)

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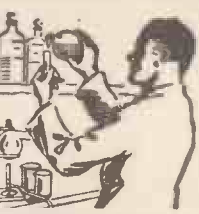

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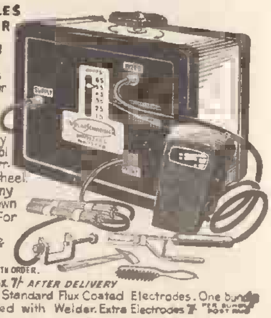

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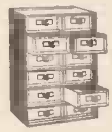

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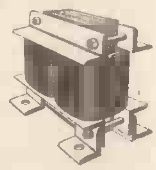

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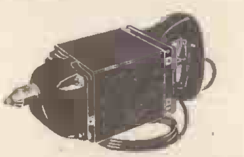

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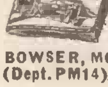

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Red Marble Powder

THE professional monumentalists when cutting and blacking in the lettering on gravestones rub the surface of the stone over with some red paste.

This is left on while cutting and acts as a protection to the surface of the stone when filling in the cut lettering with black paint. After the paint is dry the red paste protective is washed off with water leaving the stone surface perfectly clean.

Can you please tell me what this protective paste is?—I. J. Harris (Derby).

THE red paste to which you refer is known as Red Mull or, more generally, Red Marble Powder. It is not used for the purpose for which you were proposing to use it. In point of fact it would be of hindrance to you.

It is used by monumentalists to obtain sharp lineal definition when cutting semi-translucent stone such as marble. It is supplied by: Harborow Supplies Ltd., 145, Albert Road, Middlesbrough.

For your job we advise you to rub the surface of the stone clean with pumice and water, the letters will then show up in relief and the painting must be done by hand.

Rewinding Motor

COULD you please supply me with the information on how to rewind a single-phase motor from 110v. 60 cycle to 230v. 50 cycle?—G. Brint (Liverpool).

EACH coil of the stator winding should be rewound with 175 per cent. of the present number of turns, using wire having a cross sectional area approximately 57 per cent. of that of the present wire; i.e., approximately 76 per cent. of the present diameter. The coil span and connections of the existing windings should be carefully copied; the speed of the motor will then be reduced to about 83 per cent. of the original value.

Pointing Brickwork

I WISH to re-point the brickwork of my house. Please tell me what cement mix to use and how to go about the job.—J. Rondeau (Walthamstow).

YOU must first rake out the old perished mortar with a metal spike; an old file handle would do. Thoroughly wet the cavities before filling. Use a mortar consisting of three parts sand to one part cement. After mixing dry pass through a fine sieve before wetting. To do this add a little water at a time and stir thoroughly while adding until it is of a smooth consistency.

Fill in the joints, after wetting thoroughly. Do the short vertical ones first, finishing each smooth and flush. Now fill in the horizontal joints, about 3ft. at a time. Trim the edges by using an old knife and holding a straight thin lath firmly to the wall and drawing knife along it. Trim the horizontal joints so that the upper edge of the mortar is flush with the brick while the lower edge sticks out a little so as to throw off the water.

As a painting cement use one of the Cementone products, obtainable from any hardware merchant.

QUERY SERVICE RULES

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

"Fixing" Chalk

CAN you provide me with a formula for making up a solution suitable for "fixing" chalk, this being the medium I am using in the decoration of stage flats?

I should also be interested to know whether the solution could be made up to include fire-proofing properties. It should be of a consistency to permit it to be sprayed.—F. W. Bennett (Hayes).

ALMOST any ordinary adhesive such as thin size, or gum arabic, or even flour paste, can be sprayed on for fixing chalk, the latter being either painted on or drawn in its dry state. But the fire-proofing material should be applied first before the chalk, either by spraying or applying with a brush or by soaking the material in the solution, which will probably be strong alum.

After the fire-proofing is dry, do the chalk drawing and fix this with a thin solution of the chosen adhesive. Size or very thin glue, slightly warm, will be the cheapest. This or any other of the solutions can very well be sprayed without disturbing the chalk.

Graining

WHAT is the method of applying graining crayons as a fluid, i.e., what must I dissolve them in so that I can apply the dissolved crayons with a small brush? I have tried a mixture of turpentine and meths (50/50). This gave a poor, patchy solvent, with grains suspended in the solution.

I have gained a measure of success by sap marking as follows: (1) Flat undercoating of desired tone. (2) Scrumble brushed on thinly and evenly and graining crayon applied as one would use chalk on a blackboard. (3) Graining brush used overall to give effect of "shadow" graining. (4) Varnish.

I should like to effect a "beech" or "maple" design if it is within the amateur's scope.—S. Addy (Sheffield).

YOU will not be able to get a satisfactory graining fluid from crayons, as they are not ground sufficiently fine to make a stable solution.

Your procedure for sap graining is quite suitable, and should result in an excellent finish. With beech, you will need a fine comb, and it takes a deal of practice to get the breaks in the grain to look natural, but it can be done. So far as maple is concerned, it calls for a lot of hand work. A time-saver is the "O" from a rubber printing outfit in which a slight nick has been cut, which makes the bird's-eye marks quite well.

Dimming Lamps

I WISH to construct a colour-change and mixing arrangement for four or more banks of lights. The banks will consist of 16 40-watt lamps each, i.e., 640 watts in each bank, and I wish to provide slow automatic dimming and raising to give the changes I require.

The drive presents no problems, but I should like advice on the construction, arrangement and operation of the resistances involved; also I should like the formula for calculating the gauge and length of wire.—B. L. Norman (Leics).

THE current taken by 640 watts of lamps on a 240 volts supply is equal to

$$\frac{640 \text{ watts}}{240 \text{ volts}} = 2.67 \text{ amps.}$$

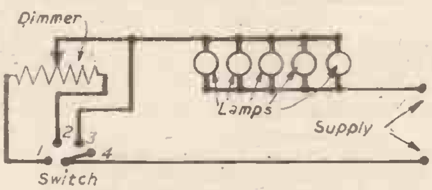
The resistance of such a bank of lamps, when hot, is equal to

$$\frac{240 \text{ volts}}{2.67 \text{ amps}} = 86.5 \text{ ohms}$$

In order completely to dim an average bank of lamps we suggest that the voltage applied to the lamps be reduced to about 30 per cent. of normal value. In order to do this we advise using a dimming resistance having an ohmic value about three times that of the lamps. In this case, therefore, a series resistor having a maximum value of about 260 ohms is required. At this point we refer to tables of resistance wire as supplied by a wire manufacturer such as Messrs. Henry Wiggin & Co. Ltd., of Grosvenor House, Park Lane, London, W.1.

From such a table we see that 25 s.w.g. Brightray (80/20 per cent. nickel-chrome) resistance wire may reach a temperature of 300 deg. C. when carrying 2.48 amp. when the wire is straight, horizontal and free to radiate heat. When coiled as a resistor the wire may reach a temperature of about 100 deg. C. higher with about the same value of current. The table shows that this wire has a resistance of 1.69 ohms per foot at 400 deg. C. or 1.68 ohms per foot at 300 deg. C.; so that about 155ft. of this wire would be required. The wire could be wound in a spiral of small diameter fitted on a ventilated, heat-resisting support and looped to contact studs over which a moving contact slides. If required it would, of course, be possible to reduce the length and size of resistance wire to some extent by using a graded resistor, i.e., by using thinner wire for the end of the resistor at which the lamps have minimum brilliance and the resistor passes minimum current.

It should be possible to mount the dimmers side by side, with their moving contacts linked together by means of an insulated bridge. By using different bridges it may be possible to adopt various combinations of lights. A switch could be connected in series with each bank of lamps, with another switch across each dimmer.



Suggested circuit.

If graded resistors are not used another scheme would be to use a dimmer and a single-pole three-way switch with off position for each bank of lamps, the moving contacts of the dimmers being coupled together. In position 1 of the switch the bank of lamps would dim when the dimmer was moved in one direction; in position 2 of the switch the bank of lamps would brighten when the dimmer was moved in the former direction; in position 3 of the switch the lamps would be fully lit whatever the position of the dimmer. In position 4 of the switch the bank of lamps would be off irrespective of the position of the dimmer.

Finish for Sheet Iron

I WISH to make up a cement wash to be used on a sheet iron fence in place of paint. Could you please advise me on the proper quantities and contents of the mixture, and also the dyes for colouring same?—J. Rae (Scotland).

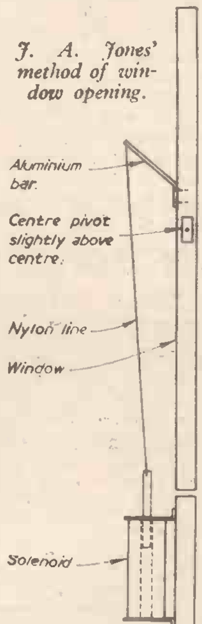
WE regret that it is not possible to use a cement wash on sheet iron, as there is no absorption on the part of the metal and, once it is dry, the cement flakes off. You will no doubt have seen a workman cleaning a bucket which has held cement mortar—one or two blows on the outside are sufficient to clear it of dried mortar. There is a certain amount of adherence with old and part-rusty iron, but not enough to make a cement wash worth trying.

If you are looking for a less expensive finish than paint, we recommend one of the bituminous paints, which are obtainable in colours from builders' merchants.

Thermostatically Controlled Greenhouse Window

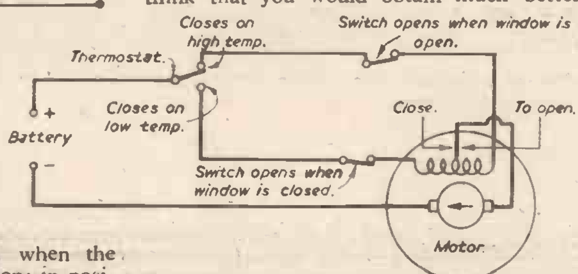
CAN you please give me approximate details to make a solenoid to operate off 4½ to 6-volt dry batteries with sufficient pull to open a centre-balanced window approximately 12in. square? A light wood frame and plastic sheet form the window aperture. This is for my unattended greenhouse on the allotment.

I have a device at present to release the window, which, being counterbalanced, opens. It is operated by a thermostat at 75 deg. F., but I wish to open it by a solenoid and install a release catch, operated by a back contact on the thermostat so that it will close by being slightly bottom-half heavy. The sketch above shows the idea of opening by the solenoid.—J. A. Jones (N.W.2).



J. A. Jones' method of window opening.

LONG - TRAVEL solenoids are very inefficient, and we do not consider that you would obtain sufficient power to operate the window by means of a solenoid-operated device fed from dry batteries. We think that you would obtain much better results by using the batteries to operate a small series motor which opens and closes the window by means of a suitable winding gear. A back contact on the thermostat could be used to energise the field windings for one direction of rotation, with a contact on the window to switch off the motor at the end of its rotation. A front contact on the thermostat could be used to energise the field winding for the opposite rotation required to close the window.



Suggested circuit using a motor.

The diagram shows how a centre-tapped field winding could be employed for both directions of motor rotation. Alternatively a reversing contactor could also be energised from the thermostat to reverse the connections to the field windings of a series motor.

Colour Frequencies

COULD you please tell me the frequency of the individual colours in the spectrum?—S. Window (Manchester, 10).

THE simple answer is:

Violet	3,900	→	4,550
Blue	4,550	→	4,920
Green	4,920	→	5,770
Yellow	5,770	→	5,970
Orange	5,970	→	6,220
Red	6,220	→	7,700.

All these values are in angströms; an angström is 10^{-8} cms. If we take the velocity of electromagnetic waves at 300×10^8 cm./sec. then the application of the formula $f = \frac{\text{velocity}}{\text{wave length}}$ will provide the frequency. For example take violet at, say, 3,900 angström.

$$f = \frac{300 \times 10^8 \times 10^8}{3{,}900} = 77 \times 10^{13} \text{ cycles/sec.}$$

∴ frequency of violet light is 77×10^{13} cycles/second.

Information Sought

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

Glossy Black Finish

COULD you please give me a formula for black gloss lacquer suitable for renovation of binoculars?—J. D. MacLean (Inverness).

Light Meter Scale

I WANT to use my AVO exposure meter to compare the strength of artificial lighting by different means in my house. A 60-watt pearl lamp, for instance, gives a reading at about the half-way mark on the meter, at a distance of 18in. Can you please suggest a method of making a scale which would give approximate readings in lumen or candle-power units?—K. N. Howard (Hants).

Piano Rattle

I HAVE an upright piano which is in good condition and, although the keys are neither abnormally loose nor tight, when I play the piano there is a distressing *rattle* as the keys move. Can you suggest what can be done to eliminate this rattle?—H. Bannister (Staffs).

Phosphorus Coating

I WISH to treat some ⅜in. dia. plaited sash cord with phosphorus so that it will glow in the darkness. Please explain the method of doing this, and also give the approximate cost of treating, say, 1,000 yards.—L. G. Thompson (Birmingham, 6).

Binocular Telescope

CAN you tell me how to adapt the idea of binocular vision on a microscope to a telescope? Some types of microscopes have one object glass and two eyepieces. How can I make one such double eyepiece to couple on to an ordinary terrestrial 'scope giving me binocular vision?—C. McEwen (Gibraltar).

Fish Stunning Device

I WISH to remove fish from one pond to another. I believe there is some sort of portable electric stunning device utilising two metal rods which are immersed in the water and a current made to flow between them. Can you give me any details of electrical circuit, brief method of construction and what distance apart can the rods be placed?—L. Ridgway (Redcar).

THE Cyclist

Editor : F. J. CAMM

VOL. XXVI SEPTEMBER, 1958 No. 434

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

Phone: Temple Bar 4363
Telegrams: Newnes, Rand, London

WHAT I THINK By F. J. C.

The Auto-cycle and Mopeds

THE Auto-Cycle Union functions in relation to motor cycles as the R.A.C. and the A.A. do for motorists. There is no official body at present representing the owners of mopeds, scooters and similar small vehicles which cannot be described as motor cycles, as generally understood. This movement, however, has assumed national proportions on an ever-increasing basis in spite of those who endeavoured to stifle the movement at its birth by pouring scorn upon these vehicles and labelling them as "buzz-bikes," "pedal-assisted motors," and similar terms of contumely. The C.T.C. found in them a means of reviving and intensifying their hate against anything to do with petrol, and suggested that they were neither fish, flesh nor fowl. They refused to take in as members owners of such vehicles, and endeavoured to give an impression of forensic erudition by stating that it was against the law of the land for the C.T.C to take an interest in drivers of such vehicles. You will no doubt remember that I challenged them on this point and asked them to quote the law which would prevent them by a simple amendment to their Articles of Association from doing so. They did not take up the challenge, for the simple reason that it is not against the law of the land.

They must be particularly chagrined, having burnt their boats in this way, to find, at a time when the membership of the C.T.C and the N.C.U. is declining, that the Auto-Cycle Union has issued draft proposals for a new national organisation to operate under the aegis of the Union, to cater for mopeds and scooter clubs. They were invited to prepare this draft by a joint sub-committee of those clubs at a meeting in October, 1957. The A-C.U.'s proposition is that the initial organisation should be "area" in nature. There would be Area Boards, making their own bye-laws in each area, somewhat similar to the A-C.U. centres commencing with half a dozen or so. A National Scooter Council is also suggested with delegates representing each area, and which would exercise executive powers. At the time of going to press, the scheme has not reached fruition, but we are hopeful that the scheme will be adopted. It cannot be denied that large numbers of utility cyclists have deserted bicycles for petrol-propulsion, and that irrevocable fact must be looked squarely in the face by the industry, who have listened far too long to the old brigade, the self-styled "legislators," now I see elevated to the position of "statesmen" by a contemporary—terms which are altogether too extravagant and which do not apply. This latest development is a further example of wrong judgment that has permeated the cycling movement for over half a century, which has been consistently misled by leaders of the cycling movement who seem incapable of logical judgment, and have opposed every move for change. In ordinary business, those responsible for persistent lack of judgment would be removed from office. It must equally be remembered that they are not entirely altruistic and are in the same position as any other paid advocate.

The Cycle Show

THE Cycle Show takes place from November 15th to the 22nd. The last show was in 1956 and the gap of one year has had the expected effect of making cyclists keener to visit it than was the case with an annual show. I forecast that attendances will be greater for the biennial show than for the annual one. As we go to press, the manufacturers, with perhaps greater zest than with an annual show, are preparing their exhibits and new designs. The exhibition will, of course, include bicycles and motor cycles, mopeds, scooters, sidecars and three-wheeled cars.

This year's exhibition assumes greater significance because of the cancellation of the Italian show at Milan and the Frankfurt show in Germany, and there should therefore be a greater number of overseas visitors and buyers. As the next show will not be held until 1960, this is an added reason why this year's show should break attendance records. There will be several entirely new scooters, including one of original design from a leading maker. A new moped is to be shown by one of the largest cycle manufacturers in the world and a new moped engine gear unit from another large manufacturer.

As far as I have been able to ascertain, there will be no radical departures in bicycle design, and it seems a pity that our designers should have neglected this parent vehicle which, in many respects, needs to be re-designed and brought up to date to accord with latest principles, new materials and better systems of construction.

A bicycle, to-day, could be made lighter, more lively, and at the same time more rigid, without using old-fashioned tubes, and a more orthodox system of gearing and dynamo lights should be produced. Here is a chance for our readers to submit practical designs for a modernised bicycle. I should be pleased to publish acceptable designs and pay readers for those which appear.

The possibilities of developing the folding bicycle for purposes of compact transport should not be overlooked, and the pressed steel frame is in my view a necessity. They have been tried before but like the original introduction of the moped they were before their time. The moment is right for an entirely new design of bicycle—if only to revive bicycle sales.

Old tile-hung cottages by the church at Witley, Surrey.

New Cycle Lighting Set

NEWS of great interest to all cyclists is the announcement of a new cycle dynamo lighting set, into the headlamp of which an electric horn has been neatly built. The set consists of the headlamp, the dynamo and tail light unit and the hornbutton, together with the necessary wiring. The headlamp of modern design, with a vizor, is of ample dimensions—3¼in. in diameter × 5¼in. long—to house the horn in the lower rearward part of the body, together with two six volt 0.5 amp bulbs and a battery. The second bulb can provide either a dipped beam or can be used as a spare. The horn button can be clipped on to the handlebar in any suitable position. The price of the complete set, less battery, is 50s.

The headlamp (with horn) and horn button can be supplied without the dynamo and tail light unit for fitting to existing dynamo sets. The price of these two items alone, less battery, is 27s. The makers are H. Miller & Co. Ltd.

Looking after Your Saddlebag

A Few Hints and Tips on Avoiding Excessive Wear and on Executing Repairs

MOST cyclists find it necessary on almost every ride to carry a few things with them—a cape, tools, spare jersey, etc., and the means most often used is a saddlebag. Usually a large one is purchased, fitted by means of the straps provided, and then left in position till it wears out. However, a saddlebag, if used properly, will last much longer than if neglected.

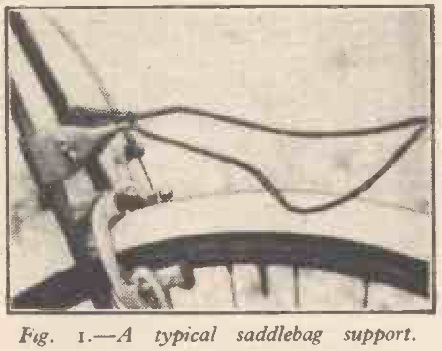


Fig. 1.—A typical saddlebag support.

Firstly a support of some sort should be fitted and there are many on the market, a typical lightweight model being shown in Fig. 1. Most bags, whether of canvas or leather material, are reinforced underneath to counteract wear from the carrier, and if not, a reinforcing patch should be fitted as shown in Fig. 2. Leather can be stitched with strong waxed thread using an awl to make the holes, before stitching with a stout needle.

Carrying Tools

The heaviest item carried regularly is the tool roll and this should not, as is so often done, be carried permanently in one of the side pockets, as this will pull the saddlebag out of shape and cause excessive wear. Nor should tools be carried loose in the main part of the saddlebag as they will soon rub holes in the bottom and also distribute dirt and grease. The best place for the tool roll is in the centre of the saddlebag and one way to keep it there is to fix a D-shaped metal ring to the front of the bag, either by means of a bifurcated rivet or by stitching, and pass the strap round the tool roll and through the D-ring (see Fig. 3).

Fig. 2.—Fitting a reinforcing patch.

Strengthening Bar

Along the top of most bags, where the carrying straps are fitted, there is usually a steel bar or wooden dowel to distribute the weight of the bag and to provide a firm anchorage for the straps, which are passed under the bar. Sometimes, when the bag has been in use for some time, the ends of this bar become forced through the leather strip along the top, and the bar is lost. Replacement is simple, all that is necessary being to ensure that the new bar is the correct length and that the ends are rounded so that the same trouble cannot recur. The leather covering-strip must, of course, be replaced, and the new one can be copied from the original when it is removed, to obtain positions of strap slots, rivet holes, etc. Large-headed rivets are usually used to secure this top piece of leather where it turns over the end of the support rod, and where these have pulled through and frayed the material of the bag, the replacement rivets can have washers fitted under the tags, see Fig. 4. The leather is stitched along its length to the bag.

In canvas or leather material bags, holes can be patched with appropriate material. In the canvas type, ragged edges of the hole should be trimmed and the patch sewn on the inside, the edges of the hole afterwards being sewn down. Leather bags are easier to patch on the outside and it is not usually necessary to sew down the edges of the holes.

Using a strong needle and waxed thread, it is also possible to sew on new straps, etc., to replace broken ones.

Saddlebags, sometimes, in spite of being well treated, still go out of shape, and one of the best ways of preventing this is to give some support by putting a floor in the saddlebag. This can be a piece of thin plywood cut to fit the flat bottom of the bag. All the corners of the board should be rounded and the edges treated in the same way. The board should be drilled in the four corners and also half way down its length and then be fixed to the leather or canvas bottom of the bag with bifurcated rivets.

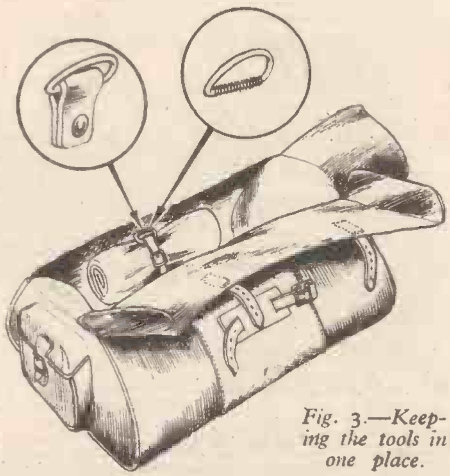


Fig. 3.—Keeping the tools in one place.

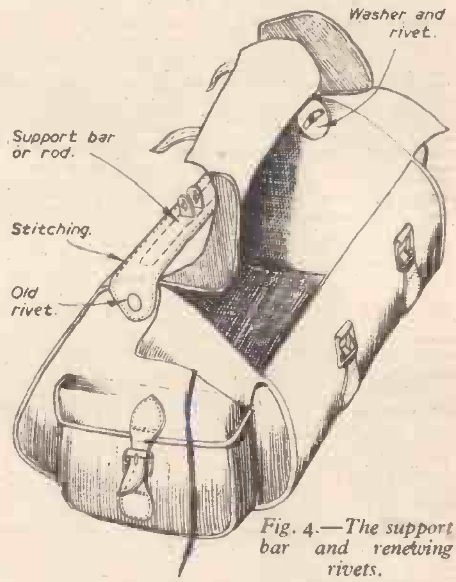


Fig. 4.—The support bar and renewing rivets.

Gear Calculations

MOST people know that cycle gears are expressed in inches and many know, too, how to calculate them, i.e., number of teeth on the chainwheel multiplied by the diameter in inches of the road wheel, divided by the number of teeth on the driving sprocket. The figure which results is used by the majority of cyclists as a form of comparison; a gear of 56in. being low, 68in. an average touring ratio, and 81 or larger a high gear. Few people, however, know what these figures really mean. The gear in inches dates back to the Ordinary bicycle and refers to the diameter of the larger wheel in inches. A rider with a 54in. gear to-day would travel the same distance for one complete revolution of the pedals as would an Ordinary rider with a 54in. dia. front wheel. It can be seen that if a 27in. wheel were fitted instead of 54in. and a gear ratio of 2 to 1 introduced between the chainwheel and driving sprocket the gear would be the same. To find the gear ratio as used by the Ordinary rider the wheel diameter must be multiplied by the number of teeth on the chainwheel divided by the number of teeth on the driving sprocket. By means of simple mathematics, it is possible from this formula to calculate the number of teeth required for rear sprocket or chainwheel to obtain any given gear ratio. The simplest method is to use a set of gear tables in which all the required figures have already been calculated.

Continental System

A different system is used on the Continent, where the gear is the distance the machine will travel for one complete revolution of the pedals, expressed in metres.

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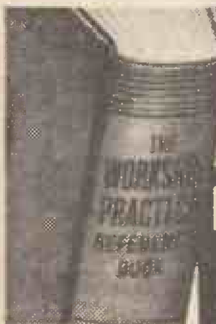

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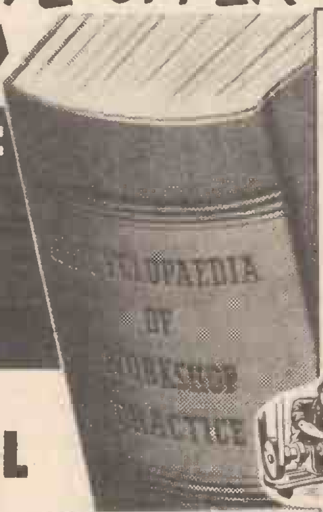

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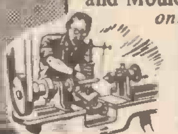

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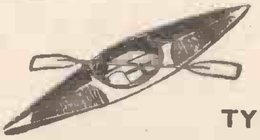

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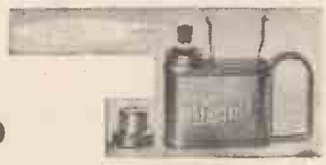

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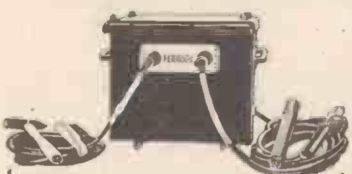

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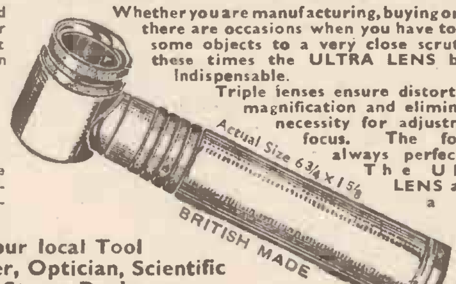

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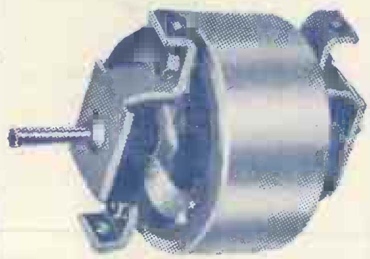

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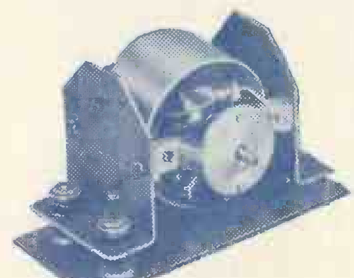

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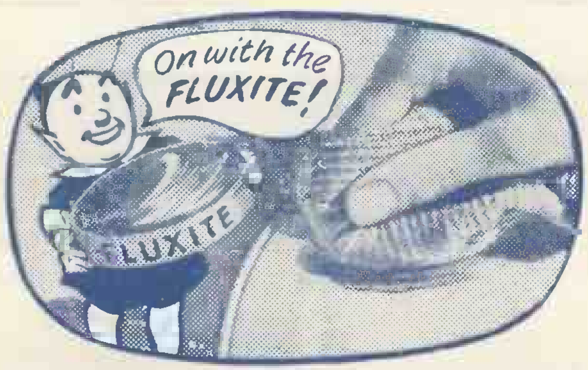

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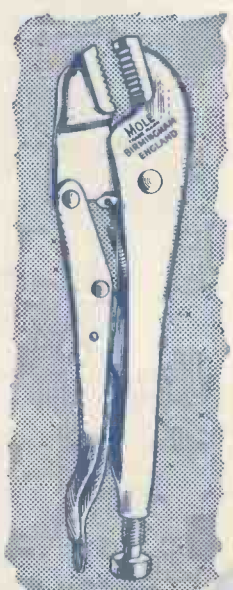

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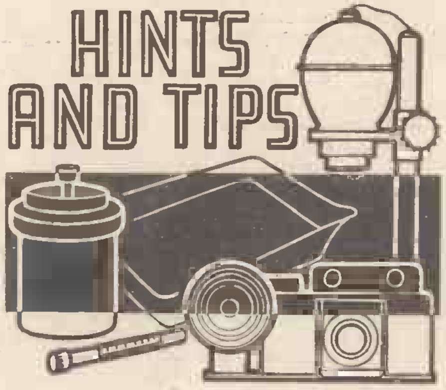
No. 6. SEPTEMBER, 1958

Monthly Supplement to "Practical Mechanics"



A Squeegee Roller

By J. DRUMMOND

A SQUEEGEE roller is used in conjunction with a glazing plate whenever glossy prints are required. The author has found that a reasonably heavy roller helps towards perfect glazing, and to make the one illustrated in Fig. 1 part of an old washing wringer roller was trimmed to a length suitable for half and wholeplate prints. The rubber is turnable in a lathe, but if the wringer roller is in reasonable condition, turning can be dispensed with.

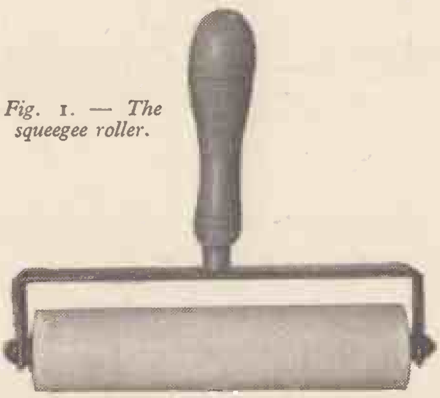


Fig. 1. — The squeegee roller.

The bracket is a piece of black lacquered mild steel of cross-section ½in. × ⅛in The ends have a ¼in. clearance hole drilled through them to take a ¼in. screw which is screwed into a tapped hole in the roller ends.

The handle, one from an old file, was held in place by a screw-nail through a clearance hole in the centre of the bracket.

A Sink Drainage Tube

By J. D.

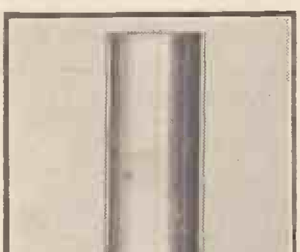


Fig. 2.—Sink drainage tube.

A SINK drainage tube is a necessity if prints have to be well washed. The tube shown in Fig. 2, consists of two concentric brass tubes soldered to a brass base plate. The outer tube is of 1in. dia. and the inner of ½in. dia. The height of the inner tube above the base determines the depth of water in the sink. The outer tube has a number of 3/16in. dia. holes drilled round the circumference at the base end to enable drainage to take place. The number and size of the holes determines the rate of water flow. The holes can be in a vertical position if so desired.

A large rubber disc jammed on the inner tube, which projects about ⅛in. from the base, enables any size of sink drainage hole to be covered.

A Film Wiper

By J. C. LOWDEN

THIS useful item can be made very easily from a strip of Perspex about 15in. long and 1in. wide of any thickness up to ½in. The centre is soaked with boiling water until it becomes pliable, and the strip is bent around a tube of about 1in. dia. until the ends are parallel (see Fig. 3). Then the inside surfaces are faced with thin viscose sponge fixed with a good universal adhesive. The film wiper should be used wet and must be kept scrupulously clean. Any particle of grit on the sponge would severely scratch the film.

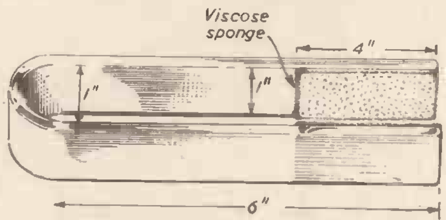


Fig. 3.—Film wiper details.

Tips for the Tourist

A TOURING holiday gives far greater opportunities for the photographer than any other type of holiday and when visiting an old and historic or picturesque village, too often only the features mentioned in the guide book are photographed. These castles and cathedrals, of course, deserve a place in the album, but the photographer is only duplicating what has been done many times before by the professional. Why not try a less usual view, as shown in the picture above of a famous city gate? Often, too, the quieter streets will provide interesting photographs, as can be seen on the left. The obvious does not always make the best picture!

(Above) A famous city gate photographed from the side. (Left) A quiet and picturesque street.

A BASIC 35mm CAMERA

Part 2 Describes the Shutter and Viewfinder

By A. L. Jackson

(Concluded from the August issue)

ATTACHED to the back of this box by two screws is a back plate or pressure plate which keeps the film flat. The film actually travels through a slot and in doing so turns the pin drum to count one exposure. All of this part must be smooth and polished to prevent it scratching the film as it moves along. There is no flat at either side, only the edge of the metal, and the cassette opening lies close up to that. Some length was saved in the camera by this arrangement and it works very well.

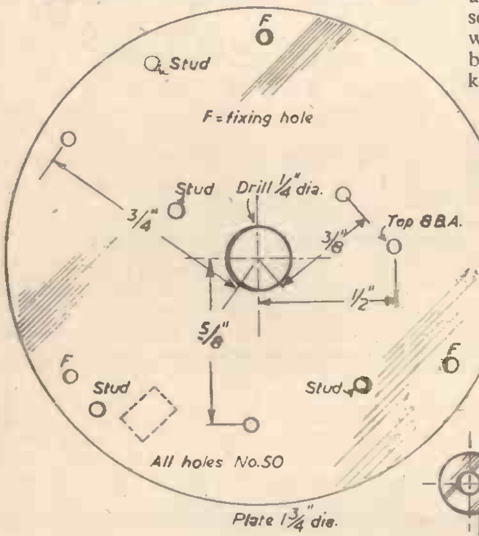
The whole of this box is riveted to the inner top plate squarely in the centre. The top plate with the interior mechanism attached is held into the body by one screw through the camera bottom, and a screwed bush to receive this is soldered in the centre of the box; a nut could be used.

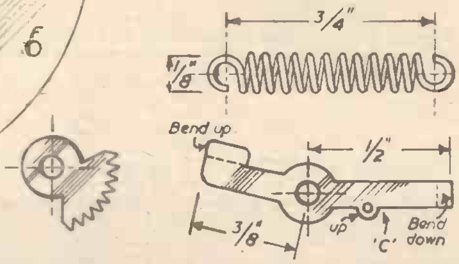
Across the bottom of the box is riveted a piece of springy phosphor bronze strip. Hard brass would probably suit. At each end it carries a $\frac{1}{8}$in. dia. stud which fits the cassette bottom hole. This bronze strip also serves to hold together the joint in the box. A piece of brass was also soldered inside the box over the whole of this join and up where the film slides.

In the photographs and the exploded view of the camera an alternative method of locating the bottoms of the cassettes is shown. As can be seen this consists of two small "hooks" pivoted on short rods and held under tension by a short length of spring. The box was also modified to accommodate this arrangement, as was seen in the August issue.

Either method of cassette location can be employed, but the one shown in Fig. 6 (August issue) is perhaps the simpler.

At the top of the interior mechanism the L.H. knob winds on the film. It needs a slotted stud to fit the cassette, turned down and extending through both plates with a screw to secure the knob. A cupped metal washer or a piece of felt under the knob may be an advantage. At the R.H. side is another knob which is a simple registering device. This is turned each time an exposure is made. A screwed stud is extended to take the full cassette. At its top is a distance piece, and on top of that is a 1in. washer. Between this washer and the top plate is a recessed knob, which is made a tight enough fit to stop it turning on its own. Here again a felt washer would help. Figures stamped round the washer and a white dot on the edge of the knob enable one to indicate each exposure as made. The prototype was stamped one to ten, and it was found quite easy to remember if ten or twenty had been passed so long as intermediate numbers are recorded. Twelve would perhaps be better with thirty-six exposures.





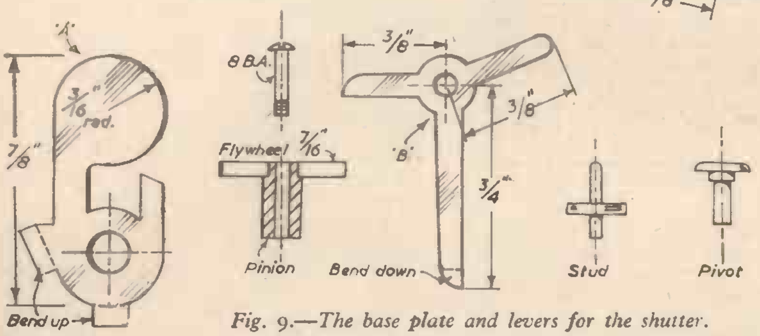


Fig. 9.—The base plate and levers for the shutter.

Wind-on Indicator

Indication that another exposure has been wound on ready is done by a pin drum (Fig. 5). The dimensions of this are shown and it consists of a thick disc, marked off in eight divisions. Eight holes are drilled and either screws or pins fitted. They are then filed to suit the film, being tapered slightly at the ends. They resemble eight widely spaced gear teeth. Into the centre of this pin drum is fitted a $\frac{1}{8}$in. steel spindle, the top end of which carries a plain disc, turning in the large hole in the top plate. It turns in a bearing made from a piece of $\frac{1}{4}$in. rod which is screwed into the top plate. The drum should be fitted so that the film just rides on the drum itself, leaving the pins to project well up through the holes. A slot will be necessary in the back plate to clear these pins. One revolution of the disc is one exposure leaving about $\frac{1}{8}$in. between exposures. Over the hole in which the disc works a piece of thick celluloid is cemented to keep out dirt. A mark on the disc and one on the body were necessary to indicate one revolution of the disc and the passage of one frame.

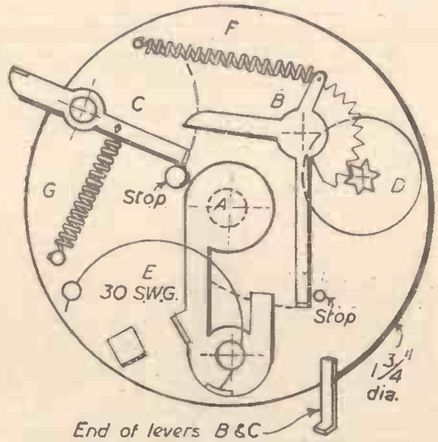


Fig. 10.—The assembled shutter.

The only other part in this assembly is the "shoe" to take various view-finders. It is bent up from sheet iron and tinned. Two 8 B.A. screws secure it.

The Shutter

The shutter levers and blade are mounted on a steel plate 1$\frac{3}{4}$in. dia. and with a $\frac{1}{4}$in. hole at its centre. Steel is used because it can be easily blackened by heating and dipping in oil several times. This avoids the use of paint, which wears off and causes trouble. For the same reason all the levers should be of sheet steel. The sizes of all

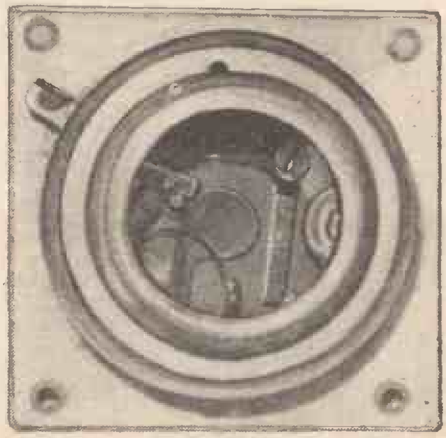


Fig. 11.—A view of the completed shutter.

levers are shown in Fig. 9. It will be seen that about 1/16in. of the ends of levers "B" and "C" are turned down. The purpose of these ends is to slide over levers in one direction, but to push them on returning. Therefore one side of these turned down ends needs to be rounded. The lever ends over which they slide must also be tapered a little so that they ride up easily.

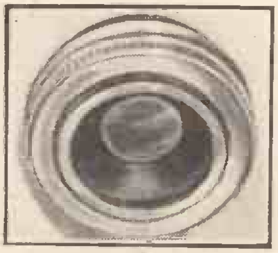


Fig. 12.—The author's simple lens combination.

Operating Sequence

This can be seen in Fig. 10. Trigger C is pressed down and its far end catches on lever B and lifts it. The reverse end of lever B goes across until it rises up over the end of shutter blade A. These movements are shown by dotted lines. Just after this the end of the trigger lever C slips past the end of B. Spring F brings B sharply back. Its far end carries shutter blade A with it and the hole is uncovered. When the hole is fully open, B slips past the end of shutter blade A. Its own spring E brings it back over the hole again and the exposure is complete.

Fig. 13.—Two photographs taken with the simple lens shown above.

Assembly

Having made all the levers, the first adjustment is to set spring E so that it closes the shutter blade with the minimum pressure; it must, however, act firmly. E passes through a small hole in the turned up lip of the shutter blade and through a small hole in the stud. In the prototype it was soldered into the stud as well.

Lever B is next assembled and its spring F adjusted until it brings the lever back without using more tension than is necessary. Finally lever C, the trigger lever, is assembled and made to operate properly. Spring G may be firm. If it is too light the trigger could be operated by accident, though, as the amount of movement is large before the other levers operate, this is not a serious danger.

It will be noticed that a part of a gear wheel is fitted to lever B. This meshes with a small pinion on a separate stud. Attached to this pinion is a flywheel. This serves to slow up the movement of lever B, and thus slows the shutter operation. This is a help in dull weather, but is probably not strictly necessary using a fast film. Experiment will show whether a slower shutter speed is feasible without introducing camera shake. On the L.H. side of the shutter blade will be seen a turned up projection and on the base, a small block. This block is screwed to take a cable release, the end of which projects through enough to push the blade open. This is the provision for making time exposures. The completed shutter can be seen in Fig. 11.

The Lens

While the simple combination already mentioned, and shown in Fig. 12, will give fairly average results for contact prints, enlarging brings out the faults of the lens. Only up to $3\frac{1}{4}$in. × $2\frac{1}{4}$in. are passable. Enlargements of pictures taken with this lens are shown in Fig. 13.

A better lens must be fitted if larger pictures are wanted. H. English, of Brentwood, Essex, has a large selection of all types of lenses. I would suggest at least an achromat which is a colour corrected lens of two or three glasses. Many good lenses have as many as six glasses to correct for the various faults or abberations and a price to correspond. Should you wish to have the thimble engraved, Messrs. Evans Bros., of Clerkenwell Green, London, E.C., are suggested for the work.

Focus

First remove the camera interior mechanism and the camera front assembly. A piece of hardboard or something similar must be placed in front of the interior mechanism to space it out to the level of the front when in place. The front is then strapped tightly to the interior mechanism and spacer with strong rubber bands. Open the shutter with the cable and adjust the lens mount in or out until a clear view is obtained of an object about 15ft. away. A glass is useful for this purpose. That object must be seen clearly on a piece of ground glass lying on the film guide and taking the place of the film. In the absence of ground glass a cigarette paper will serve or even tissue paper. It will be easier with ground glass which has a finer grain.

This will give the hyperfocal distance for a lens of 2in. focus, working at F.8. It will not apply with different conditions. Everything then beyond about 7ft. should be in good focus, depending upon the quality of the lens, of course.

Shutter speed may be checked quite simply by fixing a 12in. paper disc to the spindle of a small synchronous motor as used for making electric clocks. These motors turn at one revolution a second. If this is taken outside in a good light a single black mark near the edge of the disc photographed by the camera will make a blur. Fourteen degrees indicates about 1/25 sec. A complete revolution of the disc is, of course, one second, half is ½ sec. One-tenth would be 36 deg. Using the same method, any suitable motor could be employed provided its speed is accurately known. Gramophone motors have been used.

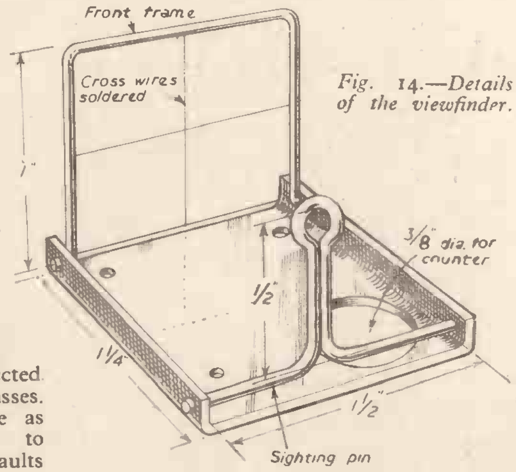


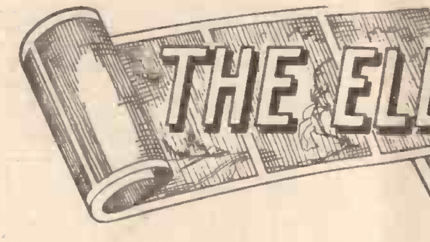
Fig. 14.—Details of the viewfinder.

View Finders

In the prototype a simple wire frame finder screwed in place of the shoe was used. It consisted of a bent up frame as shown in Fig. 14, having small holes at each end. Into these holes the ends of wire frames were fitted so that they could be folded when not in use. The size of wire frame which will accurately show the view at eye level is very easily found by observing the view seen when focusing the lens. In practice it was found that such a size was unwieldy and had to be reduced. A frame of the same size as the negative can be accommodated, i.e., $1\frac{3}{4}$in. × 1in. But the negative will take in more than that. At the back it will be necessary to fit a piece of metal terminating in a rounded point, which comes just half way up the main frame. Its purpose is to enable one to level the camera properly. Preferably, cross wires should be used on the main frame so the rounded point can be brought level with the cross. The type of mount, its main frame and pointer are all shown.

The purpose in fitting a shoe was to carry out some experiments on view finders and so far one eye-level finder using home-made Perspex lenses has been produced.

Cassettes were bought at a local shop for 2s. 3d. each and it is suggested that these should be purchased before construction is started as they may be of different design to the ones used in the prototype.



By J. C. Lowden

Speed Up Negative ... Conta...

FOR those who wish to avoid the delay occasioned by overnight film drying and also the danger of dust becoming embedded in the soft film emulsion, the answer is a film drying cabinet. The details and dimensions pertaining to the one shown in Fig. 3 can be adjusted to suit the requirements of the indiviual worker.

The Cabinet Carcase

This is made throughout of the lightest hardboard braced with light lath and ½in. quadrant. The hardboard back measures 48in. × 8in. and the two sides, 48in. × 6in. (see Fig. 2).

Along the full length of each edge of the back is glued and pinned a length of ½in. quadrant. Any good adhesive, but preferably a waterproof glue, can be used. A space, the thickness of the hardboard, must be left between the right angle of the bead and the edge of the back panel.

The side panels are next affixed to the quadrant by the same method. Assembly is greatly facilitated if the plywood base and top (8in. × 5⅝in. × ½in.), the lower front panel (8in. × 3½in.) and the upper front panel (8in. × 5½in.) are prepared ready. These parts are fixed in place with round headed woodscrews, and the carcase squared up and left to dry.

At some convenient stage in the proceedings, an aperture, of any reasonable shape and size, must be cut in he top panel. The aperture is then covered with a light gauze or perforated zinc, as used for food-safes. The purpose of the zinc it to serve as cover for the blower fan blades, and as a filter to keep stray dust particles out of the cabinet.

The lower front panel must also have a few holes drilled in it to permit air to enter. These holes are screened at the front with a piece of gauze or zinc, behind which is a washable filter of fine silk or other material. This traps the dust.

When the carcase is complete, all joints must be taped to ensure a good airtight seal. A narrow strip of brown paper will suffice, or a commercial adhesive tape may be used.

The appearance of the lower panel will be enhanced if the raw edges of the gauze screen are neatly framed with very thin wood, or food safe ventilators may be fitted.

When the carcase is completed, the edges of the side panels nearest the door are internally braced with light laths of about 1in. × ½in., and 39in. long. These braces run from lower to upper panel, and serve as door checks, act as air and dust seals, and stiffen the carcase. The edges of the lath must be set back from the edge by the thickness of the braced door, so as to permit a flush fit. Any other internal bracing as may be thought necessary may be included.

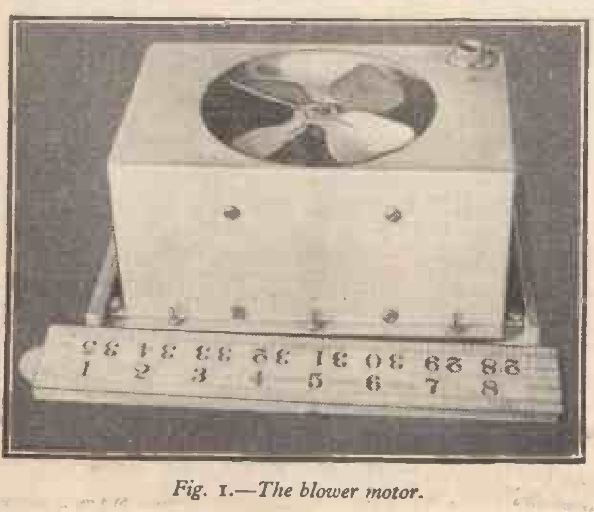


Fig. 1.—The blower motor.

The door is a length of hardboard 39in. long × 7⅞in. wide, internally braced all around its perimeter with light laths. It may be found advisable to make the door slightly oversize, and plane it down to an exact fit.

The door should be firmly hinged to the frame, and a simple catch fitted to hold it in a closed position.

Blower Bearers

These are of any suitable wood, 5½in. long, and of L-section. The "webs" of the L-section should not exceed ½in. thickness. The lower or bearing surfaces will need to be drilled to take the fine (about 6B.A.) bolts fitted on the flange of the blower casing, using the casing itself as a pattern.

The blower bearers are affixed to each side of the cabinet 5½in. from the top, by woodscrews through the sides. Care should be taken to keep the gearing surfaces level. After the position of the bearers has been fixed, they should be removed, bolted to the blower motor casing, and then the whole can be replaced as one unit.

The Blower Motor

This motor, which is a piece of "surplus" equipment, is fully enclosed in a light metal case, ready flanged, with a gauze base. The connections are simple. At the top of the box is a screwed sleeve plug. Inside this is a split tube connector, which will accept a standard wander plug. This plug, attached to one lead of plastic-covered twin flex, is inserted in the split tube. The second lead may be connected to any part of the casing.

No modification of the motor is needed, unless it is desired to make a much smaller cabinet. In this case the maximum size need be governed only by the fan blades, since the motor itself and its supports are both very small indeed, and the casing is easily removed.

This blower motor is low voltage equipment and functions perfectly on 30 volts supplied from a transformer. On no account must it be connected directly to the mains.

The blower motor is supplied complete by Messrs. Milligan of Harford Street, Liverpool, who advertise in this journal. The price

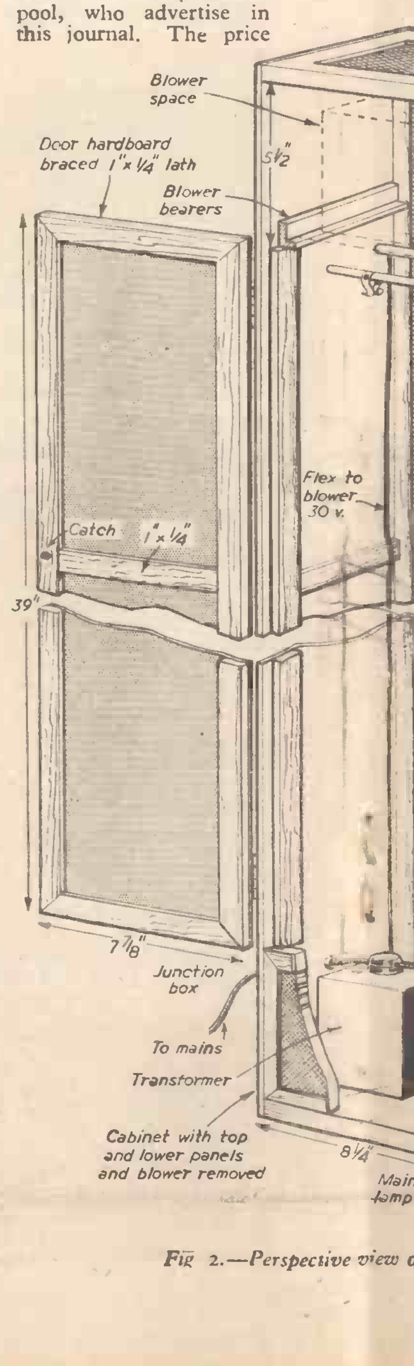
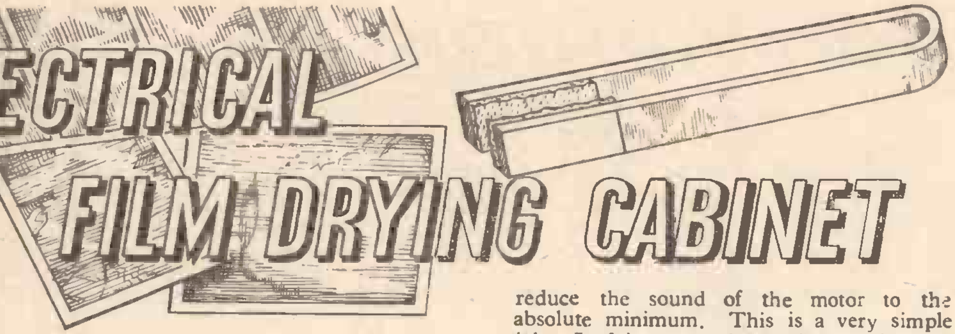


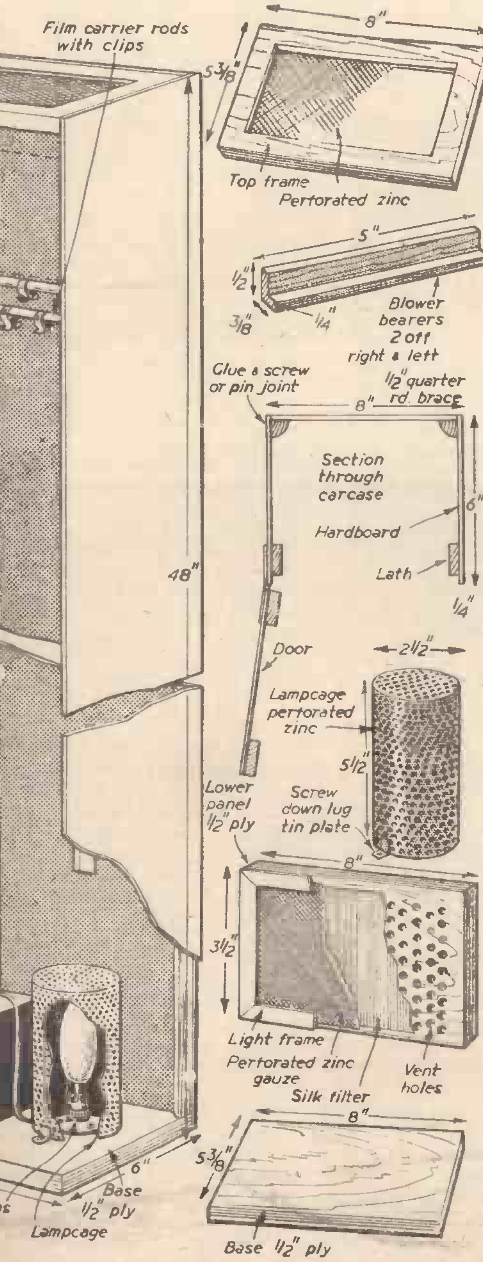
Fig. 2.—Perspective view c



Drying and Avoid Dust
amination !

is 26s. 6d. plus postage. It can be seen in Fig. 1.

The suppliers advise that in the case of certain motors it may be found desirable to repack the front and rear bearings with any high melting point grease in order to reduce the sound of the motor to the absolute minimum. This is a very simple job. In fairness to the equipment, it must be added that the writer's own motor has not been so treated, and the purr of the motor is so low as to be barely audible, even when listening intently.



f the drying cabinet and the details.

The Transformer

Many readers will have their own transformer, but the transformer used in the prototype was fitted with a range of tapping points up to a maximum of 30 volts at 2 amps. Full wiring instructions were printed on the label and the transformer was supplied by Messrs. Milligan's at 21s. plus postage.

In order to utilise the relatively heavy weight of the transformer to lower the centre of gravity of the tall cabinet, it is fitted inside the base compartment. For protection the transformer is housed in a light wooden casing, inside measurements 3¼in. × 3¼in. × 3in. This box is a very light affair, made from "offcuts." The transformer is screwed to the base of the box by means of the lugs on the frame, the entire box being secured to the floor of the cabinet. The flex to the motor is secured to the rear quadrant brace of the cabinet. The "input" flex emerges from the box and leads to a small junction box fixed to the lid of the transformer box. The A.M. junction box, price 9d., was obtained from Milligan's.

This junction box is wired to the mains in the usual way, the mains lead being passed through the side of the cabinet.

One lead from the junction box is taken to the transformer as already described. A further lead is fed to the batten holder which is used to hold the mains voltage heater lamp. This batten holder must be firmly secured to the base of the cabinet.

The Heater Lamp

The heater lamp used in the model described is a 40-watt miniature fitting lamp from a well-known store. This particular lamp was selected because its relatively large glass bulb offers a bigger heating surface. Within reason, any type of lamp may be used, and a low power carbon coil heater lamp has proved to be a very efficient heat source. Overheating is avoided since the fan draught is so strong.

Heater Lamp Cage

This is a very simple cage to diffuse the heat, and to protect the lamp from any possible stray drop of water. A piece of perforated zinc is rolled around any cylinder of about 2½in. diameter and lightly soldered into tube form. A square of the same metal, soldered on to one end, can then be trimmed to fit as a top cover. A small fixing lug of tinplate, soldered to the lower end, is drilled to allow the cage to be fixed to the base of the cabinet.

Film Carrier Rods

These are two ½in. dowels 8in. long, fitted across the cabinet immediately below the blower bearers and screwed through the hardboard sides. On each rod are four "clothes line" grips, hoops of stainless steel with plastic gripping surfaces. These grips may be bought at most household stores for a few pence a dozen. Many workers will no doubt prefer to use the proprietary film clips on sale for the purpose.

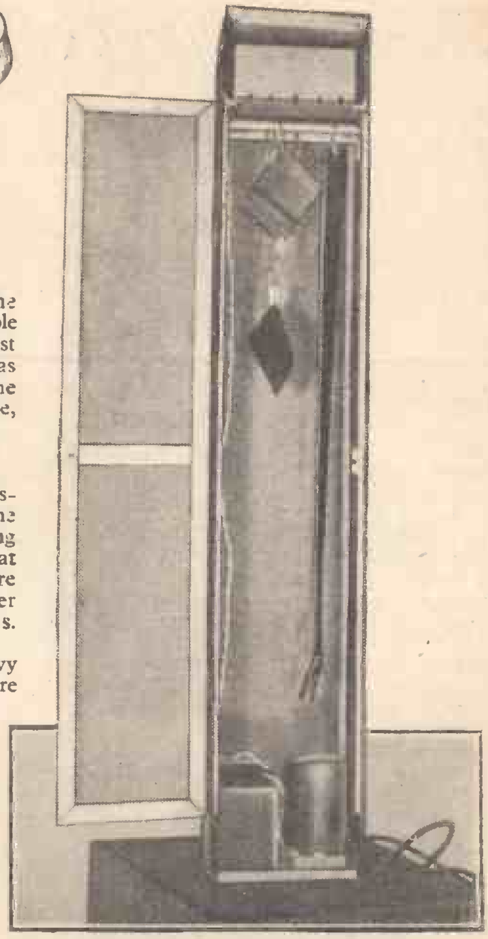


Fig. 3.—The completed drying cabinet.

The cabinet is long enough to take the full length of a 120 size, or a 20 exposure length of 35mm. film. When drying a full length (36 exp.) 35 mm. film it will be necessary either to cut the film or to loop with a stainless steel clip.

The Drying Cabinet in Use

After the film has had its usual thorough wash in running water, it should be rinsed for ten minutes in still water to which has been added the correct amount of wetting agent. The wetting fluid should not be used in excess of the stated amounts, or it may become sticky, and have precisely the opposite effect to that intended. After this rinse the film should be run through well-wetted fingers, or lightly wiped with a film wiper to remove large droplets of water.

Plate negatives can equally well be dried in the cabinet, provided that hangers are used.

Before using the cabinet for the first time it is a wise precaution to clean out the interior thoroughly with a vacuum cleaner to remove working dust, and this action might well be repeated periodically.

Finish

The exterior may be finished with any suitable paint or stain, or the pleasing brown of the hardboard may be left untouched. If it is decided to treat the interior, care should be taken not to use paints compounded with genuine turps or substitute, both of which attack film emulsion.

Photographing AIRCRAFT

How to Obtain the Best Results

THE exhibits at Farnborough and other air shows present opportunities for record photography of the parked aircraft, and action shots of the flying which generally takes place at a low level above the runway. True, the photographic aspect is not made too easy by the numbers of people inspecting the aircraft, but no real difficulties are encountered. Photography at civil airports is quite feasible although, owing to the distance usually separating the public enclosure and the tarmac and runway, it is not always possible to get the image of the aircraft very large on the negative.

Parked Aircraft

It is obvious that there is no need to have a camera with a fast shutter speed. The lens must be capable of being accurately focused, and the aperture should be capable of adjustment so that the whole length of the fuselage of an aircraft photographed from a three-quarter front position will be recorded sharply. Dull light and poor weather may render this rather difficult to accomplish, but every effort should be made to obtain sharp focus from the nose to the tail of the aircraft (Fig. 1). The front view of a particular aeroplane is not necessarily the best for the purpose of illustrating the various interesting technical aspects of its design. The best policy is to walk around an aircraft and carefully note the position of the principal points you wish to illustrate. Then the best viewpoint can be found and the picture taken. In Fig. 2, the all-round visibility from the control position, the propulsion unit and the tail were the most important technical features for the purpose of an illustration. The picture is, however, almost a "tail-on" view.

Shots for Effect

On occasions it may be desirable to avoid showing all of the aircraft and, by choosing the camera viewpoint very carefully, to exaggerate some special and characteristic part of the exhibit. This has been done in Fig. 3, where the long slender nose of the aircraft is more prominent in its rendering and positioning in the picture area, than the remainder of the aeroplane. A low angle was chosen, well in to the nose of the aircraft, and the lens iris closed down to give adequate depth of focus. A very light yellow filter, to bring out the cloud formation, was clipped over the camera lens and the exposure made almost directly into the light.

Since the choice of the camera angle may not always enable you to have the illumination coming from the best possible quarter particularly on a sunny day which gives high contrasts, it is essential to use a lens-hood for every shot. In this way, the greater part of the extraneous light is kept away from the lens and the picture brilliance is not affected. Working right against the light is not particularly troublesome, once you have mastered the art of giving sufficient exposure to enable the shadows to be recorded without undue loss of detail and, indeed, it is often productive of some very dramatic effects.

Fig. 4.—A flying picture enlarged from a small section of a negative made on a fine grain film.

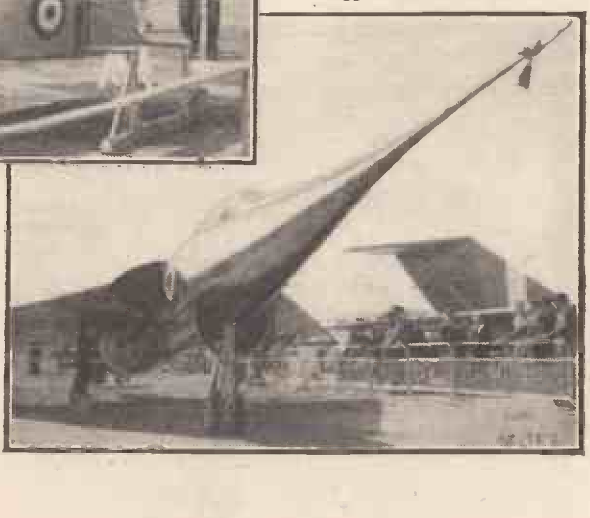


Fig. 1.—(Above) Adequate depth of focus is essential even in bad lighting conditions.

Fig. 2.—(Left) A helicopter photographed to include all the principal technical points.

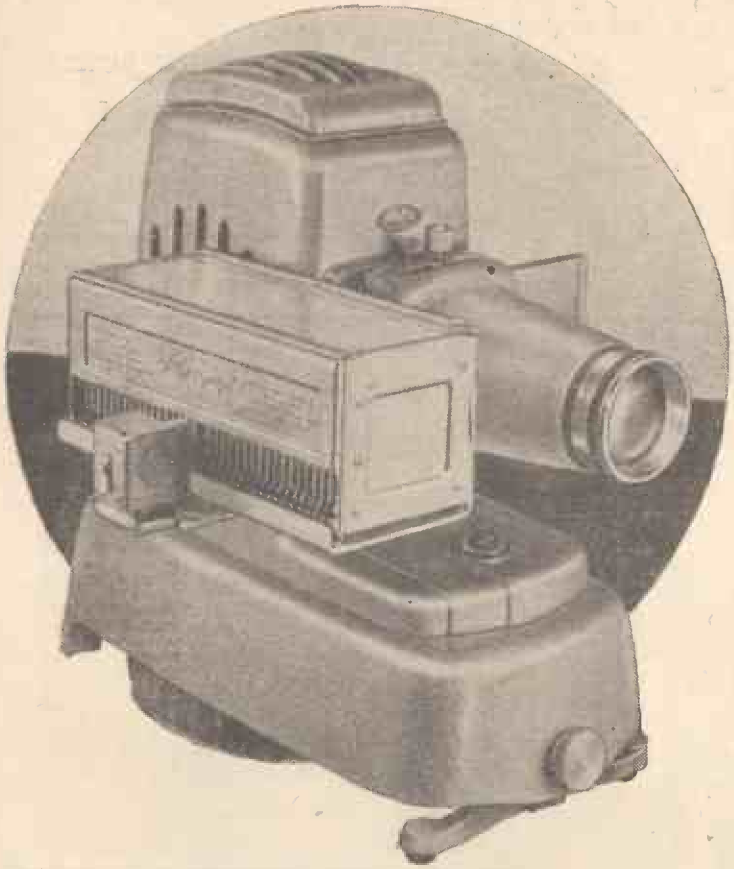
Fig. 3.—(Below) The long nose of this aircraft has been deliberately exaggerated in this view.

Aircraft in Flight

The owner of a camera with only slow shutter speeds will need to content himself with pictures of parked aircraft and others standing on the runway immediately prior to take-off. Cameras fitted with shutters having a top speed of 1/250th of a second or faster, can be used for actual flying shots. Naturally, the nearer you are to the flying area the better will be the results.

In general, only the higher-priced miniature cameras have the facility of interchangeable lenses, so enabling a long focus objective to be used and a correspondingly large image to be obtained on the negative. Users of cameras having only the standard lenses will have to obtain the required degree of enlargement when making the print. For this reason it is important to use a relatively slow fine-grain panchromatic film. As the majority of flying pictures are taken at the "infinity" focus setting, there is little point in stopping the lens aperture down very far, except to gain good overall definition; this latter point applying mainly to the very fast lenses. Provided that a high shutter speed can be used with a slow film, the aperture is used only to control total light intake.

As the aircraft to be photographed approaches, hold it in the centre of the viewfinder and, still swingng round to follow the subject, gently release the shutter as a suitable angle is reached. By doing this, it should be possible to obtain a sharp image which will stand considerable enlargement (Fig. 4).



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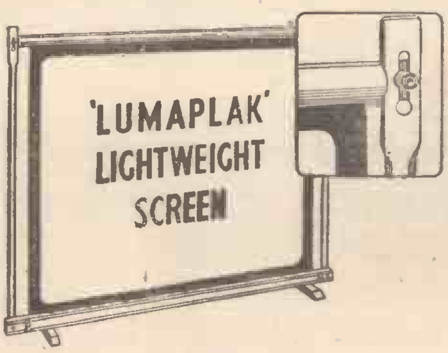

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40″ × 40″	38″ × 38″	4. 2.6
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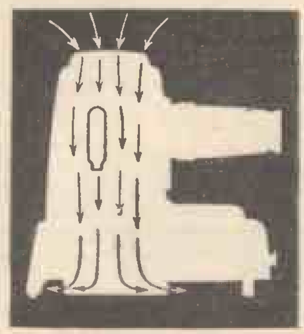

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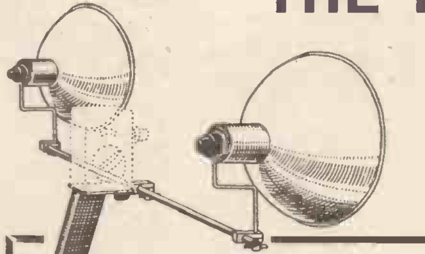

The Photopia Unit Lighting System due to its unique design is fully interchangeable and for this reason it is possible to purchase one complete Single Floodlight and by obtaining additional parts, convert it into a triple unit, etc. etc. Basically five different units are available, but having acquired one it is only necessary to buy the few extras to convert it at will to another unit—lots of possibilities are available.

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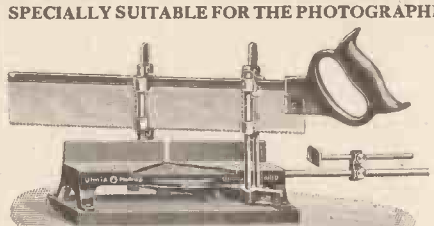

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