An Indoor-Outdoor Miniature Golf Course

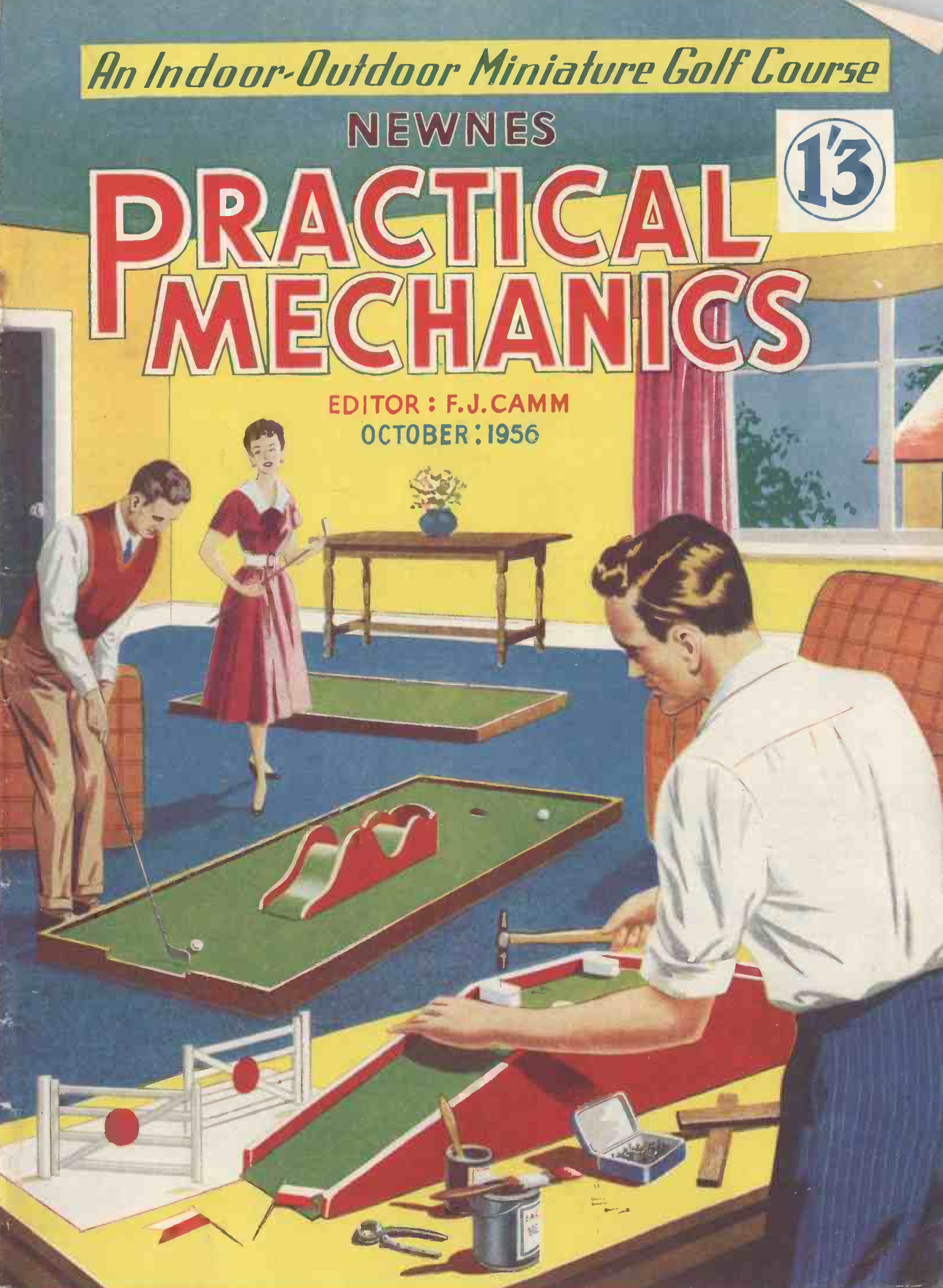
NEWNES

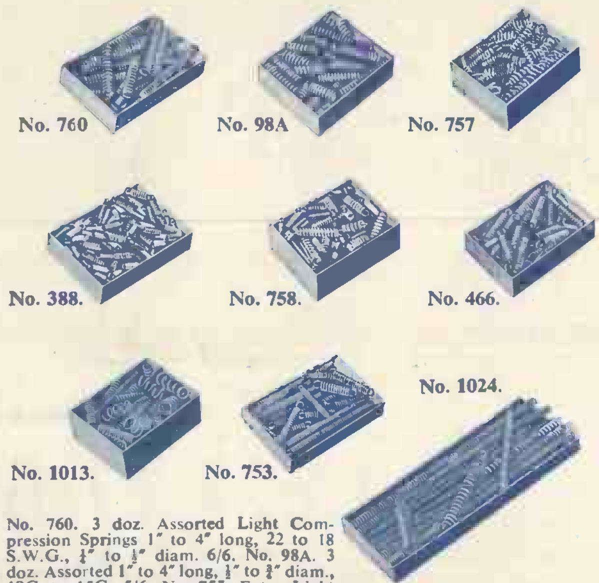
PRACTICAL MECHANICS

1'3

EDITOR : F. J. CAMM

OCTOBER : 1956





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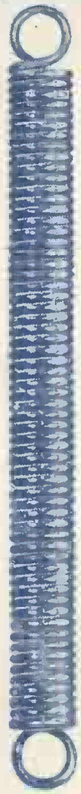

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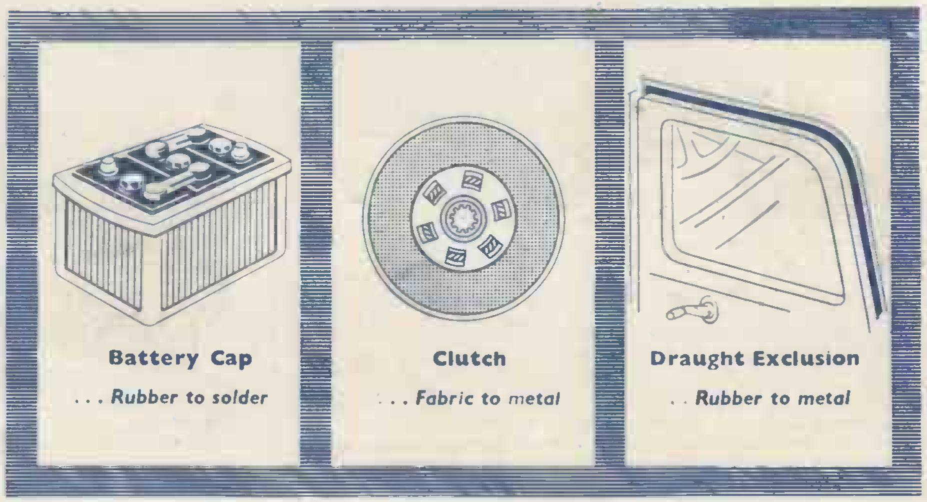

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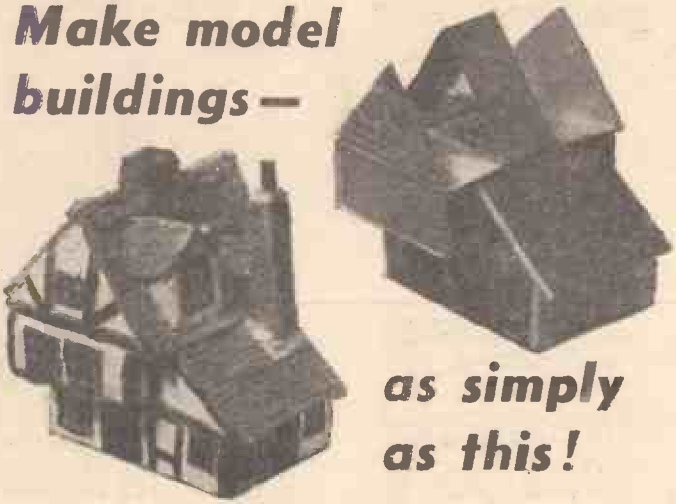

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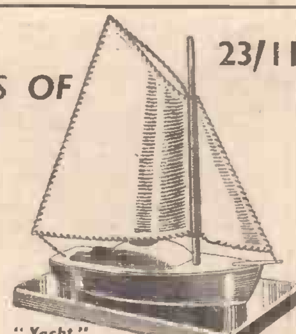

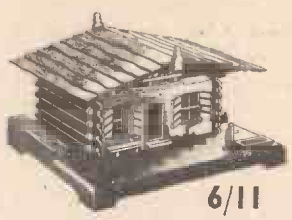

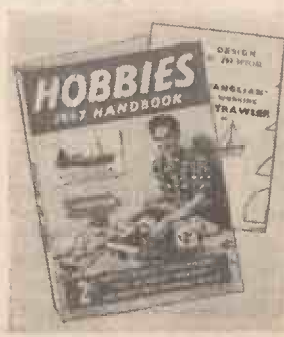

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PRACTICAL MECHANICS

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

VOL. XXIV. No. 272

Editor : F. J. CAMM

OCTOBER, 1956

FAIR COMMENT

By

The Editor

Founders of Industry

IT is one of the pleasant duties of the editor of technical journals to visit annual exhibitions. By this means he is able to see trends in development, changes in design, new ideas, materials and methods of particular industries under one roof, and thus to bring the very latest information to his readers.

He is also able to discuss various subjects with executives of firms and once a year meet those with whom perhaps he only has contact during the year through the medium of the post.

In strolling round this year's Radio Show, Model Exhibition, The Aeronautical Show, and several other national exhibitions, I reflected upon the large numbers of people now holding important positions either as founders of firms or as designers and works managers, who owe their careers almost entirely to their interest in models and amateur mechanics. The radio industry undoubtedly was founded by amateurs. Every important firm started its existence in a small way as a result of the enthusiasm of a keen amateur. Today those businesses have expanded, and in their turn are absorbing into their personnel the amateurs of the present generation. The aeronautical industry was entirely founded by model makers and experimenters. Sopwith, Fairey, A. V. Roe, Handley-Page and many others were all keen model makers, who have founded large businesses of international standing and importance.

Model making and amateur mechanics, therefore, are important national movements which should be encouraged by the State. The Science Museum at Kensington contains some of the models of young men who later became famous. Model making is indeed a fascinating way of learning the rudiments of engineering. It imbues a desire to use tools and to understand materials. Parents should encourage it. Any inclination shown by their children towards making things is bound to stand them in good stead later on.

Education of the Young Worker

BEARING on this subject, it is reassuring to note that some of our universities are interesting themselves in the education of the young worker. The sixth Oxford Conference on this topic was held earlier this year and the particular subject under consideration was the needs of those young workers for whom at present there are no satisfactory schemes of training or further training, or who fail to take advantage of such opportunities as are open to them. There was general agreement that every encouragement should be given to the provision of training for those outside the apprentice group, remembering that they are an offspring of an age which has known two world wars and has seen striking advances in science and technology. For all these young workers the change-over from school, where they were of some importance, to work, where they become a mere check number, is a period of considerable difficulties. They enter the work with a certain enthusiasm which tends to disappear in the atmosphere and attitude towards work which they find in employment. Their elders often fail to foster in them a proper regard for work as a source of human dignity and a necessary social activity.

The conference recommended that for the non-apprentice groups, schemes of training should be instituted under an officer parallel to the apprentice-supervisor, to enable the adoption of planned training. The responsibility for initiating such schemes, including those run jointly for small and medium-sized firms, should be with the trade associations in collaboration with the appropriate trade unions. Small employers should band themselves together for schemes of further education on general lines, in much the same way that joint apprenticeship councils now do for vocational training and the initiative for framing these schemes should come from trade associations. The possibilities should be investigated by the Ministry of Labour and the T.U.C. of the extension of the apprenticeship system to occupations other than the traditional crafts and to the inclusion of girls in all such schemes.

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The Young Inventor

I HAVE often remarked that this country gives precious little encouragement to inventors. It is only concerned with production and marketing and the exploitation of inventions after someone has ploughed the lonely furrow. The Institute of Patentees, which was founded 37 years ago, has done a great deal towards encouraging and advising inventors and canalising their efforts. For the young inventor it has a special class of membership known as "Companion." These are young people of schoolboy and student age who the Institute wishes specially to encourage so that any inventive talent they may have may be developed.

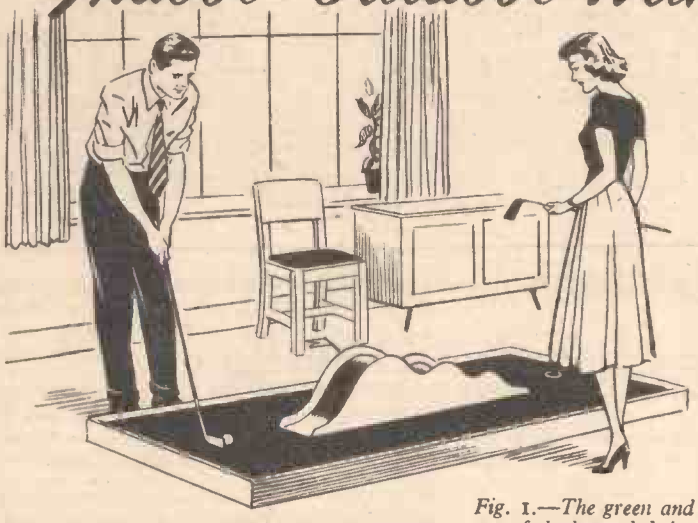
The president of this Institute is Professor A. M. Low, and the vice-presidents and executive are all men of wide experience and international reputation. I am giving a lecture on the subject of invention and inventors before the Institute on October 9th, and readers who wish to attend should write to the Institute at 207-208, Abbey House, Victoria Street, S.W.1.

Volume 23—Indexes

LAST month I mentioned that the September issue completed Volume 23, but the dates of the commencing and finishing issues became transposed. Volume 23 commences with the issue dated October, 1955, and concludes with the issue dated September, 1956. Indexes for Volume 23 are now available at 1s. 3d. by post. This is a reminder that Volume 23 contains only 10 issues as, owing to the printing dispute, we did not publish issues dated March and April.

This present issue, of course, is the first of Volume 24.—F. J. C.

AN Indoor-Outdoor Miniature Golf Course



Constructional Details for Making a Green and Nine Interchangeable Hazards

Fig. 1.—The green and one of the hazards being played.

THE green is the same in every instance, being a smooth flat wooden surface covered with baize, so that it will look realistic and effective. There are nine hazards all different and each of robust construction. The heading picture shows the completed green and one of the hazards. A full-size golf ball and putter are used and, if the hazard is removed, practice at putting on the flat green may be obtained.

The Nine Hazards

1. The Bridge.
2. The Switchback.
3. The Castle.
4. The See-saw.
5. The Slope.
6. The Gates.
7. The Chasm.
8. The Tunnel.
9. The Bell.

Construction of the Green

Plywood 3/16in. thick is used for the floor and two pieces 3ft. 6in. long by 2ft. 3in. wide are required, the green being made in two sections. Each half of the green has two sides and one end made from wood ½in. thick and 2in. wide. The two sides are 3ft. 6½in. long and the end 2ft. 3in. long. The end piece in one green has to be shaped as shown in Fig. 2. This cut out is at the opposite end to the hole and is to allow for the swing of the putter.

Four cross strips must be provided for each half of the green, 2ft. 3in. long, ½in. thick and 1in. wide. These are fitted inside the 2in. wide outside framework and ensure that the plywood top is at the right height. One is put immediately inside the end, the next 9¼in. farther in and the third one 10in. beyond that. In one of the halves the fourth strip is set ½in. in from the further end, and in the other level with it (see Fig. 4). These pieces are all glued and screwed to the side, flush with the bottom edges, so that when the whole framework is turned over and the piece of plywood dropped into the frame, it is ¾in. below the edge of the sides.

Making the Hole

First make the block of wood which is to strengthen and provide depth to the hole and which is shown in Fig. 2. The block should be 5in. square with a 3¼in. hole cut in the centre. Drop the plywood sheet into position and turn the frame over. Place the block into position so that it touches the wooden supporting strip exactly in the centre, as shown in Fig. 3. Pencil round the inside of the hole on to the plywood, remove this and then cut the hole in the plywood with either a bow saw or keyhole saw.

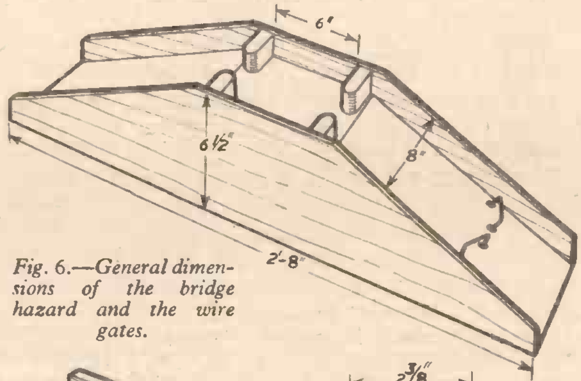
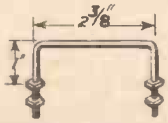


Fig. 6.—General dimensions of the bridge hazard and the wire gates.



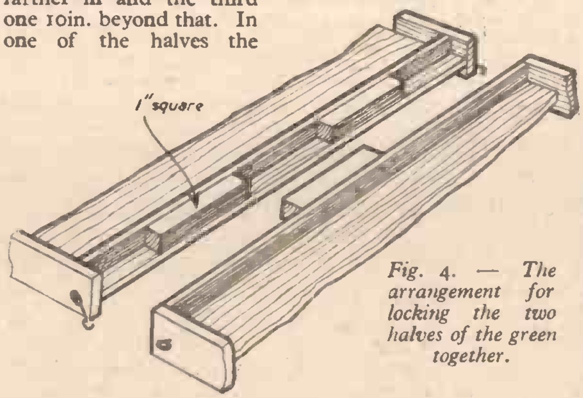
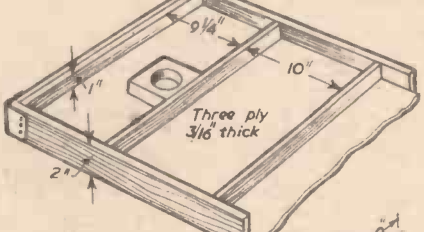


Fig. 4. — The arrangement for locking the two halves of the green together.

Fixing the Baize

The plywood greens are not fixed in place until they have been covered with green baize cloth to make them more realistic and, of course, better to play on. The baize is cut, leaving about 2in. to turn over on each side. Take the baize and turn one of the long edges to the underside of the plywood, about 1in. inwards. To get a better grip a strip of tape or lengths of 1in. by ¼in. stripwood can be used. Then turn the plywood over and stretch the baize evenly across to the other side, where it is turned over the edge and held in a similar manner. The cloth should be glued to the whole surface of the plywood as it is stretched over. A hot iron is put over the cloth to smooth it out and press on to the wood before the glue sets. The overlap of the baize at the ends is turned over in a similar way. When the glue has set cut across the cloth over the hole in the shape



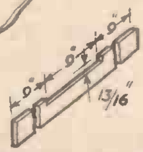


Fig. 2.—An underside view of the end of the green.

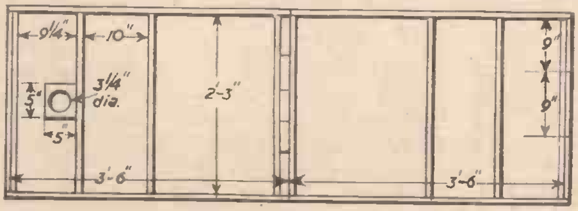


Fig. 3.—An underside plan view of the green.

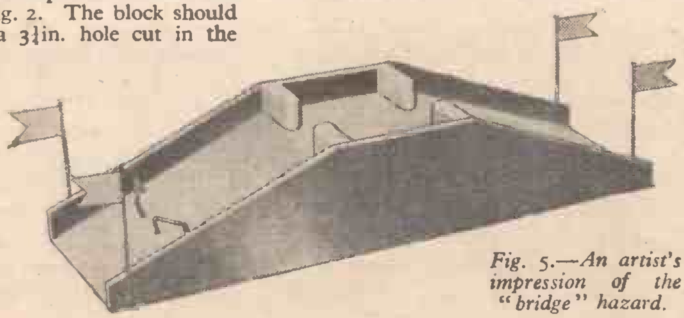


Fig. 5.—An artist's impression of the "bridge" hazard.

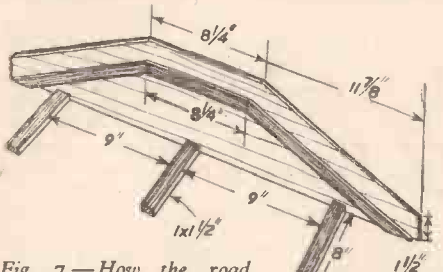


Fig. 7.—How the road supports and spacers are positioned.

of a star, turn the points under the board and fix there as before.

The complete sheet of plywood is now forced into the framework and if it has been accurately made it will fit firmly in place. If stripwood has been used to hold the baize underneath, accommodating recesses

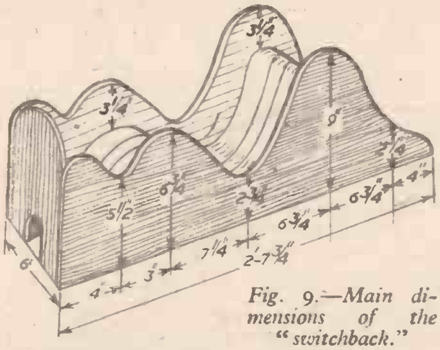


Fig. 9.—Main dimensions of the "switchback."

must be made in the cross struts of the frame. The thick block forming the depth of the hole is glued beneath the corresponding hole in the top (see Fig. 2). The upright edges of the green can be covered with baize if so desired, but look quite well if merely given two coats of green paint.

The outside corners of the green should be protected with brass strips measuring 3in. by 2in., bent round the corners and tacked in position as shown in Fig. 2.

The Locking Device

In Fig. 4 is shown the method of joining the two halves of the green together. An 18in. strip of 1in. square wood is cut into three pieces, each 6in. long. These are glued to the two end battens as shown in Fig. 4, one piece fitting between the other two. A hook and eye on each side complete the arrangement.

The Bridge Hazard

Fig. 5 is an artist's impression of this hazard, which is known as the "bridge," and the main overall dimensions are given in

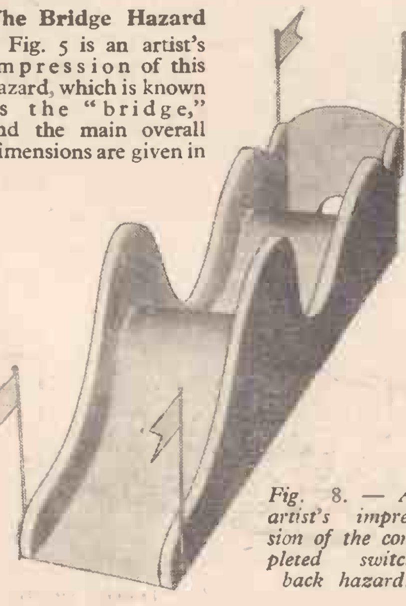


Fig. 8. — An artist's impression of the completed switchback hazard.

Fig. 6. In order to hole out, the ball must be driven up the ramp between the projecting walls and down the other side.

The two sides are made first and these are cut from pieces of 3/16in. plywood, each 2ft. 8in. by 6½in. The shape will be apparent from Fig. 7. An interior framework has to be provided to hold the two sides together and support the roadway which runs between them and the pieces of stripwood required are shown in position in Fig. 7. The three strips to support the road on each side are made from wood ⅜in. thick and ¾in. wide, glued parallel to the top edge and 1½in. away from it. Strips 1in. wide by ½in. thick by 8in. long are used to form the struts across the bottom.

The roadway is formed from three pieces of 3/16in. ply which are laid on the supports glued to the sides. The ends of the pieces which form the ramps are chamfered with a file so that they join smoothly with the top piece and so that no ledge is formed where they meet the green.

The projecting walls on the top are cut

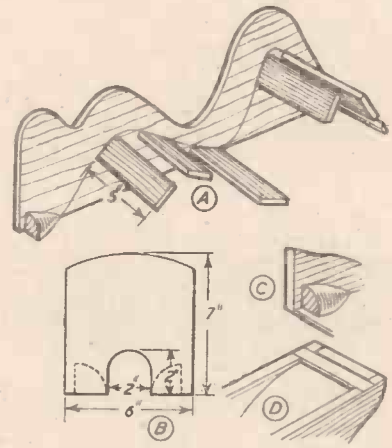


Fig. 10.—The interior supports of the "switchback."

from pieces of wood 1in. thick, 1½in. wide and 2¾in. long. The corners on the fairway side must be rounded as shown in Fig. 6 and the walls must be glued in position about 6in. apart. On one of the slopes two guides can be provided to guide the ball towards the hole after it has passed between the walls on top. These can be bent up from steel rod, threaded and fixed as shown in Fig. 6.

Finally, the whole of the outer surface is given a coat of glue and whilst it is still tacky

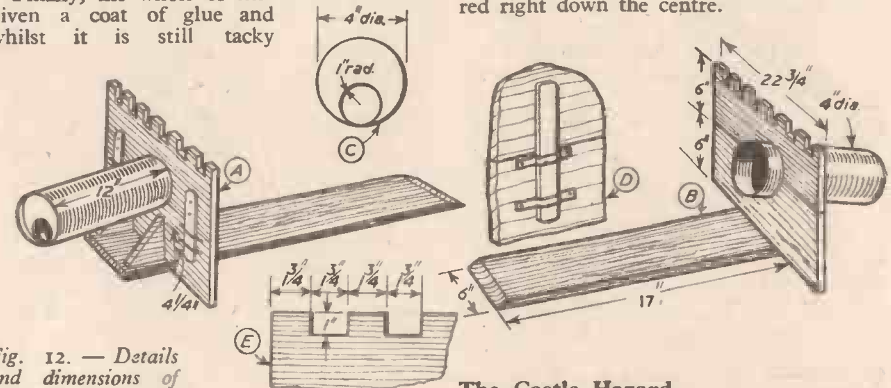


Fig. 12. — Details and dimensions of the "castle" hazard.

sawdust is sprinkled on. When it is all dry, the hazard is painted green and the fairway a lighter colour such as buff or sand.

The Switchback Hazard

The completed switchback is shown in Fig. 8; it measures 2ft. 7¾in. long and 6in. wide. As can be seen it has two "waves"

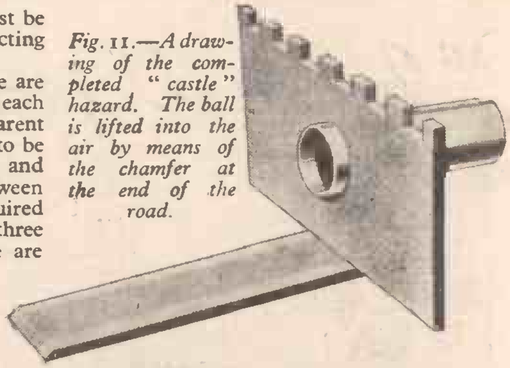


Fig. 11.—A drawing of the completed "castle" hazard. The ball is lifted into the air by means of the chamfer at the end of the road.

and finishes up with a hole at one end through which the ball is guided. There is a definite knack in playing the hole for the ball has to run at an exact speed in order to get over the two waves of the hazard.

For the sides two pieces of deal or plywood are required 2ft. 7¾in. by 9in. wide and on each is marked off the dimensions and heights given in Fig. 9. Connect up the marks in a continuous curving line as shown and cut along the line with a fretsaw. On the inside of the two pieces draw a line parallel with the curved top edge and 3¼in. below it as shown in Fig. 9.

The six struts which support the roadway are cut from ½in. deal, 5in. long and 2in. wide and these are fixed in the position shown at A in Fig. 10. They are glued in place and can also be nailed and screwed from the other side, but before fixing them in position cut out the end piece, shown at B in Fig. 10. This is cut from a piece of ½in. wood of the dimensions shown, the top curve and bottom arch being cut with a fretsaw. When this and the struts are fixed in place the whole structure should be rigid.

The roadway is fitted next and this is made from a strip of linoleum of appropriate length and 5in. wide which should fit snugly between the two sides. The tacks for fixing the linoleum are fixed as near the sides as possible, leaving the fairway smooth and clear. A strip of tinplate is fixed underneath the open end of the switchback, so that the end of the linoleum may be nailed to it as shown at D in Fig. 10; the other end may be fitted under the end arch piece. At C is shown two small wedge-shaped pieces which are fitted to guide the ball out through the hole.

The sides and end of the hazard are finished off as was the first hazard with sawdust, glue and green paint. The fairway may be painted a buff colour, with perhaps a strip of black or red right down the centre.

The Castle Hazard

An artist's impression of the "castle" is given in Fig. 11 and the principal dimensions are shown at A and B in Fig. 12. As can be seen, it consists of a fairway on which is raised the battlemented wall. Through this wall is a pipe positioned at a slight angle, so that once the ball is shot into it it will roll down gently and out the other end. The roadway and castle wall are made from ½in. deal and the pipe which is 4in. in diameter may consist of any available piece of tubing. The roadway is a board 20in. long, one end of which is chamfered to make the ball rise.

The wall is built in two pieces, each 22¾in. long and 6in. wide. One edge is cut to form the battlements (see E in Fig. 12) and the two parts are held together by a stirrup being fitted to the upper one and receiving brackets to the lower one (D in Fig. 12). Semi-circles of 2in. radius are cut out of the centre of both top and bottom sections so that the pipe fits loosely and tilts downwards from the roadway.

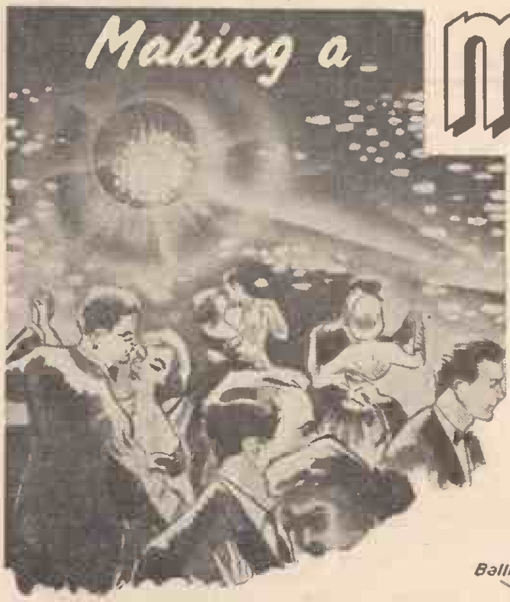
The completed wall is fixed to the roadway 3in. from the end opposite to the chamfer, and little angle blocks (see Fig. 12) help to hold it in place.

Screw and glue all these parts together and then cut out the 4in. diameter circle of wood which fits in the end of the pipe. A 2in. diameter hole is cut in this, with its edge just touching the perimeter of the circle (C in Fig. 12). A larger pipe may, of course, be used.

The wall may be treated with sawdust and glue method and the roadway painted as for the last hazard. The pipe may be painted black.

(To be continued.)

Making a MIRROR BALL



Details Received from W. J. Watts in Reply to a Query Published in "Information Sought"

FIRST, the beach ball is blown up to the required size, then pieces of gummed strip as used in parcel wrapping is placed round it with the sticky side outwards. This is continued until the surface is covered, with as little crossing over as possible to ensure a regular shape. An area of about 3in. diameter, through which the ball may be removed later, is left uncovered.

The beach ball is now blown up a little more until the paper covering becomes taut.

Another layer of gummed strip is stuck on with as much change of direction as is possible. This time the gummed strip is stuck with the gummed side down, finishing with a ring of stout brown paper round the " neck," which is glued in position.

Layers of newspaper and brown paper are now put on alternately until the required thickness is obtained, but allowing the glue to harden between layers. About eight layers should be sufficient, always finishing with the ring round the neck. When the glue has thoroughly hardened, the ball may be let down and removed.

A light coat of Bostik is now put over the ball and also allowed to dry. It is advisable to glue pieces of strip paper over the edge of the neck to " seal " in the layers of paper.

Light glass (10in. x 8in. photographic plates) can be silvered for 1s. 6d. per sheet, and is then cut into pieces 1in. x 1½in.; the number required for a 16in. ball will be around 600.

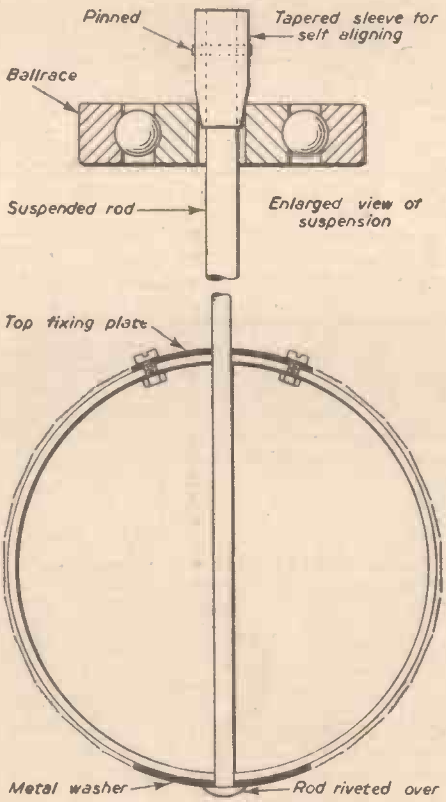


Fig. 2.—*Method of suspending ball from the ceiling.*

The method of fixing is for a complete ring of pieces to be put round the middle of the ball first, either vertical or horizontal, as long as each succeeding ring is put the opposite way; this counteracts for the loss of diameter in each ring of pieces (see Fig. 1).

The last few rings will be found awkward, but by careful placing of the pieces only small areas of the ball will be left uncovered. Care should be taken to ensure that the Bostik with which the glass is stuck on goes on to the edges of the glass, otherwise the silvering may give way, allowing pieces of glass to fall.

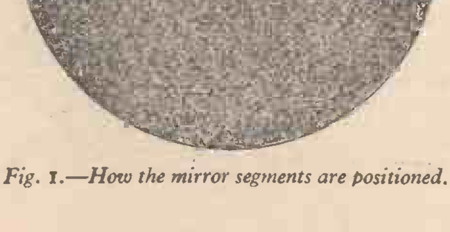


Fig. 1.—How the mirror segments are positioned.

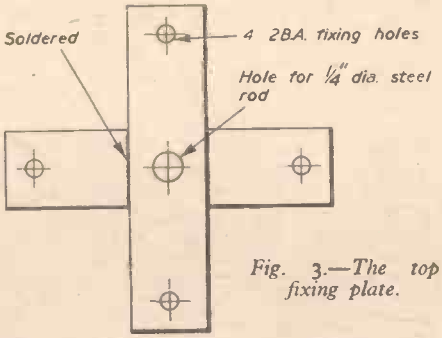


Fig. 3.—The top fixing plate.

Sufficient space should be left at the bottom for a metal disc about 3in. diameter so that a rod passing through the ball may be safely fixed without fear of pulling through the ball (see Fig. 2). The top hole has two strips of metal about 1in. wide, which are soldered in a cross, the ends of the cross being fixed through with bolts, nuts and washers to give stability to the suspending rod, as shown in Fig. 3. The method of drive in my case was a small motor geared down to 5/6 r.p.m. (sold for around 12/6). It required 110 volts, and a small transformer was used.

Suspension is important and the method used was a taper plug fixed on to the end of the suspending rod and resting in a ball-race, the taper allowing the ball to be self-aligning.

Materials Required

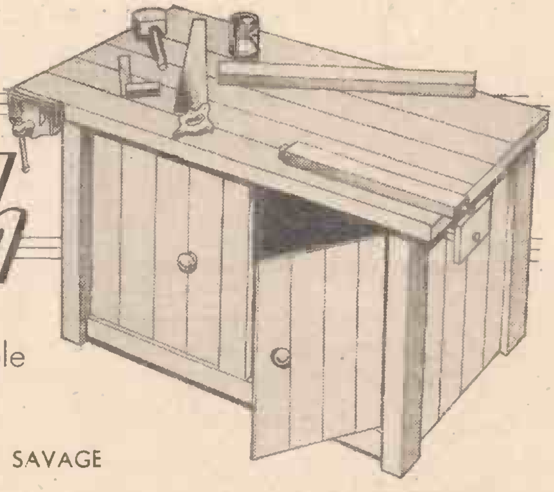
- A beach ball.
- A supply of brown paper and newspaper.
- Glue and one tin of Bostik.
- Gummed strip.
- Old photographic plates (any lightweight glass).
- ¼in. diameter steel rod.
- Metal disc.
- Metal strip.

The newspaper and brown paper are cut into squares of about 2in.-2½in.

A Carpenter's Bench

Sturdy; Rigid; Comfortable and Cheaply Made

By G. E. SAVAGE



THIS bench is of fairly straightforward construction. Its rigidity is gained by extra framing which allows any type of top to be fitted and also provides for renewal and/or replacement of this when required without disturbing the frame. In addition a very strong member supports the vice and provides for the best possible way of attaching this all-important tool. Further, a tail vice has been devised which is easy to make and is a very great help in many ways—especially in dealing with awkward chiselling or planing jobs which cannot be safely held by normal methods.

The general construction follows standard mortise and tenon practice with important proviso that all joints *must* be very good fits. An idea of general frame layout may be obtained from Fig. 1.

The material must, of course, be a personal choice; there are many suitable woods available. In new wood there are imported woods which are very good and not too expensive—Santa Maria, Podo Iroko, and many others. Alternatively, good second-hand timber is useful. A valuable source of sound stuff is the second-hand market, where many obsolete spring mattress frames can be bought. The larger ones provide a good proportion of the wood required. In any case, it is worth seeking out the best material that can be afforded because this bench will give a lifetime's service. It is important that the sizes of the various members are not reduced in any way, because these sizes have been found to give satisfaction over a long period.

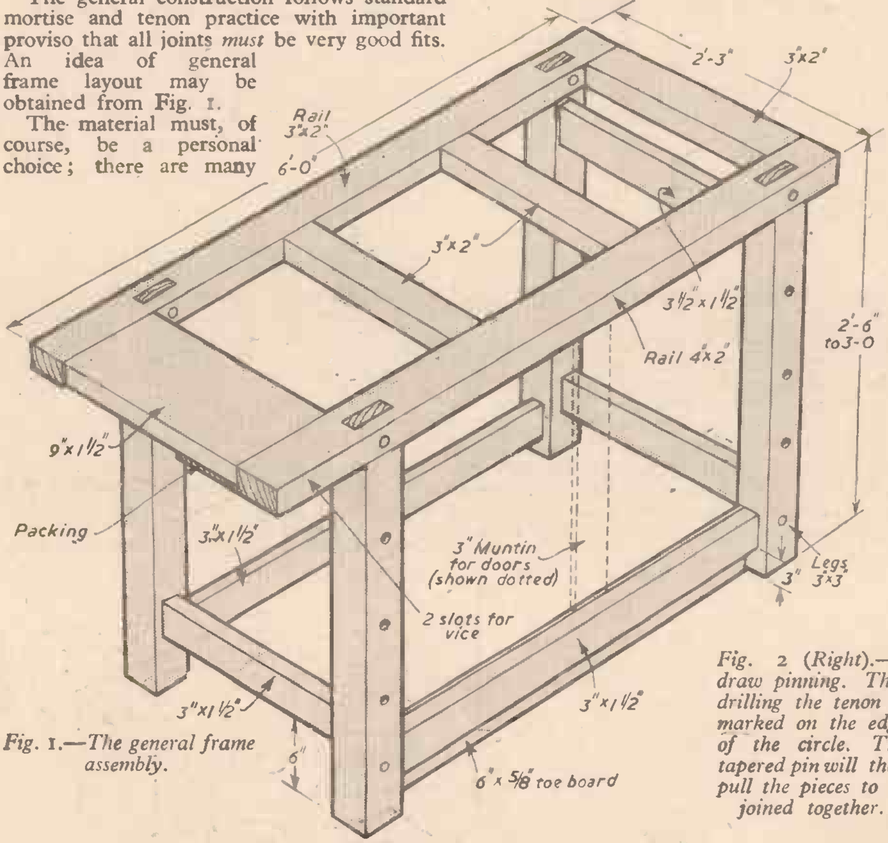


Fig. 1.—The general frame assembly.

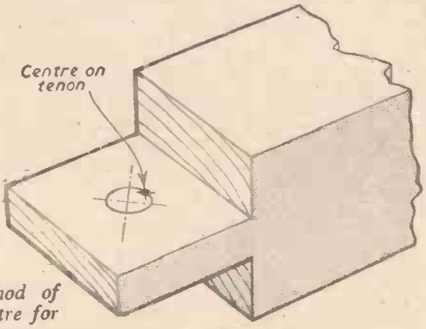


Fig. 2 (Right).—Method of draw pinning. The centre for drilling the tenon is marked on the edge of the circle. The tapered pin will then pull the pieces to be joined together.

The Top Frame

The construction is best done in sections, dealing with the top frame first, since this is the most important item. It must be both square and flat, so the greatest care should be taken with all the joints. The

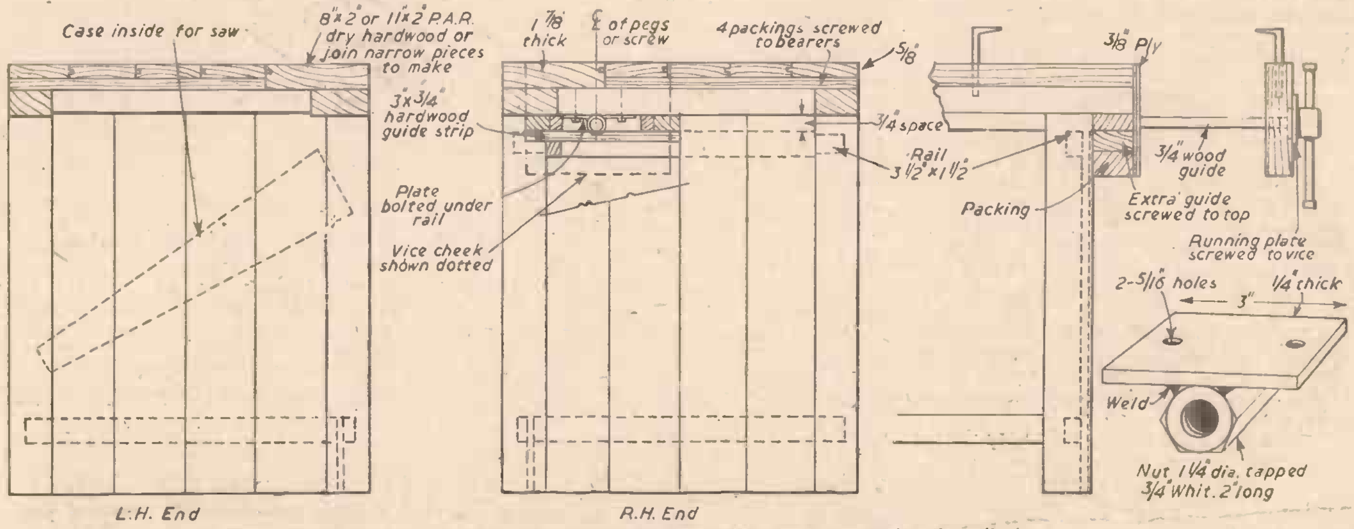


Fig. 3.—Views of the two ends of the bench and details for fitting the tail-vice.

end mortises are haunched mortises and the middle ones stump mortises. Those in the front rail should be 2½in. long and the back ones 2in. long. As it is very likely that many will not have the heavy cramps required to put this frame together, it is suggested that the very old and sound method of draw pinning be used.

After the frame is assembled dry and tested for truth, it is taken down and each *mortise* has drilled in it a central 7/16in. hole right through from side to side. Next the frame is reassembled, using a heavy hammer and a block of wood to drive home the joints. The bit used for the boring is pushed into each hole in turn, given a full turn and removed. Each tenon should now have a clear circle marked on it. Take apart and mark the centre for boring on the *edge* of the circle nearest to the shoulder on each tenon (see Fig. 2). Bore all the tenons. Now make a dozen straight pieces of wood 12in. long by ½in. to 5/16in. square. Roughly round these like a skewer. The taper gives a drawing effect and the holes being a half out of centre adds to the terrific compression possible by this method. All the old framed houses were assembled by this method and many old carpenters' tool bags had in them a draw pin forged by the local blacksmith to help start the pegs. Now, with all ready and some Cascemite glue to hand, glue up and assemble. Do not overdrive the pins, because the mechanical advantage of these is enormous. Once all is up and true, set aside to dry.

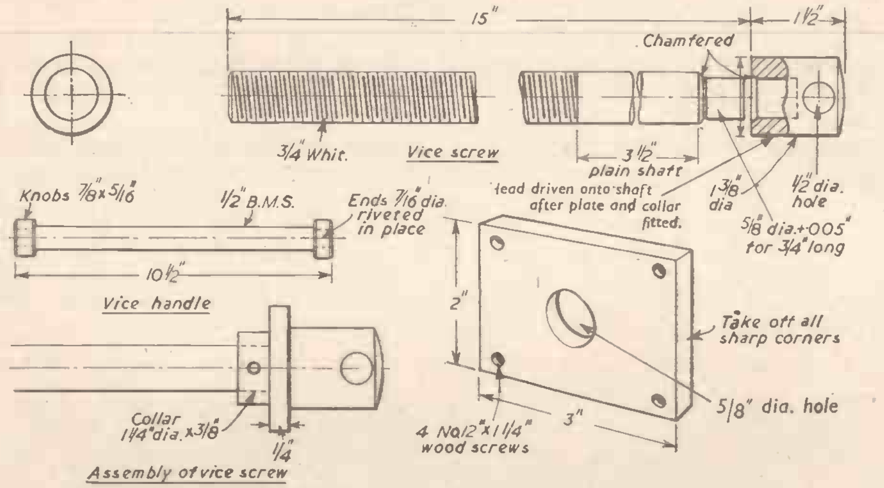


Fig. 4.—Details for making the vice screw and handle.

The Leg Frames

These again must be sound jobs. Decide which type of cupboard you wish to use underneath and set out the rails accordingly. As drawn, the top rails are intended to finish at ¾in. below the top of the leg tenon shoulder (to allow at right-hand end for the vice guides), see Fig. 3. Alternatively, several rails can be fitted at one or both ends to take drawers or additional shelves. Note in Fig. 3 provision for box to take a handsaw. Assemble these end frames true and square otherwise the finished bench will not be stable or stand level. The same method as for the top frame is used to pull the joints home and tight, i.e., draw pins.

Remember in setting out the rails to allow for sufficient space at the outside for the panels, i.e., the rail face must finish ⅝in. in from face of leg for ¾in. matchboarding and 3/16in. for hardboard panels.

Assemble the leg frames to the top frames, using draw pins as before.

The Tail Vice

Plane the guide pieces to a good sliding fit between the rail and the top frame; make packings as shown in Fig. 3 to form a square box to take the guide strips and pack out, finishing level with the end face of the top frame. A piece of ⅝in. or ½in. plywood screwed to the end rail of the top and to the packings will make a smooth surface and allow the tail vice to be used as an extra vice. Fig. 4 shows one method of making a screw, but these can be bought complete from Hamptons, of Sheffield, if no facilities are available for making one. Fig. 5 shows details of construction. Sycamore is usually used.

The Main Vice

The main vice is fitted to the wide rail at the left-hand end of the top. Standard vices will require two slots for the ribs behind the main cheek and packings will be needed to bring the vice cheek to 1in. from the top of the finished bench top. This is more than usual, but it provides a more efficient finish. A strip of hardwood at least as wide as the cheek is thick and more than 1in. thick is glued and screwed with brass screws to the edge of the top plank. Mushroom head bolts are used to bolt the vice in place (use hexagon-head nuts underneath); ¾in. block board makes efficient soft jaws.

The Top and Fittings

The top is fitted with No. 14 by 3in. screws in deep recesses which are filled in with pallets of hardwood and planed smooth. The tops of the vice cheeks are planed level with the top face.

The bench stops are easy to make from ½in. or ¾in. dowel rod, and at least three should be fitted square across the top; one at 1½in. from the front edge, the next at 1½in. between centres away and, finally, one at 1½in. from back edge of main top plank. Given care in fitting, these last a long time, but, in any case, are easily replaced.

In line with the centre line of the tail vice screw, bore ⅝in. holes 6in. apart, starting at 4½in. from the left-hand end. These holes take ⅝in. steel dogs (see Fig. 3). With these dogs wood can be clamped between the tail vice and any appropriate hole and work done on it without any risk of movement; carving and dovetailing is easy this way. In addition a strong pad can be contrived with holes to fit those in the tail vice so that this with a peg in the bench acts as a cramp.

The Cupboards

It is strongly recommended that the lower part of the bench be fitted out as store space. It is suggested that the space be divided into two by a wide muntin set in behind the lower rail and stumped into the top rail (shown dotted in Fig. 1). Behind this a hardwood panel is fitted to a similar muntin at the back. Two matchboard or panelled doors are fitted, the left one being fitted out with racks, etc., for all small tools in normal use. This door folds back on hinges on the muntin and if the pockets for tools are carefully made they will fit snugly under the top and be handy at all times. A floor of hardboard on battens will, of course, be needed. The top can be kept free of all tools and, since there is no well, it is only a minute's work to sweep all junk off on to the floor. The right-hand cupboard is useful for paints, varnishes and all sundries. To add to efficiency make a sawing board with a hole in it to match the holes in the bench top. Then, when sawing a difficult part, a peg pushed through the bench sawing board into a bench hole will stop all movement. Keep this at the right-hand end on a peg and do all your sawing here so that the waste goes on to the floor.

The holes in front of the legs (shown in Fig. 1) are for pegs to hold long boards or frames while planing or sawing in the main vice.

Finishing

Paint all framing with creosote and then apply hard brown spirit polish over this. Two coats each of this treatment will prolong life considerably and prevent staining.

For outside workshops it is recommended that the bottom 3in. of each leg be well tarred and then stood on thick bitumen felt.

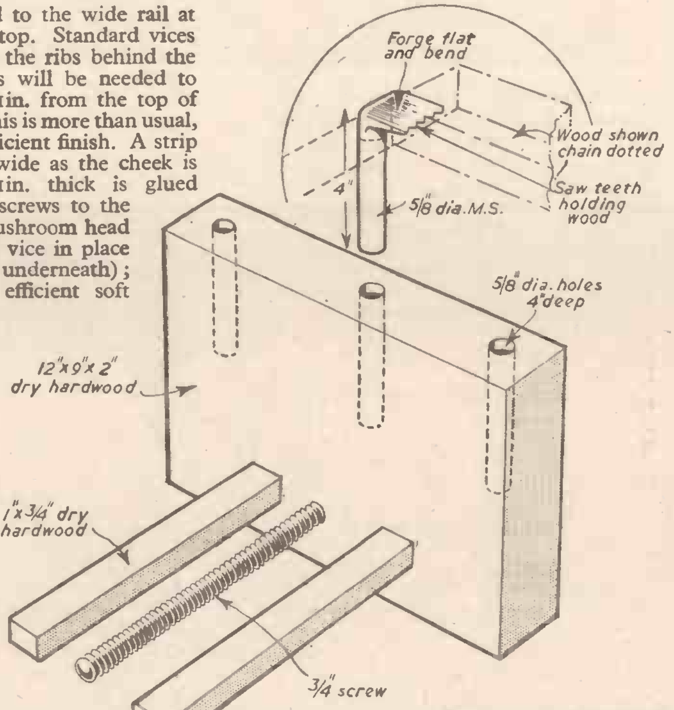
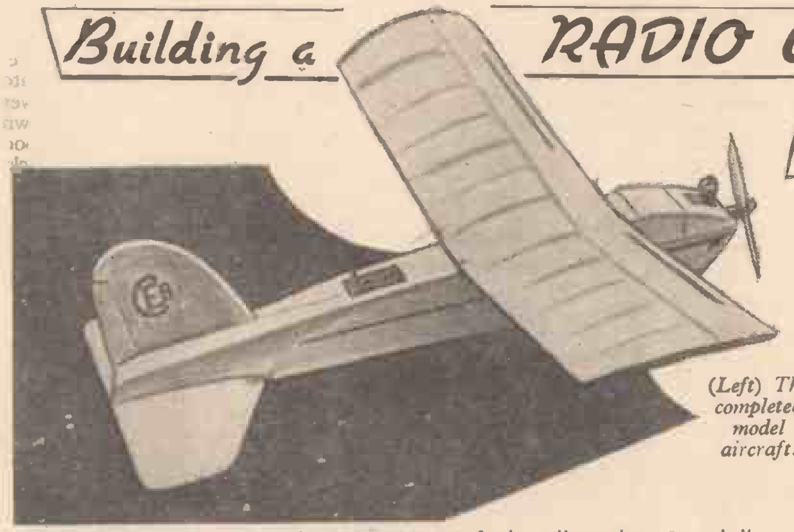


Fig. 5.—Constructional details of the pin vice.

Building a RADIO CONTROLLED MODEL AIRCRAFT

By Col. C. E. BOWDEN



(Left) The completed model aircraft.

A Description and Diagrams of the "Radio Rook"

(Concluded from page 519, September Issue)

NOW that the fin has been fitted to the fuselage, the whole can be covered with cheap " butter muslin " of light weight, obtainable at a fabrics shop. This material can be tautened over the fuselage, etc., after smearing the structure with photopaste. It is then doped with two thick-flowing coats of Cellon *full-strength tautening dope.* Real aeroplane dope is preferable to model dope, for it makes a lasting durable job, whereas model dope requires at least six coats, and is really too thin for radio models. One or two coloured coats of dope can then be put on, but remember too much " finish " weighs a lot, and always gets shabby through fuel, etc.

The Wings and Tail

These must be drawn out full-size from Figs. 11 and 12 on to kitchen paper, and the wings and tail *built over the plan,* with a sheet of greaseproof paper inserted between to prevent cement sticking to the plan.

Wing construction is very simple. First, lay down the trailing edge 1/16in. sheet balsa, and cement on the trailing edge spar of ⅛in. by ¼in. balsa and the ⅛in. balsa tip. Now lay down the central lower main spar and cement the ribs into their correct positions over the plan, cementing the ends of the ribs to the trailing edge and its sheet. Pin until dry. The spars can be of hard balsa, but if you can obtain it, spruce or obechi wood are best for these two main spars. They are the only hard-

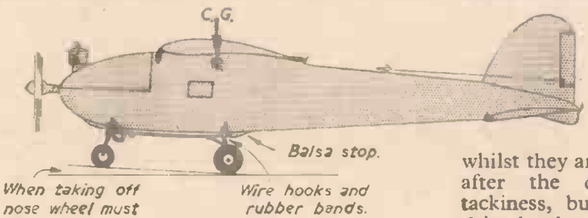


Fig. 10.—Aircraft in take-off position, with centre of gravity marked.

wood spars in the model. Now cement in the leading edge spars of balsa, 3/16in. by 3/16in.

The wing is best made in one piece on this size of model, but if transport forbids this it can be " split " at the centre. A one-piece wing is far stronger and more true, giving more consistent flights. Five foot is not a long structure to carry. Assuming you make the wing in one piece, the dihedral must now be put in as shown in sketch Fig. 13. One end is jacked up on a table or building board, and 12 s.w.g. wire centrepieces are bound and cemented to the various spars, with the trailing edge wire well plastic wooded into the rear sheet balsa. When set hard the whole wing is sanded down, and the leading edge is covered with light $^1/_{16}$in. sheet balsa, top and bottom, up to the central spars only, and at wing-tips, using plenty of cement to adhere to ribs, etc., and temporary pins. Cement in wing hooks, well reinforced by plastic wood, and reinforce the wire dihedral pieces with plastic wood on the inside of the sheet covering. Finally sand down.

Now cover with butter muslin or nylon. The first is cheaper, and is applied dry, using photopaste to stick down to the framework. If nylon is used it must be put on damp and allowed to shrink dry before doping. Apply two coats of full-strength full-scale aeroplane tautening Cellon dope, and two of colour.

The tailplane is made in the same way as the wing, only there is no dihedral to bother about.

Be sure to weight down surfaces to flat boards or table whilst they are tautening after the dope loses tackiness, but before it dries hard. Should any warps develop in spite of this, they can be twisted out in front of an electric stove, being very careful not to set the wings on fire.

Flying the Model

Make sure you have the angles of wing and tail correct, as shown on the side elevation of the fuselage drawing. Be sure there are no warps anywhere, and that wings and tail, etc., are set on square. If slightly out through poor building, pack up square with balsa.

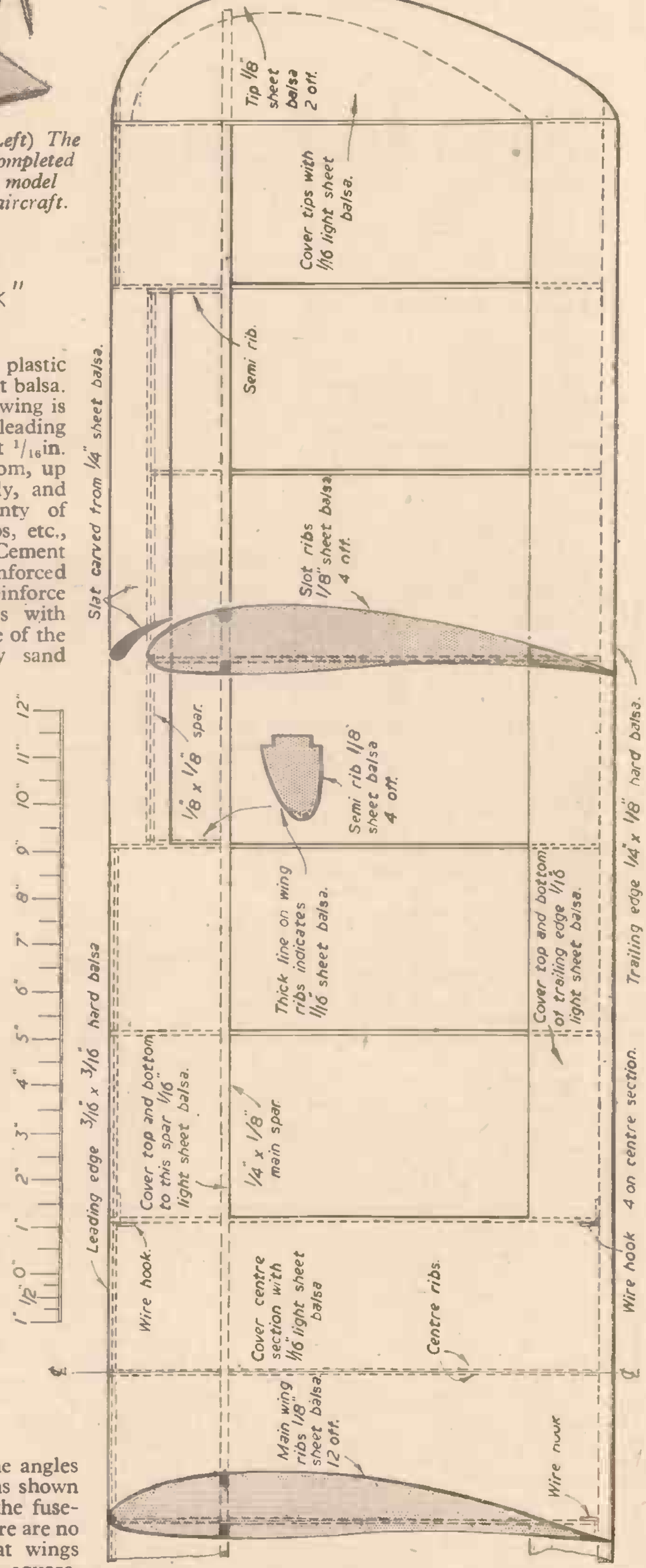


Fig. 11.—A scale drawing of the wing, showing details of construction.

Be certain that the model balances on the fingers at "C.G. Point of Balance," shown in Fig. 10. If not, due to poor building or balsa weight differences, move the balsa box slightly to get proper balance, *and then fix position.*

Now glide the model with radio in, over long grass, dead into a slight wind, throwing the model forward, and very slightly downward like a dart. It should glide nose slightly down, but flat. If it rears up in a stallish flight, put ⅛in. packing under the tail end of the fuselage and tailplane. If it dives too steeply put in a nose packing above the front end of the tailplane between tail and fuselage. Get the glide perfect by these methods, and then *never alter it*, for the model must glide properly when the power ends.

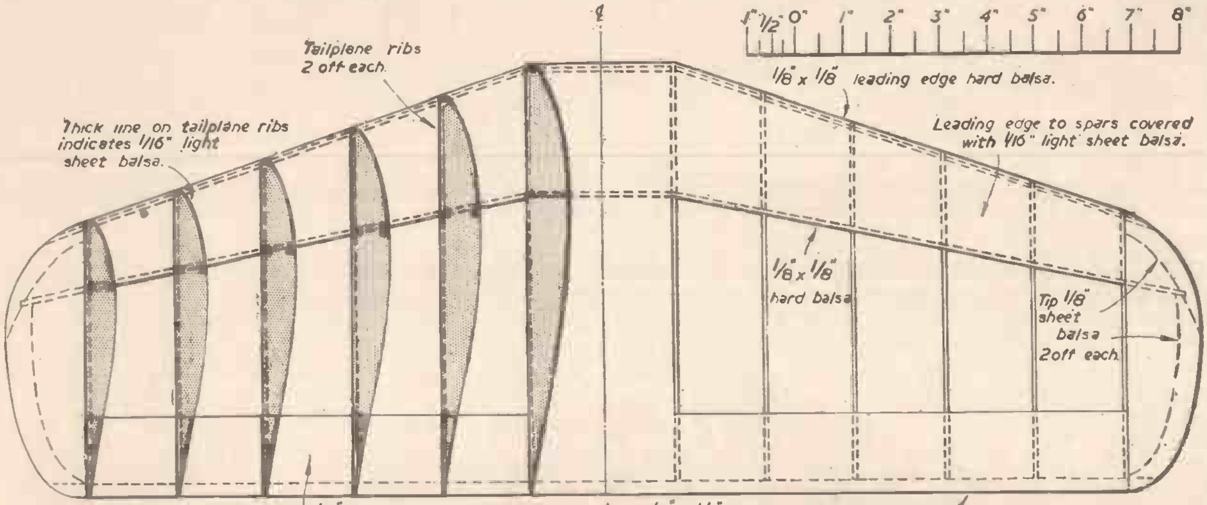


Fig. 12.—Scale drawing, showing details of the tailplane.

Now try power flight. Too stallish a flight under power is adjusted by a little more down-thrust of the engine, or vice versa. This is automatically built into the engine platform, and no change is likely to be required, unless you have an unusually powerful motor. If the model turns to the left too much under power, point the engine slightly more to the right by altering engine bolts. The engine should look right from above, looking forward, about 2 or 3 deg.

Try flying with radio, having the rudder to only half travel at first. Launch into wind, and allow the model to climb a little, then give *very swift and small bursts of rudder,* weaving the model up wind and climbing, steadily until you can handle it competently. *Never hold on a turn too long, until you have gained good height,* and then only do spiral diving long turn handling when you understand what you are doing. Turn more to the left than to the right when you start, for this is safer. To do a long turn give a short rudder left, a tiny one right, and follow up with another short left and so on. Later you can provide the rudder with full travel, and having gained height (good height), you can try some long periods with the rudder and start learning how to stunt. When the engine finally cuts you should steer the model by short turns into wind for the landing, *with a final approach dead into wind.*

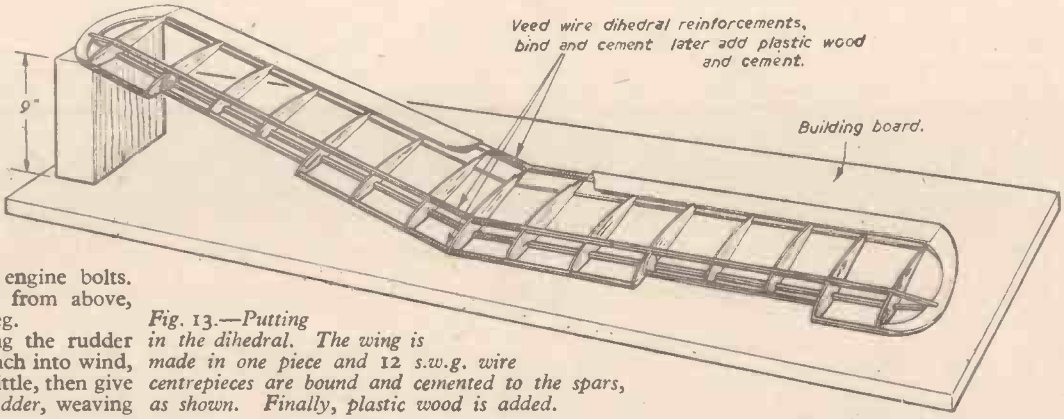


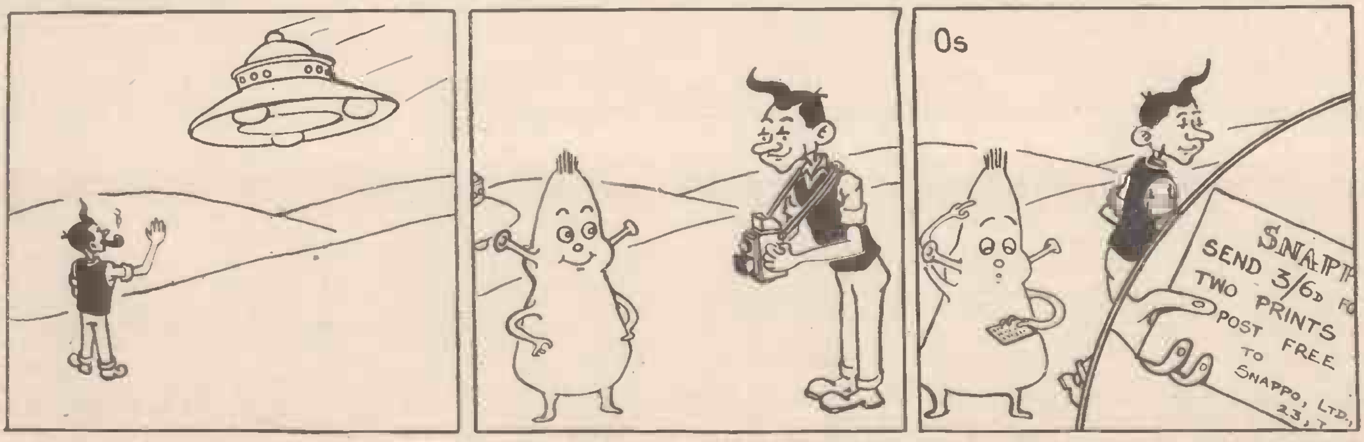
Fig. 13.—Putting in the dihedral. The wing is made in one piece and 12 s.w.g. wire centrepieces are bound and cemented to the spars, as shown. Finally, plastic wood is added.

With the E.D. clockwork actuator, there is provision to alter the amount of rudder travel. If the model always turns too much one particular way, adjust the rudder lines so that there is a trifle of offset to the rudder in the opposite direction, but first make sure that the model flies straight under power when the rudder is centralised, by engine offset adjustment, as already explained.

Home-constructed Radio-control Equipment

This article is intended mainly for the model aircraft enthusiast and consequently all the radio equipment mentioned is commercially made. The series of articles, recently published in PRACTICAL MECHANICS, however, entitled "Radio Controlled Models" included comprehensive instructions for building, installing and operating radio receivers, transmitters and other equipment, and many readers will, no doubt, prefer to build and use these in conjunction with the "Radio Rook." Finally, before any transmissions are made a licence should be obtained from Radio and Accommodation Department, Headquarters Building, G.P.O., St. Martins-le-Grand, London, E.C.1.

ANDY MANN THE PRACTICAL MECHANIC



A Computor for the game of Nim

A Device Which Ensures That the User Will Always Win

By P. DOWDING, A.M.I.Mech.E.

A YEAR or two ago a computer or " electronic brain " was seen which was playing the game of Nim and could not be beaten. The little computer to be described here will enable its operator to obtain similar results although not fully automatically. It is, however, very easy to operate and is completely reliable, and its operator can be quite sure of winning each time.

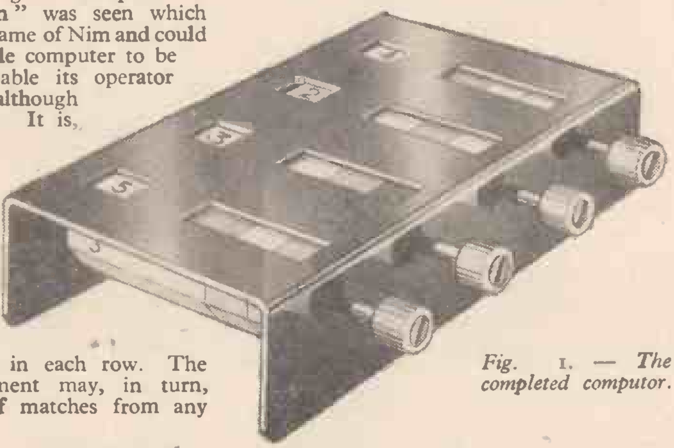


Fig. 1. — The completed computor.

The Rules of Nim

Matches are arranged in any number of rows and any number in each row. The player and his opponent may, in turn, remove any number of matches from any row ; in fact, a whole row may be taken. The object of the game is to continue in this manner until all of the matches are removed, but the person who is forced to take the last match is the loser.

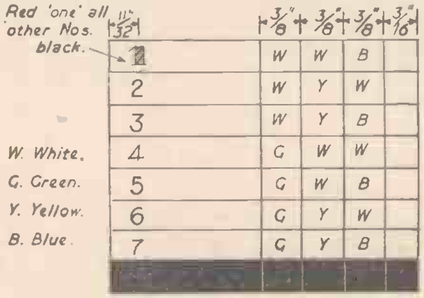


Fig. 2.—A developed view of a drum giving the colour sequence.

It would be as well for those not familiar with the game to play two or three times in order that the subtleties are fully appreciated.

Mathematical Theory

The game lends itself to mathematical treatment and, providing that certain rules are obeyed, it is possible for a player to beat a less knowledgeable opponent every time. These rules are difficult to work out mentally and the computor is designed to do the job instead.

To understand the mathematics of this game it is necessary to know something of the binary numbering system. In everyday life we are accustomed to counting in the decimal system, in other words, our calculations are made to a base of ten. The number ten was almost certainly chosen by our primitive ancestors because of the convenience of counting or tallying on their fingers. It has been suggested that twelve would be a more convenient number, as it is divisible by two, three, four and six, whereas ten can only be divided by two and five. If such a system were ever introduced it would be necessary to invent two new symbols for the extra digits.

The binary numbering system became important when the digital computer or " electronic brain " came into being. As this system uses the base of two, numbers can be represented by a series of electric pulses. In order to clarify this statement some binary and decimal numbers are compared.

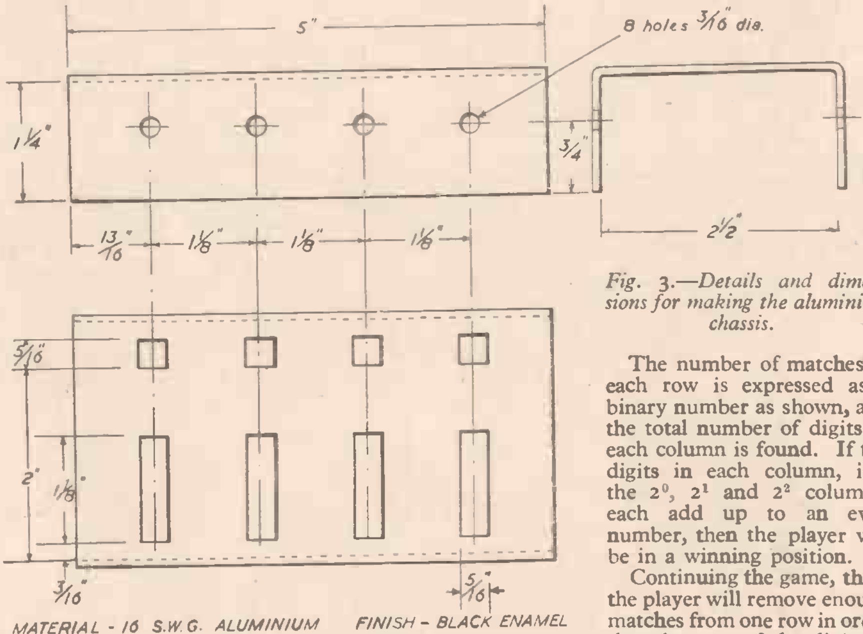


Fig. 3.—Details and dimensions for making the aluminium chassis.

Decimal	Binary	
1	1	(2^0)
2	10	(2^1)
3	11	
4	100	(2^2)
5	101	
6	110	
7	111	
8	1000	(2^3)
9	1001	
10	1010	
16	10000	(2^4)
32	100000	(2^5)

Clearly, then, in the computer, the number ten would be represented by the following pulses : on, off, on, off.

Without going too deeply into the matter, it may be said that by converting from the decimal system to the binary system, simple rules may be made for Nim.

A Sample Game

Let us assume that the matches are set out as follows :—

Row		Binary Number 2^2	2^1	2^0
a	IIIIIII	1	1	1
b	IIIIII	1	1	0
c	IIIII	1	0	1
d	III		1	1
Totals (decimal)		3	3	3

The number of matches in each row is expressed as a binary number as shown, and the total number of digits in each column is found. If the digits in each column, i.e., the 2^0, 2^1 and 2^2 columns, each add up to an even number, then the player will be in a winning position.

Continuing the game, then, the player will remove enough matches from one row in order that the sum of the digits in each row will be an even number. Hence by removing all of the matches from row (a), the position will be :—

Row		Binary number
b	I I I I I I	110
c	I I I I I	101
d	I I I	11
	Totals	222

Let us now assume that the opponent does not know these rules and he takes, say, three matches from row c so that the position is :

b	I I I I I I	110
c	I I	10
d	I I I	11
		131

now the player will take five matches from row b

b	I	1
c	I I	10
d	I I I	11
		22

Without proceeding further, it can now be seen that, although the opponent has many possible

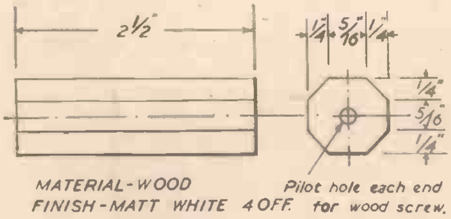


Fig. 4.—Details and dimensions of the drum.

moves, he cannot win. For example, if he takes all of row d, the player will take row c and the opponent will be left with row b. Alternatively, if he takes one from row c, the player will take two from row d. Then the opponent takes one row, the player another and the opponent the last. By considering all of the possible alternatives it can be seen that the player is truly in the winning position.

There is just one small departure from the "even sum of digits rule." Supposing that the game takes the following form :

a	I I I I I	101
b	I	1
c	I	1
		103

According to the previous rule, we should take all of row a. Our opponent would then, of course, take row b, and we would be left with the last match. Thus the second rule is that if there are two rows containing one match and one row containing any other number, then the correct play is to take all but one match from the last row. It will then be seen that the player will be in a winning position. This second rule will only come into operation towards the end of the game, if at all, and can be very easily applied.

Construction of the Computer

As can be seen from Fig. 1, it consists of an aluminium chassis and four drums. The developed view of a drum (Fig. 2) should be compared with the table of binary and decimal numbers, and it will be seen that each binary number is represented by coloured blocks. Different colours are used for the 2^0, 2^1 and 2^2 digits in order that each column may be quickly identified.

The chassis, although originally made from aluminium could be made from stiff cardboard if metal-working facilities are not available. All the details and dimensions necessary are given in Fig. 3. The four drums are all identical, and are made from wood. Starting with a piece of square section, the corners are planed off at 45 deg. to produce the correct shape, as shown in Fig. 4. Each drum may be given a coat of flat white paint, and when dry, the other colours added. The numbers should be marked on with indian ink. The operating knobs were made from turned brass buttons soldered to wood screws, as shown in Fig. 5. Small cupboard door knobs with screws moulded in could be used instead. After assembly the drums should revolve freely.

Using the Computer

Each drum is moved in turn so that the number appearing in the small window is equal to the number of matches in the equivalent row. If there is an even number of green, yellow and blue blocks showing, i.e., nought, two or four green ; nought, two or four yellow; and nought, two or four blue, then the operator is already in a winning position, and the opponent should be invited to move first. If, however, there is an odd number in any or all of the columns, then one drum should be turned until the correct state if found, remembering of course, that matches can only be taken away and not added.

It may be thought that it will be necessary to experiment with each drum in turn in order to find the row that needs attention. In actual fact, however, after a few games, a quick

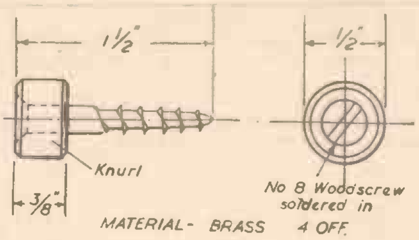


Fig. 5.—The operating knobs.

glance will be all that is required in order to determine which row needs adjusting. Having made this adjustment, the number of matches in the equivalent row is reduced to the number shown in the small window. If it is necessary to move a drum into the blank position, then, of course, all of the matches in that row are removed.

When the operator has made a move, his opponent may make his move, but he cannot be displaced from his superior position. The procedure is repeated right to the end of the game.

Occasionally the special rule relating to two rows of one plus a third row, will have to be applied. If this is the case, then a reminder will appear on the computer in that the figure one on each drum is painted boldly in red. This situation will in any case, as previously mentioned, only occur towards the end of a game.

Although the theory of the computer is a little complicated, in use it will be found to be surprisingly easy to manipulate.

Making Luminous Paints

Some Formulæ for Experiment

DURING the course of the year we have a very large number of requests from readers who wish to make luminous paints or inks. The formulae given below should provide a good basis for those who like to experiment in this direction.

A base or vehicle is needed to carry the actual paint and this can be made from the following ingredients : Zanzibar or Kauri copal, 6 parts ; oil of turpentine, 24 parts ; pure linseed oil, 10 parts.

First melt the copal and dissolve in the turpentine, strain and add the linseed oil, which has been previously heated and allowed to cool. The resulting solution completes the base or vehicle of the luminous paint.

The paint itself is composed of 10 parts of the base ; 1½ parts of barium sulphate ; 3 parts of white zinc sulphide ; 1½ parts of of calcium carbonate ; and 9 parts of luminous calcium sulphide. To obtain the last-mentioned chemical it may be necessary to send away to a manufacturing firm, as calcium sulphide is not in general use. It is listed by Messrs. Griffin & Tatlock, Ltd., Kemble Street, Kingsway, W.C.2.

Coloured Luminous Paints

Red can be made by mixing together 30 parts of the base ; 1 part of madder lake ; 4 parts of barium sulphate ; 3 parts of sulphide of red arsenic, and 15 parts of luminous calcium sulphide.

The formula for green luminous paint is 12 parts of base ; 2 parts of green oxide of chromium ; 2½ parts of barium sulphate ; 8½ parts of luminous calcium sulphide.

For yellow luminous paint, the following are required : 12 parts of base ; 2½ parts of barium sulphate ; 2 parts of barium chromate ; 8½ parts of luminous calcium sulphide.

For violet luminous paint, use 21 parts of base ; 2½ parts of ultramarine violet ; 4½ parts of cobaltus arsenate ; 5½ parts of barium sulphate; and 18 parts of luminous calcium sulphide.

Luminous Ink

This is very easily made by mixing a small quantity of calcium sulphide with thin gum water. Anything written with this ink must, however, be exposed to daylight before it will become luminous. If you wish to avoid the trouble of making the ink, or cannot obtain the calcium sulphide, similar luminous writing can be done, by inserting a piece of phosphorus in a penholder and writing with that.

Ghostly Light

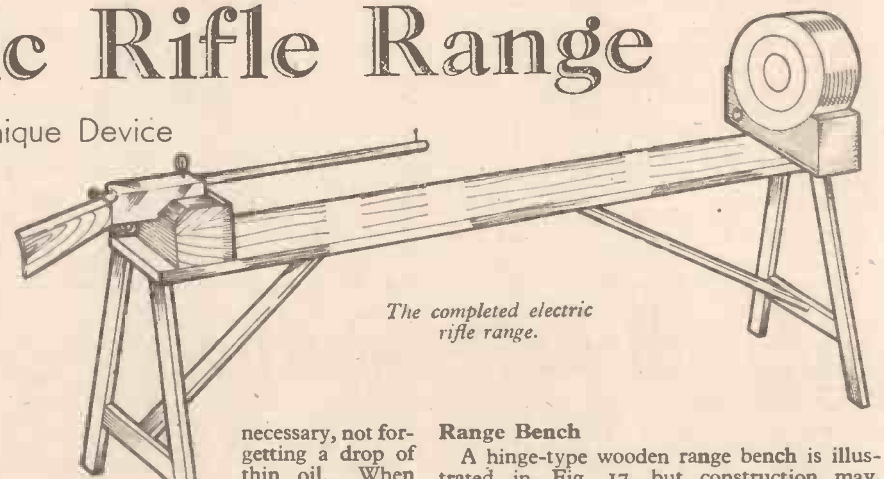
Articles dipped in olive oil, which contains a small amount of phosphorus, give out a weird greenish light that is excellent for amateur theatricals, where ghostly lights, etc., are needed for a good effect. The bottle containing the olive oil and phosphorus also makes a novel nightlight, for when the cork is taken out of the bottle, a light immediately appears to enter the bottle, running down from the neck to the surface of the oil, and if the cork is placed back this light will continue to glow for some time.

An Electric Rifle Range

Try Your Skill Indoors With This Unique Device

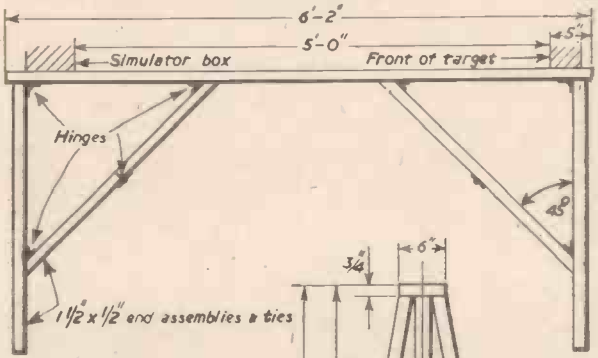
(Concluded from page 512, September issue)

By R. BRIERLEY



The completed electric rifle range.

THE simulator shown in Fig. 16 is built up from wood faced with brass washers. Each washer has a short wire soldered to its rear, which runs through a small hole in the bobbin to connect with a rear terminal bolt. Small countersunk screws secure the washers to the bobbin, which must be a tight fit in the simulator box. The centre target pin is insulated from the inner washer. Inspect all components prior to assembly of the rifle unit.



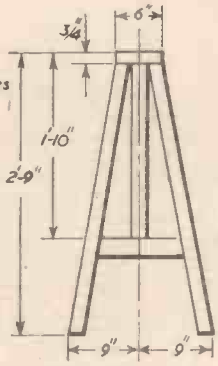


Fig. 17.—Side and end views of the range bench.

Assembly of Rifle Unit

Check the assembly of the firing mechanism. The rifle is " loaded " by withdrawing the bolt until the sear clicks into position to retain it. It is aimed at the target, and " fired " by pressure on the trigger which releases the sear, allowing the bolt to jump back to the unloaded position. Proceed by threading the other end of the rod through the wrapper plate and screwing the knob tightly on to the rod end. Eight No. 6 screws secure the wrapper plate to the butt, sear spring block and body block. Test the firing action and make any adjustments necessary, not forgetting a drop of thin oil. When the action is satisfactory, secure the trigger guard and glue the rifle barrel into the body block, ensuring the front sight is vertical. The rear sight is screwed into hole A (Fig. 13).

Range Bench

A hinge-type wooden range bench is illustrated in Fig. 17, but construction may, of course, be varied if desired. Staining and polishing will greatly enhance the appearance.

Target

The 10in. diameter target (Fig. 18) is constructed as a separate unit. A semi-circular rear wooden piece is cut first and this is screwed to the base together with the wooden front piece or saddle. The tinplate or metal casing forming the outer target portion is then screwed to this saddle. Should a suitable piece of material be available for this casing, the size will be approximately 4½in. x 32in. long, but this length may be made up of short lengths of tinplate, folding them together or lapping one over the other. Two similar but smaller units which form the internal compartments of the target are assembled individually in the same manner. Bulb contact strips are positioned with a single screw in each case. Connecting wires may be soldered to the front contact strips at this stage. In the case of the leading and centre compartment, the backing strip is soldered to the cylindrical piece in order to support same. Bulbs may now be mounted in each compartment and tested. Assemble compartments, commencing at the centre piece or " bull," threading its connecting wire through the hole in the rear of the next compartment and dropping a spacing ferrule on the bolt

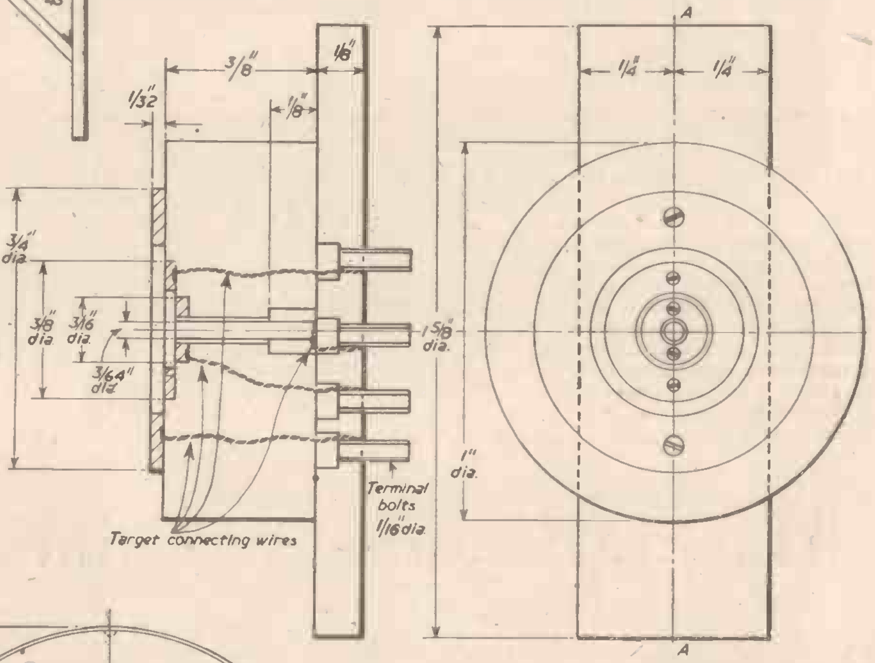
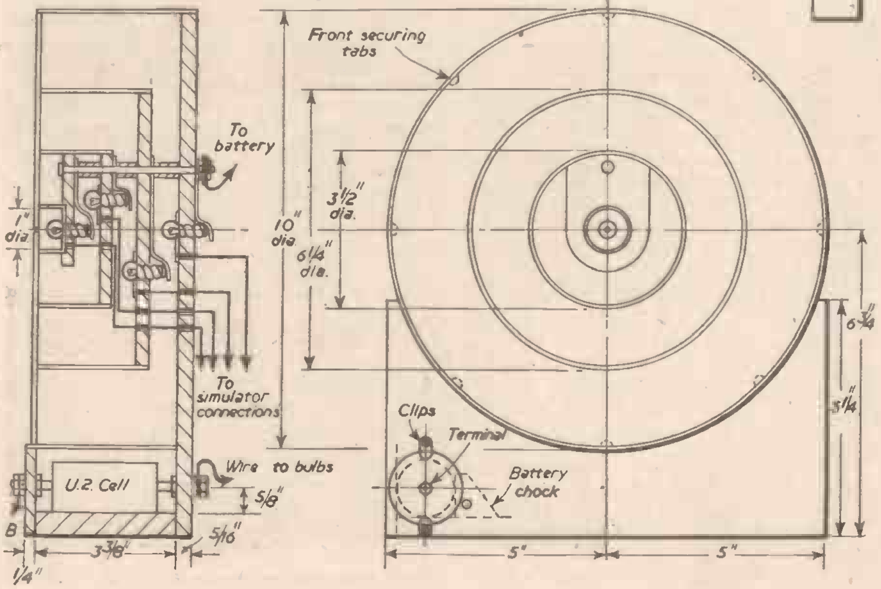


Fig. 16.—The target simulator.
Fig. 18 (Left).—The target.



between compartments. Continue in this way, finally tightening the nut and adding a terminal nut for the battery connecting wire.

A Perspex disc 10in. diameter is most suitable for the front, which is retained by tabs around the periphery. Coloured, transparent papers may be stuck to the inner side of the Perspex if desired. To allow access to the battery a 1½in. diameter hole is bored at the front target base, a combined cover and terminal being secured with two clips. A small wooden chock serves to retain the battery.

Final Assembly

The target and rifle unit may either be screwed to the range bench or may locate on dowels to facilitate storing. Set the units carefully in the position shown in Fig. 17, and align by running a piece of thread from the small hole in the target centre through the two sights. Set the rifle mechanism in "fired position," with the dart on the simulator centre or "bull." Adjust the front sight until the thread is "dead centre" within the bead hole. Tighten all mounting screws and check alignment. Couple up the battery wires and test each circuit before finally screwing the top shield in position. The unit is then ready for use.

A Ball-bearing GARDEN-ROLLER

Cheap to Make and Easy to Propel

By I. W. BRASSINGTON

THE usual home-made garden roller has a spindle running in a hollow tube, without bearings of any sort, and this obviously makes hard work of lawn rolling. A roller with ball bearings is a vast improvement.

Obtain a five-gallon oil drum and cut out one end with an old-type tin opener. In most cases the seam will be on the side of the drum, so the cut will have to be made actually on the side, too, and, of course, just below the seam. This will allow the roller to be more easily removed from the drum when the concrete is set. For the same reason, the inside of the drum should be greased or oiled before use, and stood on end.

Next, get hold of the complete hubs (with some spokes, if possible) from two old *front* bicycle wheels. One of these will be set in the concrete at each end of the drum, but before they are ready for use the spindles must be moved along to one end, so that this extra length will protrude from the ends of the roller, for the handle to fix on to. To do this it will be best to dismantle the hub completely, repack the bearings with grease, and thoroughly clean the thread. Be sure to hold the job over a box of some sort, which will catch the ball bearings as they drop out. Fig. 1 shows a hub in section, and moving the spindle along is merely a matter of unscrewing the cone at one end and tightening the other to correspond. So that this adjustment shall remain permanent on the end which will be set in the concrete it is a good idea to ruin the thread either side of the cone. The outer cone will be adjustable, so only needs a lock-nut.

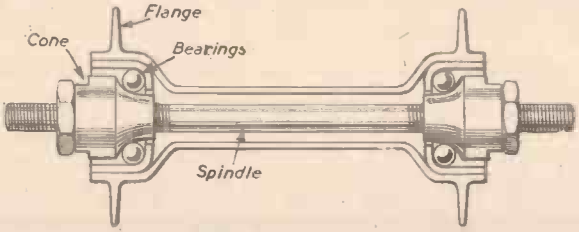


Fig. 1.—Section through a front cycle hub.

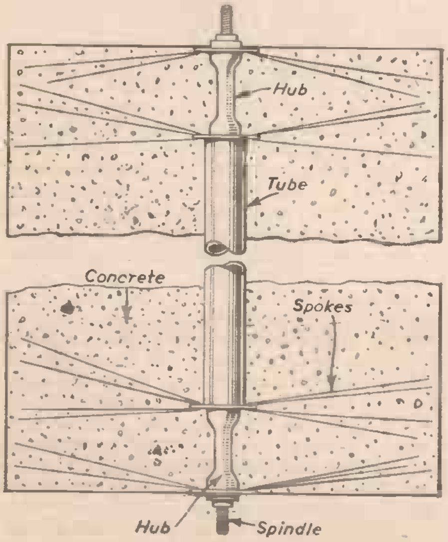


Fig. 2.—How the hubs are positioned.

A circular hole must now be cut in the bottom of the drum, just large enough to allow the cone to pass through. The flange will, therefore, rest on the inside of the bottom of the drum and prevent concrete from running through when the drum is being filled. When cutting this hole I was fortunate enough to get hold of a tool called a tank-cutter, which is used in an ordinary brace. Most plumbers would, I imagine, count them as part of their kit.

To find the centre point for this hole upturn the drum, press a sheet of newspaper on top so that an impression of the edge of the drum is made on the paper. Cut around the impression, obtaining a circular piece of paper, the exact size of the drum. Fold this in two directions and the point of intersection of the folds gives the centre, and the template is placed once more on the drum.

Filling the Drum

Now the drum is placed ready for filling, with the first hub in place, the spindle protruding through the hole in the base. Because of this it will be found necessary to raise the drum an inch or so off the floor.

The filling can now be commenced. Three small buckets of chippings, two of sand and one of cement are more than enough for this size roller. A 2in. covering should be worked into the bottom to hold the hub in place and pieces of the spokes, bent in all directions, threaded through the spoke-holes in the flange, to key the hub in place. As the filling continues put in any odd bits of heavy metal, iron bars, etc., which you may have lying around. A few pieces of chicken netting will help to reinforce the concrete.

One point which must be borne in mind is that the inner ends of the spindles must not be set in the concrete. I avoided this by putting a metal tube between the hubs, as shown in Fig. 2. Being cut to the correct length, this had the advantage of holding the upper hub at the correct height until the concrete set. When the filling is complete the drum should be left undisturbed for a fortnight.

The handle is a matter which will be determined either by individual taste or by the material available.

The completed roller, which is shown in Fig. 3, is an extremely handy size, weighing a little over 1 cwt. and handling quite effortlessly.

Fig. 3.—The author's roller.

Using Lenses

No. 2.—Telescopes and Compound Systems

By F. G. RAYER

SOME optical devices require a number of lenses, it being impossible to accomplish the desired result without these. For example, several lenses are necessary in a microscope designed to give high magnification, while further glasses may be required to obtain an image the right way up, as in a telescope. Though such arrangements become a little more complicated than do simple magnifiers and similar devices satisfactory optical assemblies can easily be achieved when the correct method is known.

It is important to remember that the manner in which a lens functions depends upon the relationship between image and object distances, as well as the focal length. Fig. 1 will help to make this clear. Here, A may be considered the object of which an enlarged image B is to be obtained. This is exactly what happens in a lantern or projector, for example, A being the plate or slide and B the screen or picture produced. As the image is larger than the object enlargement has taken place. The same lens may be used for reduction, in which B would be the object and A the image. This arises in some equipment, such as a camera, B representing the scene photographed and A the much-reduced image on the film.

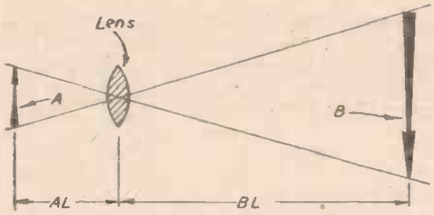


Fig. 1.—Object and image distances.

The magnification will be at maximum when A is the object, AL the focal length of the lens, and BL very great. As distance BL is reduced, distance AL requires to be increased, to maintain a sharp image. This continues until AL and BL are the same, when object and image will both be at the same distance from the lens, equal to twice its focal length. A simple example of the practical outcome of this may be found in a projector—as the projector is moved away from the screen the picture increases in size, but the lens needs to be slightly nearer the slide for sharp focus. The ability to vary magnification in this way can be used in telescopes, microscopes, etc.

When calculation is required the Linear Enlargement can be found from the formula:

$$\frac{BL - F}{F}$$

where F is the focal length of the lens, and BL the distance from lens to image (Fig. 1).

Optical Bench

The separation required between lenses can easily be found by trial, if the lenses can be placed at various distances apart. This may readily be achieved by using an optical bench, or strip of wood marked in inches. Small blocks of wood under the lenses will bring their optical centres in line, when necessary, as indicated in Fig. 2, and they may be held upright by modelling clay or any other suitable material.

A test of this kind is always wise before making a microscope, telescope or other apparatus with several lenses, in order that the best spacing may be found from the scale or rule. This will avoid making lens tubes too long, or the reverse, and the distances can be ascertained accurately and the mounts and tubes fashioned to suit. It is impossible to hold the lenses in the hands, especially with more than two, but when arranged as in Fig. 2 they can be looked through exactly in the same way as the finished equipment.

Microscopes

These are considered first, because the same optical system is often found in a telescope, with the addition of an object lens. A microscope may consist of two lenses mounted in a tube, as shown at A in Fig. 3, though additional glasses will usually be present. The two-glass microscope has disadvantages, one of which is the relatively long tube length—as much as 2ft. may be required. For this reason it is not often employed, though it does have practical applications, especially in low powers, where the tube does not require to be long.

Three or more glasses are more usual, as greater magnification is obtainable with short tubes, and a four-lens microscope magnifying approximately 20X is shown at B. The magnification may be increased by using an objective (lower lens) of shorter focal length or by using an eye-piece (upper lens) of greater magnification. Magnification can also be increased by employing a longer tube. The separation of all lenses can be fixed, focusing being carried out by varying the distance between objective and stage. The usual mirror directs light up through transparent objects.

With multiple lens systems stray light is reflected from the inside of the barrel containing the lenses, reducing the clarity and contrast of the image. This can be avoided by inserting stops between the lenses—discs with small centre holes. Such stops also increase definition by cutting off the extreme edges of the lenses, where aberrations are most severe.

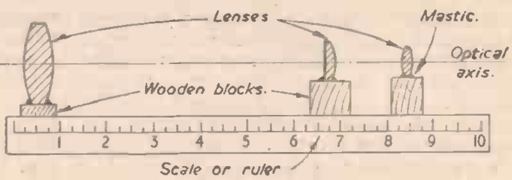


Fig. 2.—An optical bench.

The manner in which a microscope magnifies will become most clear after considering the optical system of a telescope, where the presence of a virtual or aerial image is most readily demonstrated.

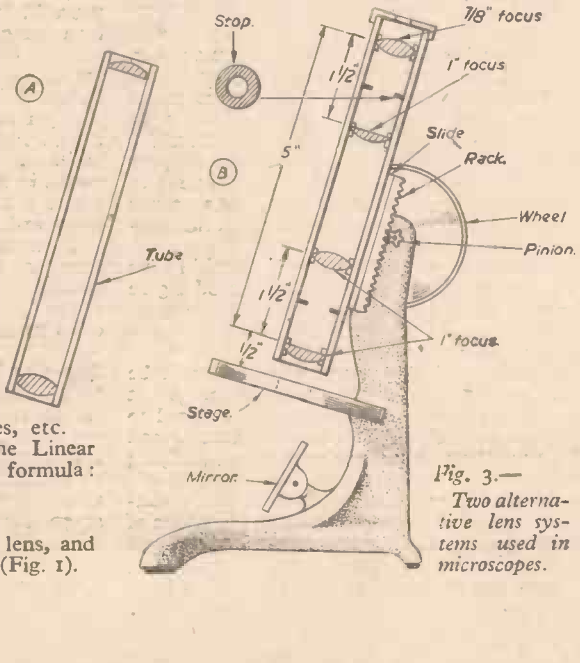


Fig. 3.—Two alternative lens systems used in microscopes.

Astro Telescope

The astronomical telescope gives an inverted image of the object upon which it is directed, and a typical type is shown in Fig. 4. The object lens is an achromat, as this gives best definition, and will have a focal length of about 16in. to 20in. in small hand telescopes, increasing to 30in. to 40in. in types requiring a tripod. Other things being equal, the final magnification of the telescope will increase as the focal length of the object lens is increased, and observatory telescopes have lenses (or mirrors) of extremely long focal length.

When the telescope is directed at an object at infinity, an aerial image of the object will be formed at the distance of the focal length, as in Fig. 4. This aerial image may be observed by placing a sheet of ground glass at this point. However, when the instrument is in normal use, the aerial image is virtual only, not being made actual or observable by the presence of such a screen. Instead, a short focus lens, or eyepiece giving high magnification, is arranged to observe the aerial image. The final result, to the observer, is thus a magnified impression of the aerial image, or enlarged view of the object upon which the telescope is directed.

The same arises in a microscope, except that the distance from object to lens is now smaller than that from lens to image (see Fig. 1). As a result, an enlarged aerial image is cast at a certain plane in the tube, which is observed by the eyepiece. As the object/lens distance (AL in Fig. 1) is modified, so the

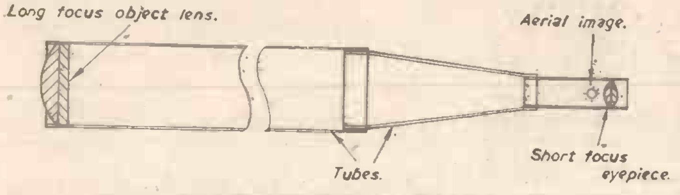


Fig. 4.—Astro telescope.

lens/aerial-image distance (BL) changes, as explained. Sharp focus is thus such a setting that the aerial image coincides with the position of focus of the eyepiece.

When an image is cast by a lens it is upside down, and this explains the inversion in the astro telescope. In order to obtain an image the correct way up the eyepiece must invert the aerial image. This can be done by erector glasses, a prism, or by using any form of reversing magnifier system for the eyepiece end of the telescope. The microscope system at B in Fig. 3 inverts the object observed, and is thus perfectly suitable for a terrestrial telescope (one showing objects the correct way up). The complete optical system of such a telescope is shown in Fig. 5, the object glass being of any convenient focal length. For a telescope to hold in the hand 10in. to 14in. would be suitable. Greater magnifications would be difficult to apply successfully unless the telescope were on a tripod.

Only the distance between object glass and eyepiece assembly need be adjustable, so that the aerial image can be brought into sharp focus. Apart from using an object glass of longer focus, magnification may be increased by using an eyepiece assembly of *shorter* focus, or greater magnifying power.

The terrestrial telescope optical system is not used when erection of the image is not required, since some loss of light and detail arises in the extra lenses required. The four small lenses in Fig. 5 will be spaced exactly the same as those in Fig. 3, and stops may usefully be added. The distance between object glass and tube, for infinity, will be the focal length of the object glass plus the lower focus of the eyepiece assembly (½in. in the example). For viewing nearer objects tube and object glass must be separated slightly. A movement of 1in. to 2in. will normally be ample, but this is best tested on the optical bench, as it will be impossible to focus near objects if the adjustment is too limited.

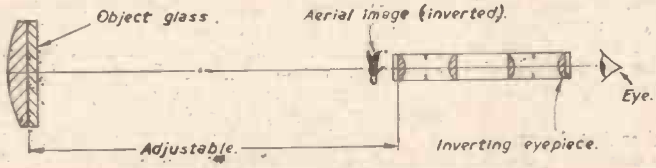


Fig. 5.—Optical system of terrestrial telescope.

For the highest magnification an object glass of very long focus is required, and an eyepiece or eyepiece assembly of very short focus. Exact calculations are likely to prove disappointing or inaccurate, especially with ex-Service or other lenses where the exact focal length is not known. However, a good approximation to the magnification of a telescope may be found by measuring the distance between object glass and image, as thrown upon a screen, and the focal length of the eyepiece assembly, and dividing the former by the latter. For example, a 30in. object lens and ½in. eyepiece assembly would give a telescope with a power of 60X.

Light-gathering Ability

As binocular or telescope magnification is increased, the brilliance of the image falls. This also depends on the light collected by the object glass, from which it will become apparent that large object glasses will give a brighter view.

With binoculars magnification and light-gathering power are usually expressed by a set of figures, such as (a) 8x30, (b) 6x25, (c) 10x50, (d) 8x50, or whatever the case may be. Here the first figure gives the magnification. Both (a) and (d) would thus magnify 8 times, while (b) has a magnification of 6 and (c) of 10. The remaining figures give the diameter, in millimetres, of the object glass, this being an indication of the brilliance of the image. Both (c) and (d) have lenses 50 mm. in diameter, while (a) has a lens 30 mm. in diameter and (b) one of only 25 mm.

The significance of these figures will become more apparent from Fig. 6. This shows two object glasses, one of 30 mm. and one of 50 mm. diameter. At first sight the difference may appear of no great importance. However, the light-gathering ability of the lens depends on its *area*—and the area of the 50 mm. glass is almost *three* times that of the 30 mm. glass, so that an image of nearly thrice the brilliance would be expected. It is for this reason that lenses (or mirrors) of very large diameter are used in astronomical telescopes, where the light may be exceedingly poor. For small telescopes of this kind a lens 2in. to 3½in. in diameter is good,

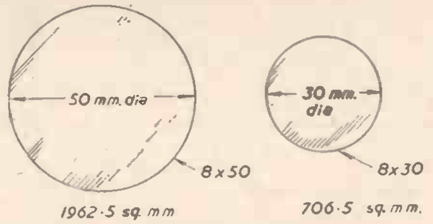


Fig. 6.—Binocular objective ratings.

while a lens 1in. to 1½in. will do well for the terrestrial telescope, since magnification will be lower.

Science and Observation

By Prof. A. M. LOW

Travel Sickness

CAR-, train-, flying- and sea-sickness are all unpleasant, but the car type is one of the most mysterious. The basic reason, no doubt, is that many cars are still sprung like a stagecoach. Designers have forgotten that every wheel should be independent and the moving parts so light that *they* will do the jumping instead of the passenger.

Cures are rather weird, except for the various chemicals which partly paralyse the balance apparatus near our ears. Some find that sucking a lemon is good, perhaps because it distracts the attention, or it may have some astringent action which is useful. Others find that glucose helps, or they suck barley-sugar.

Queerest of all, I learn from correspondents to the press regarding this subject that to put a piece of brown paper on your back under a coat is a good plan. Another says that to sit on a folded newspaper means certain safety. My view is that these are positively super-psychology. But I at once begin to think of electrical insulation, or even the generation of electricity by friction between coat and paper, or between where you sit down and brown paper.

Then I recollect the brown paper and spark experiment, when by pulling the dry paper under your arm quite nice sparks can be drawn from it with the knuckle. An alternative possibility is that the paper provides a slippery seat, and thus the innumerable little jerks as each cylinder fires or as the car progresses (not smoothly) forward do not reach the body undamped.

The point is: which is best? Should I slide as if rowing in an outrigger, or should I glue myself to the seat?

New Fuels

I BELIEVE that many new fuels will be employed by our grandchildren. What we now regard as explosives will be used to release their energy in a suitable manner and this will help us to have such things as flying cars.

From the many suggestions as to the conversion of coal to oil comes the obvious idea of mixing the two. The coal would be in a form so finely divided that it would remain suspended in the oil almost indefinitely.

I saw recently an ingenious method of deciding how quickly coal was settling in a vessel containing oil. You can make the test yourself. Imagine a small glass tube suspended by a string about 2ft. long. The tube is filled with the oil-coal mixture. By giving the tube a push it naturally swings from side to side on its string. It is, in fact, a pendulum.

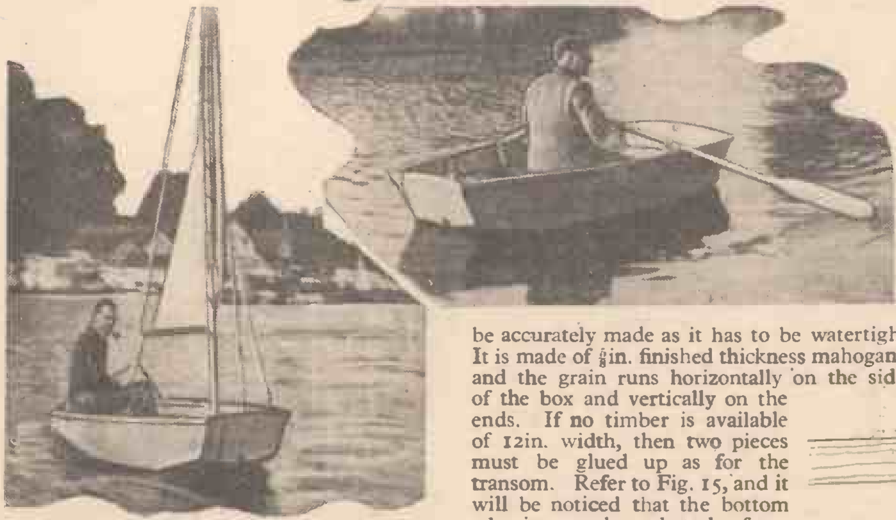
A pendulum depends for the rate of swing upon its length from the point of its support to its centre of gravity. So when the coal settles in the tube the centre of gravity of the whole vessel containing the coal and oil falls lower and lower in this tube.

By measuring the pendulum's swing it is very easy to determine the rate at which the pendulum is altering its effective length by virtue of the coal gradually falling down out of its surrounding oil.

Sun-ray Houses

THERE is an experimental house heated by the sun alone. The heat is collected by copper plates, and passed to storage casks where it is stored in glauber salt. Fans extract hot air as required. Nearly 30 tons of salt is used to store up the heat and the house can be kept at 70 deg. even if there are 10 successive sunless days. Not very helpful in an English winter!

Building an 8 FT. Sailing Dinghy



An All-wood Family Craft Which Can be Carried on the Car Top

By FRANCIS HOOK

(*Continued from page 501, September issue.*)

THE next operation is to cut the slot in the keel for the centre board to pass through. This slot should be marked out accurately 12in. long x 5/8in. wide and positioned 9in. forward of Frame No. 2. It is important that the width should be an easy fit for the plywood centre board so as to allow for any expansion when in the water. A good method of making this slot is to bore a series of holes with a centre bit on the centre line of the keel and to join them up into a slot with a pad saw. Trim up the sides with chisel and file and glasspaper smooth. Fig. 2 in the August issue shows the approximate position of the centre board.

Centre Board Casing

Having made the centre board slot the trunk may be made to take it. This box must be accurately made as it has to be watertight. It is made of 5/8in. finished thickness mahogany, and the grain runs horizontally on the sides of the box and vertically on the ends. If no timber is available of 12in. width, then two pieces must be glued up as for the transom. Refer to Fig. 15, and it will be noticed that the bottom edge is curved so that the front end is only about 10½in. tall. This curve can be worked on the edge of a piece of thin plywood to fit to the hog and then the shape can be transferred to the side pieces of the box. It is helpful to cut and work these curves to shape before the box is glued and screwed together, so that only a little fitting will be required before screwing the box to the hog.

The position and direction of the screws fixing the box to the hog are shown in Fig. 16. It is as well to screw the box in place first of all without the jointing gasket and Seelastic to make sure the fitting is good. To help in this fixing two sash cramps may be used, being passed up through the casing and gripping the top of the casing and the keel. When this trial fixing is satisfactory take down and fit a thin canvas gasket between the hog and the casing, coated liberally on both sides with Seelastic sealing compound, and screw the casing back in place. As an additional precaution for making a waterproof joint, quarter-round beading can be fitted round the casing bedded in Seelastic compound as shown in Fig. 16.

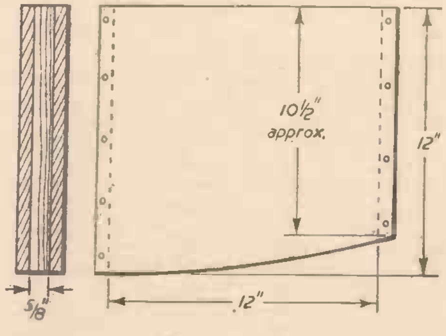


Fig. 15.—The centre board casing.

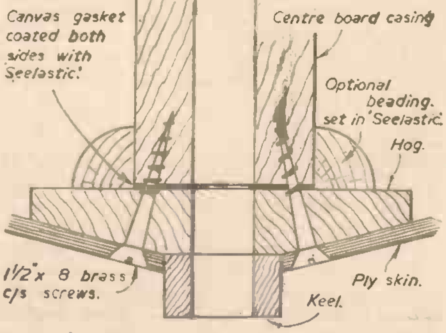


Fig. 16.—Fixing the centre board casing

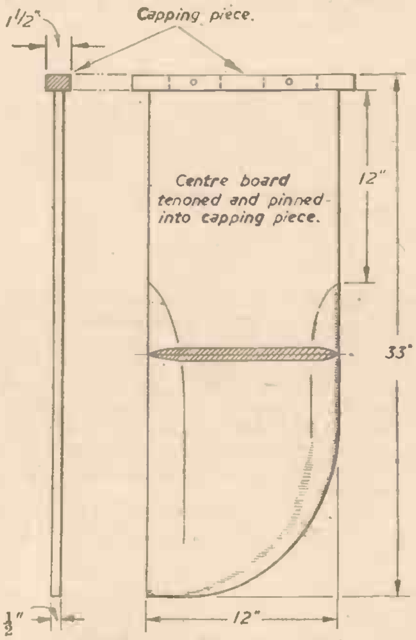


Fig. 17.—Details and dimensions of the centre board.

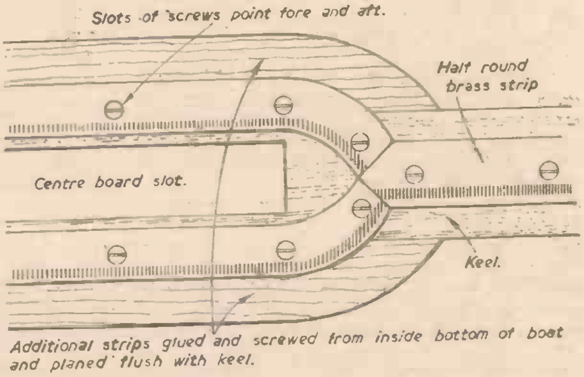


Fig. 18.—Reinforcing the keel and centre board slot.

Making the Centre Board

The centre board is made from ½in. resin bonded plywood. The length is 33in. and the width 12in. The lower end is shaped as in Fig. 17. At the top end two tenons are sawn and are morticed into a capping piece 13½in. x 1¼in. x 5/8in. The joints are secured with glue and an added precaution is to pin the tenons with dowels. The fore and aft edges of the centre board are faired off to prevent resistance and drag in passing through the water.

Keel Rubbing Strip

At the keel and skid is the point where friction in hauling the dinghy ashore and during launching will do the most damage, and the paint at this point will be removed quickly. It is usual to guard against this by fitting a brass rubbing slip along the length of

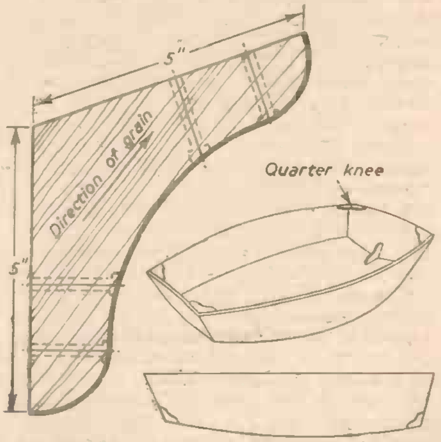


Fig. 19.—Making and fitting knees.

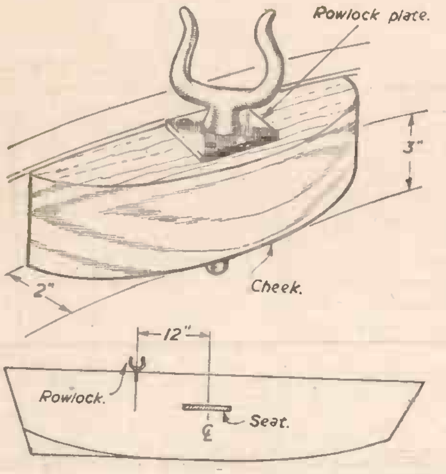


Fig. 20.—The rowlocks and rowlock cheeks.

the keel. Half-round brass strip specially made for the job may be purchased and secured with brass screws, the heads of which are well countersunk.

Because of the centre board slot this brass strip cannot be in one continuous piece. A separate piece is used each side of the centre board slot and these are mitred into the fore and aft pieces as shown in the diagram. Fig. 18 and also in Fig. 13.

A certain amount of abrasion also occurs at the chines. As this rubbing will be taken by the plywood bottom skin it is essential also to protect this edge. This can be done with brass strip, or alternatively, to save expense, a hardwood moulding can be used and renewed from time to time as it wears. In such a case it is suggested that these strips should be fixed into place after the painting of the boat.

Seats and Seat Risers

The seats are supported on risers which are strips of mahogany 1½in. x ⅝in. running from the bow to the transom on either side of the boat, see Fig. 14. They are housed a ¼in. into the side futtocks and are screwed into place. The top edges of the risers should be 7⅝in. down from the sheer line if the seats are made of the ⅝in. plywood, i.e., the top side of the seats would be 7in. down from the sheer line. A more substantial but heavier seat could be made of ⅞in. mahogany.

The stern seat and seat amidships are both 12in. wide and the bow seat is 8in. wide.

The fitting of the seats, so as to get a snug fit against the curved sides of the boat, is quite a tricky job. It is helpful to make a thin cardboard template first of all to fit in the place of the seat, and this is used to mark off the length of the underside of the seat. Remember that the edge of the seat will slope outwards from this length, and allowance must be made for this fact.

The forward seat in the bows is very useful for the oarsman when taking out the family party. The boat is on an even keel and he is in a position to keep an eye on the younger members of the party. For the lone fisherman or sailor the seat amidships is ideal. Thus two pairs of cheeks must be provided for rowlocks (Fig. 2).

The seat amidships is housed round the centre board casing to a depth of 1in. in order to give rigidity to this casing.

Here the seat is supported by a small block of wood screwed through the seat on to the end of the casing. In the case of the stern seat, beside the support at the risers, it may be necessary to support it in the middle with a piece of 2in. x 1in. running down to the hog.

If the dinghy were to be exclusively used for sailing it might be as well to do away with the stern seat, as it is quite impossible to use this seat when under sail due to the use of the tiller.

Making and Fitting Knees

Six knees are required, sawn from oak or elm 1in. thick. To get the correct shape cut out a piece of thin card to the correct angle and transfer the shape to the wood. When doing this arrange the grain of the wood as in Fig. 19 so that should the knee become fractured at any future period the parts are held firmly by the screws.

Having marked out the shape of the knees, cut them out with a tenon saw and bow saw and smooth up to shape with plane and spokeshave. The straight edges are bevelled to suit the slope of the sides of the boat. The knees are screwed and glued in place, screwing from the outside of the boat with 1¼in. x No. 8 brass screws through the sheer strip. The knees fixed to the hog and bow and transom will require the screws through the hog and keel to be longer, 2½in. x No. 10. Note that with these two knees the screws are driven from inside the boat through the knee into the hog, transom and bow.

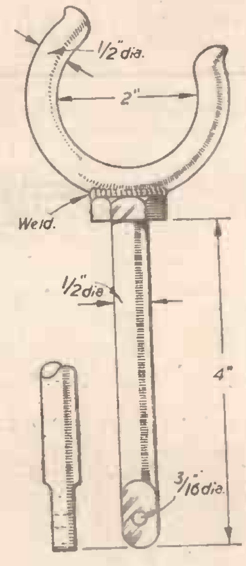
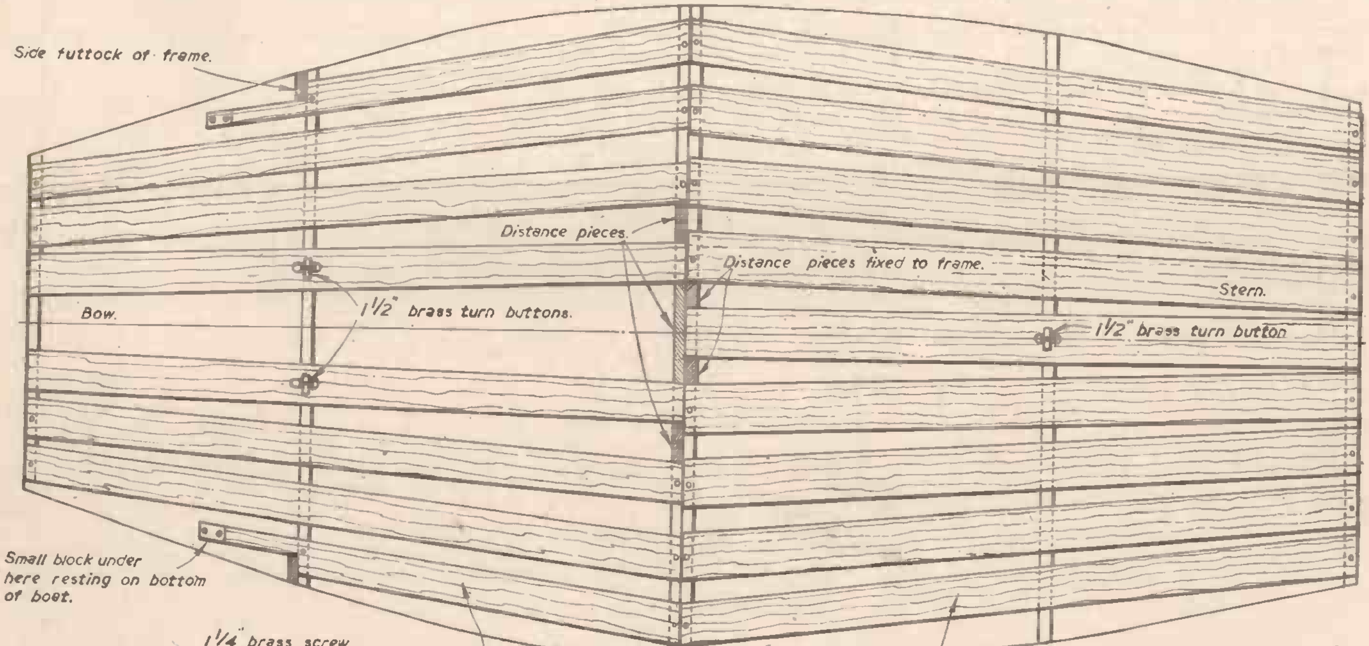


Fig. 21.—Details for making rowlocks.



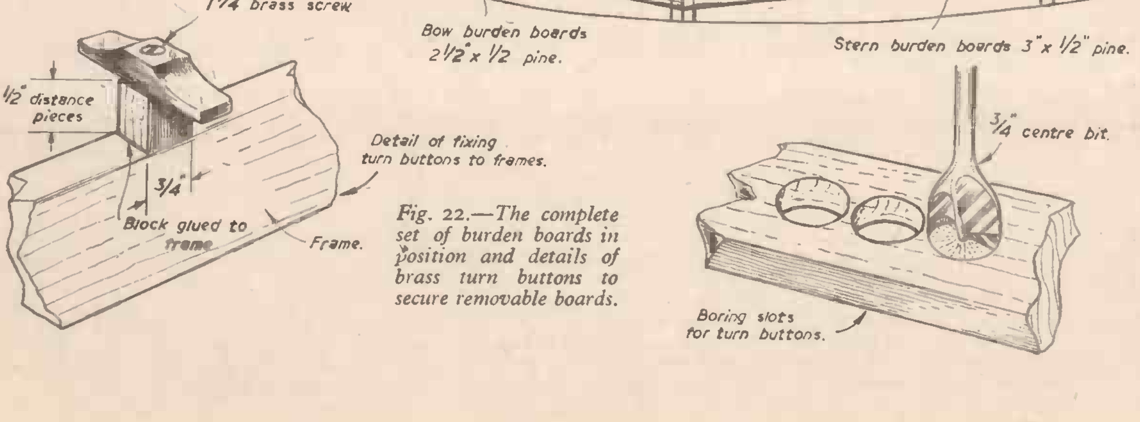


Fig. 22.—The complete set of burden boards in position and details of brass turn buttons to secure removable boards.

When all the knees and seats have been made and secured, the three supports across the tops of the frames may be removed. The horns left on the frame side members may now be sawn off flush and a quarter-round

Fig. 23.—The completed hull.

spokeshaved on each end. The top edge of the plywood sides may also be smoothed off with a smoothing plane so as to run in smoothly with the sheer strip, the transom and bow.

Rowlock Fittings

When fitting the rowlocks it must be borne in mind that they must be positioned 12in. from the centre of the rowing thwart or seat. A pair of rowlock cheeks, as shown in Fig. 20, are made from a piece of 3in. x 2in. mahogany and screwed from the outside through the sheer and the plyside. The shank of the rowlock is usually ½in. diameter and a hole this size is drilled through the cheek. A small rowlock plate surrounds this hole and it is recessed into the cheek to be flush with the surface and then screwed in position.

Rowlocks

A pair of galvanised rowlocks may be bought for about 7s. 6d. Alternatively, they may be made by welding the shaped ring to the top of a 4in. bolt head as shown in Fig. 21. A flat is filed on either side of the end and is drilled to take a cord, which is used to secure the rowlock to the seat riser, so that it may not be inadvertently pulled out and dropped overboard when shipping an oar. The rowlocks when cleaned up can be sent to the platers for galvanising.

The Burden Boards

There are several ways of making up sets of burden boards, but that shown here is quite simple. The method of setting out the boards is shown in Fig. 22. There is a bow set and a stern set. The former strips are made from pine 2½in. x ½in., and the latter from pine 3in. x ½in. For convenience, at the bow end two boards are made removable; the ones on either side of the centre board casing. At the stern the centre strip only is made removable.

The stern burden boards rest on frame No. 2 at their forward ends and on a ledge ¾in. x ¾in. glued and screwed to the transom. Ledges for the bow set of boards are glued and screwed to the bow board and to the forward side of the bottom futtocks of the No. 2 frame. Spacers or distance pieces are screwed to the frame as shown in Fig. 21 in order to be able to locate easily the removable strips.

The three removable boards are held in place by three brass turn buttons, as shown in Fig. 22. They are mounted on small distance pieces, which are glued to the frames.

The fixed boards are spaced out equally and are screwed in place with some 1in. x No. 6 brass countersunk screws. Note how the two outside boards in the bow are cut round the side futtocks of frame No. 1. The burden board may be seen in position in Fig. 23.

Making a Pair of Oars

If the builder of the dinghy makes himself a pair of oars he will save approximately £4. It is suggested that the type with flat blades should be attempted at first. These are made out of spruce and consist of the centre handle, made from 2in. x 2in. timber, which runs right through to the bottom of the blade. The latter part is made up with two pieces of spruce 24in. x 2½in. x 1in. glued and dowelled to the handle.

First of all plane up the material for the handles and the blades. Whilst the handles are still in the 2in. x 2in. section mark out the positions of the ¼in. dowels and drill. When this is done mark out and work the taper on the handles, which should start 24in. from the one end and taper down to 1in. at the blade end. Glue up the blades and set aside to dry.

When the joints are set work may commence on rounding down the handles and fairing off the blades to shape as shown in Fig. 25. Recourse will have to be made to smoothing plane, bullnose plane, spokeshave, rasp, file and glasspaper in order to obtain a fine finish.

It is usual to varnish the oars although the blades are sometimes painted to match the boat.

At 21in. from the handle end a piece of thin leather 6in. wide is wrapped round the oars and secured with copper tacks. It should be noted that when making the nailed overlap to the leather the nails should be on top when the oar rests on the rowlock. So that there will be a port and starboard oar. Thus the one illustrated in Fig. 24 is for use on the port rowlock. The leather blocks are made from some ¾in. wide strips of shoe leather, three to each block. These strips are well wetted and then bent around the handles. Drill a hole through the centre of the length of each piece and screw into position with a 1¼in. x No. 8 brass screw. Then work the leather round into place and hold there in a vice whilst two screws on either side are fixed, i.e., five screws are used for each block. The ends are carefully trimmed off square.

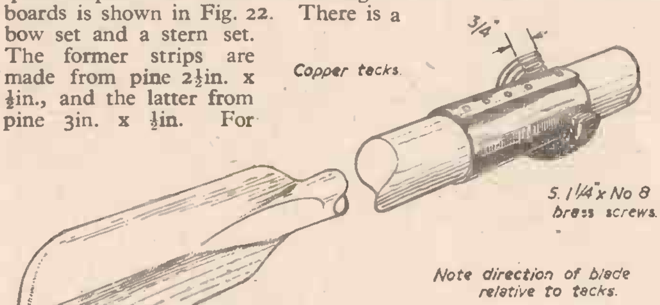


Fig. 24.—Details of fitting the leather strips and blocks.

Painting and Varnishing

No two builders of small craft will have the same opinion as to the correct method of finishing off the craft. Certainly it would seem sacrilege to cover the beauty of the mahogany transom and bow with paint, so that varnish only is indicated here, at least for the first years of the boat's life. It is usual to varnish the seats and the burden boards. The bottom and sides of the dinghy can be enamelled.

Whatever the final finish is to be, paint or varnish, the bare wood must be thoroughly

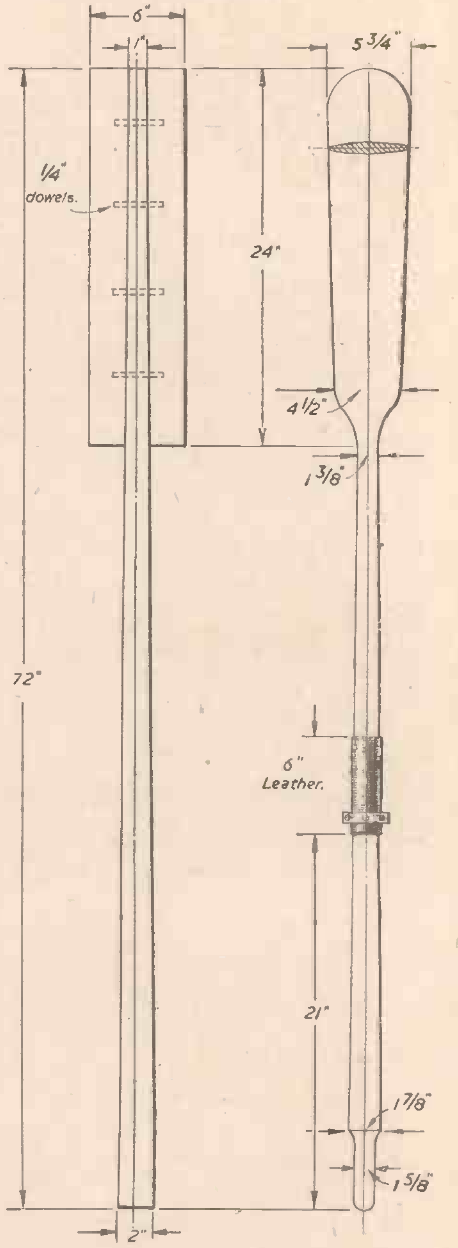


Fig. 25.—Rounding handles and shaping blades.

prepared by rubbing down first with middle No. 2 glasspaper and then with No. 1. On no account rub across the grain of the wood, but keep all the time with the grain. Dust the woodwork down and all is ready for the paintbrush. It is strongly recommended that only first-class marine paints and varnish be used.

For the varnished surfaces a priming coat of varnish diluted with half its volume of turps is used. This mixture is well brushed into the wood and allowed to dry out. The priming coat is well rubbed down with fine glasspaper and dusted down. Then follows the application of three coats of normal boat varnish, each coat being allowed to dry thoroughly, followed by a light glasspapering before the application of the next coat.

If surfaces are to be painted, first of all apply a coat of pink priming, which should be well brushed into the grain of the wood. When this is dried out rub down well with fine glasspaper.

For this boat the quantities of paint required are one quart each of priming, undercoat and top coat, together with a quart of boat varnish. To this can be added, say, a quart of turps substitute.

Fig. 1.—A view of the ¼in. to 1ft. Bassett-Lowke model.

Modelling th[e] CUNARD

Scale Draw[ings]
Detailed Inst[ructions]
Building this
By E. W.

THE original vessel was constructed by John Brown & Co., Ltd., of Clydebank, for the passenger and cargo service of the Cunard White Star, Ltd. She is a twin screw one class vessel of length overall of 534 feet, 500ft. between perpendiculars. She has a sister ship named the *Parthia* which was built by Harland and Wolff, of Belfast, in 1947. The *Media* was the largest vessel launched on the Clyde in the year 1946 and the first to be completed for the Cunard White Star Company since the *Queen Elizabeth* in 1940. She made her maiden voyage from Liverpool to New York on August 20th, 1947.

Figs. 1 and 2 illustrate a facsimile model, externally, by Messrs. Bassett-Lowke, Ltd., of Northampton, and thanks are due to them for permission to reproduce them. Their model is to a larger scale, viz., 1/48in. or ¼in. to 1ft.

Other particulars of the original vessel are:

Extreme breadth	70ft.
Load draught	30ft. 2¼in.
Gross tonnage	13,700.
Net tonnage	7,481.95.
Service S.H.P.	13,700.
Maximum S.H.P. ...	15,000.
Passengers	250.
Crew	184.
Cargo capacity	371,430 cu. ft.
Speed, knots	17.

The lifeboats are of steel and are carried by Welin MacLachlin gravity davits fitted well above the heads of people on the promenade deck. It will therefore be seen that in modelling these boats their exteriors will be carved smooth and will show no longitudinal planks or seams.

Forming the Hull

The model is to be to a scale of 1/16in. to 1ft.; the length will be approximately 33in. and the beam 4½in. An outline drawing in sheer and a deck plan will be seen in Fig. 3, whilst Fig. 4 gives all the necessary particulars for the dimensions of the hull. From both of these drawings it will be seen that above the load water line the outline is the same as the prototype, but that below it is different. It was made so because it is proposed to make it wholly of metal and as large a displacement as possible is required.

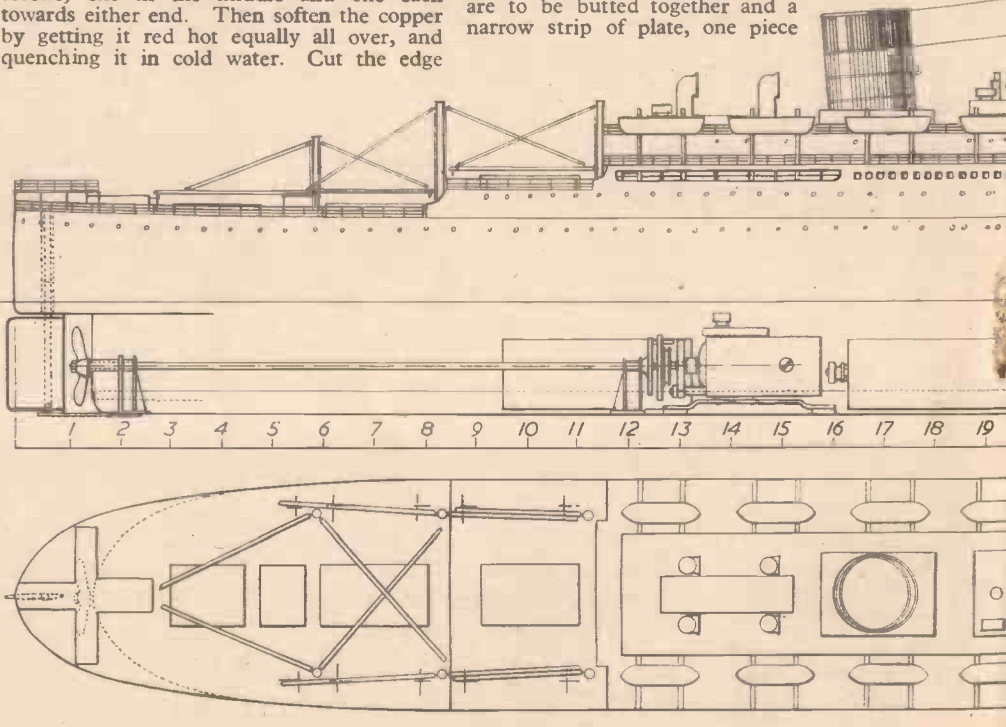
To model this hull in sheet metal instead of wood will reduce the amount of time and the labour taken in making enormously. It is simply a matter of bending the vertical strip of metal in a horizontally curved direction, making the underwater curve at the stern to a smaller camber than the above-water portion. This will be best done by dividing the two sides of the hull on the centre of the stern and cutting the underwater parts shorter than the upper portion. A tinplate strip will be needed to cover the seam in each case. Where the upper and lower portions over-reach a tin plate, cut to fit the two curves, will be added on a length of angle brass soldered as shown in Fig. 4 and in Fig. 5.

The Bottom Plate

Now the whole of this upper portion of the hull must be made and soldered to a bottom plate which is to be cut from sheet copper of as nearly as possible No. 24 s.w.g. This is to be flanged upward by beating it over the curved edge of a shaped hardwood board; either oak or birch will do, 1in. thickness, say, 5in. wide by 32in. long. Draw a centre line down the middle of this and on each side mark off the dimensions given in the plan Fig. 4. Join up the points arrived at with draughtsman's curves and saw cut to the curved lines, keeping the saw carefully square with the surface of the board. On one side and edge of the shaped board, either with plane or spokeshave, produce a rounded corner of about ⅜in. radius. It would be best to cut a cardboard template for this curve, so as to be sure of getting it equal all the way around. Now on the centre line of the copper drill, say, three holes to take No. 4 round head screws, one in the middle and one each towards either end. Then soften the copper by getting it red hot equally all over, and quenching it in cold water. Cut the edge of the copper to an outline following the shape of the board, but about ⅜in. larger all around, screw it to the side of the board on which you produced the rounded corner and commence beating the edge of the plate over. The best tool to use for this beating will be made of beech. There is a plumber's tool which can be bought which will be ideal for the purpose. It has a long head of half-round section with a flat on one side and a handle at one end, all formed from one piece of beech. The beating is done with the flat side. The blows must be delivered with a dragging motion, a little at a time, all around. Continue the beating until the curve is completed and the upturned edge is standing square with the bottom.

Should the plate show any signs of buckling or inclination to fold, take it off the board and anneal it again by heating it. Flatten it and screw it on the board again and proceed with the beating. Do not forget the dragging blows in the direction in which the plate is to be bent: this will assist considerably in producing the required shape. When beating is completed take the plate off the wood, file the beaten edge and thoroughly tin it with solder, wiping off any surplus. A large soldering bit will be best for doing both the tinning and the soldering.

Apply the tinplate upright sides, making sure that these are square with the bottom. Start at the bows and solder on, working backwards to a point at the centre of the stern; here cut off the superfluous tinned plate. Then do the other side. At the stern the plates must not overlap; they are to be butted together and a narrow strip of plate, one piece

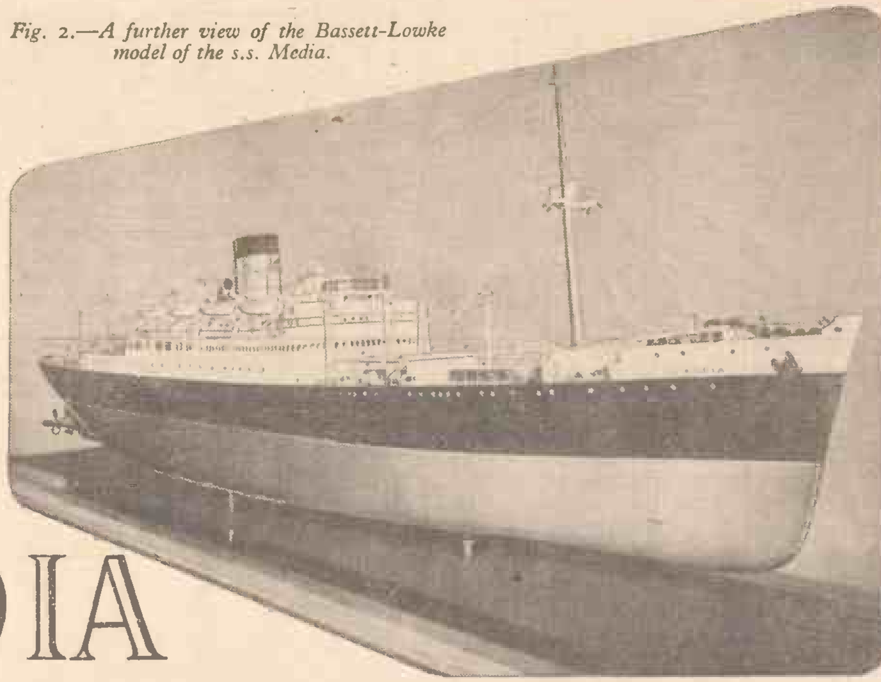


below and another above the break, which will be below the L.W.L., will be soldered over the joins, the strips being laid on the inside of the hull. The three holes in the copper bottom which received the holding down screws can now be closed by three pieces of tinned plate, letting the solder fill the holes and be filed off flush with the outside of the plate.

The Rudder and Propeller Bearing

The details of this part will all be clear from Fig. 5. Whereas the prototype vessel has twin screws the model is provided with only one, and this is placed on the centre line of the ship. Drill for the propeller shaft bearing through where the tinplate fishplate is. Make two bearing brackets soldered down on a brass plate and in these solder a piece of thin brass tubing of about 5/16in. diameter. At the front end of this there is a brass collar having a ⅛in. hole in its centre. Having made the bearing, apply it to the stern and see that the tube enters the hole prepared

Fig. 2.—A further view of the Bassett-Lowke model of the s.s. Media.



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S.S. MEDIA

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Model Liner
TWINING

for it, at the same time ensuring that the bracket plates stand fair and upright on the copper bottom; if all is in order put the propeller shaft through the bearing and see that this lies along the hull parallel with the centre line. Then solder the tube in place and at the same time solder the bottom plate of the bearing to the copper. The propeller should be 1½in. diameter; it should be three bladed and it is suggested that it is purchased from Bassett-Lowke, Ltd. Pack the tube with soft cotton wick, thoroughly well greased, and compress it by pushing in the propeller hard. The wick will be best wound, not too tightly, around the shaft. Be careful to wind it so that the turns are opposite in direction to that in which the propeller rotates, so that it tends to unwind as the shaft revolves.

The Rudder

The upright shaft or post is a brass tube having a diameter of 3/16in. and long enough to extend from a brass strip, screwed by two countersunk screws to the underneath face of the copper bottom, a fraction of an inch above the deckline.

This deck will be flush with the tinplate sides of the hull. At this point the rudder shaft will have a short lever pinned to it which will be made with bend downward and will make a friction grip on the deck. The rudder itself is a vane made from stout copper foil or very thin brass. It will be formed of a doubled-back piece of the copper foil extending from the trailing edge on one side, around the forward part and go back again to the trailing edge, where the two sides of the foil will be soldered together. It must be boxed in with four little pieces of copper foil cut with scissors to shape and soldered at both forward and after sides at top and bottom. This means lightness, for although it is underwater it will be filled with air. There is to be a ring of copper wire around the shaft, both above and below the rudder, to serve as washers.

The Motor

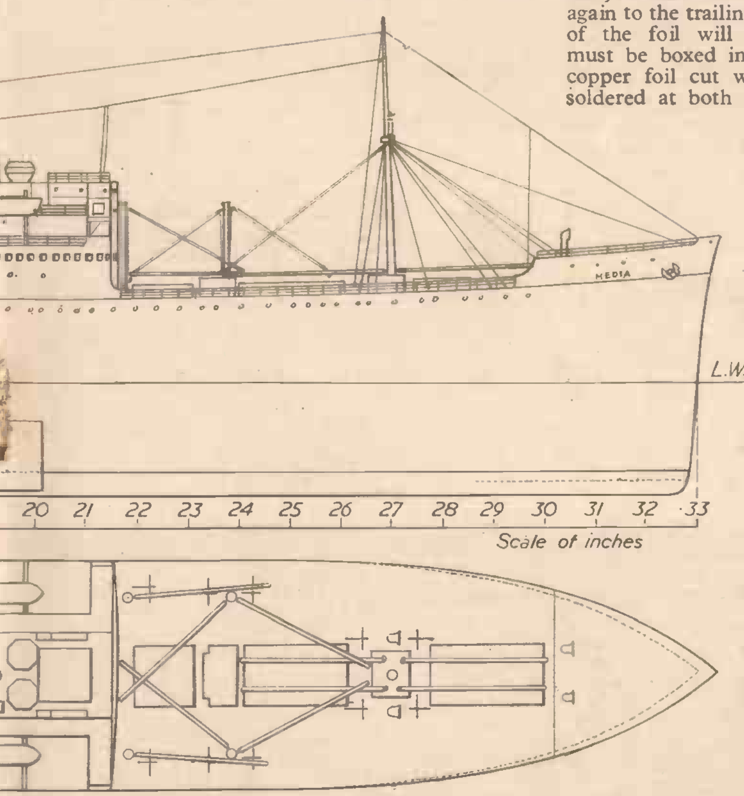
To propel the boat, a polarised motor from Bassett-Lowke's catalogue is used. It is called the " Marine " ; it has a base 2in. wide by 3⅜in. long and its weight is 11¼ ounces. It is wound for six volts and dry batteries will provide the current. At the motor end of the propeller shaft an additional bearing will be wanted. This is exactly like the other, but the brass tube actually fits the shaft without a bush, i.e., it makes a running fit, therefore get a bit of tube with a ⅛in. hole, probably a short piece of the same as the rudder post will suffice to make it.

The Decks and Superstructure

The main deck will be in three pieces, all ⅛in. thick, of white waterproof plywood. These will be secured with metal screws tapped into an angle, soldered ⅛in. down inside of the hull, as shown in Fig. 5. The first piece of deck will extend from the bows to the commencement of the superstructure; the second will include only the superstructure and will go back to a point immediately forward of the second derricks, and the third from this point right to the stern. The second portion, as will be seen, will be much the longest of the three and this is the part which will most often have to be removed to get at the motor and batteries—the latter especially since they will require renewing from time to time.

This superstructure should be as light and as strong as possible, and is made of fairly thick Bristol-board of, say, 10 or 12 sheet thickness. If Bristol-board is not employed it would be best to use hardwood about 1/16in. thick, although Bristol-board, which is made up of layers of hard white paper, will be the best. Whichever is used it must be cut with a knife, the said cutting being done downward on glass, a piece of plate glass for preference.

When all the pieces are cut, and allowance must be made for overlapping either of the sides over the ends or of the ends over the sides, every piece must be soaked, whether of Bristol-board or of wood, in a solution of celluloid. This can be done by dissolving shredded celluloid in amyl acetate; this may also be bought from electrical firms, where it is used as a lacquer. Soak for about



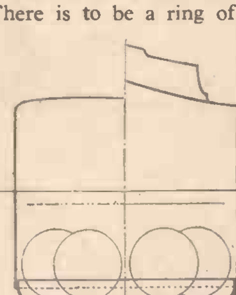


Fig. 3.—General arrangement of model of s.s. Media. Outline drawing in sheer and deck plan.

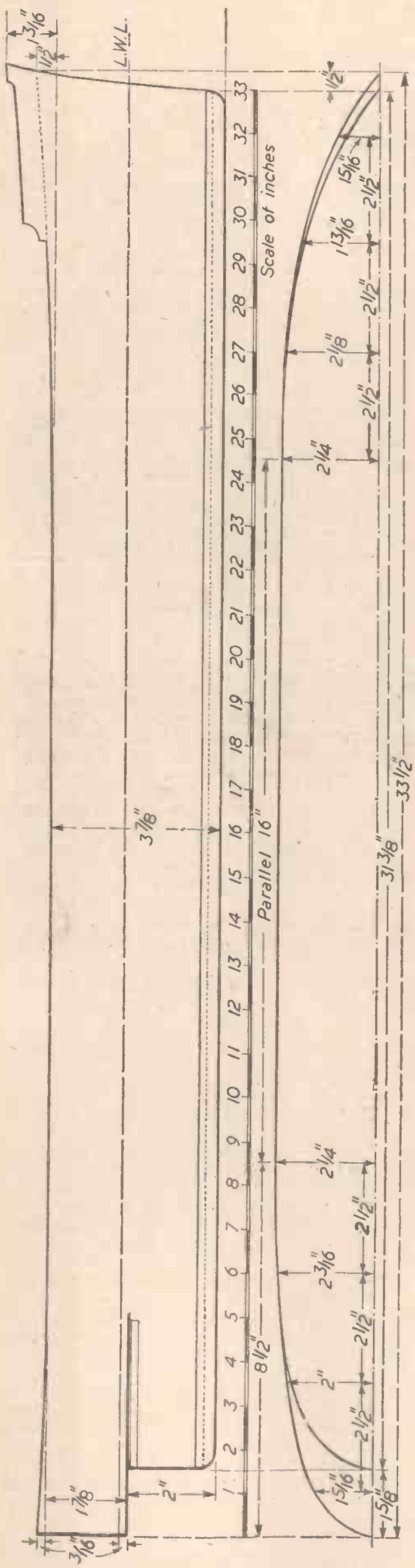


Fig. 4.—Measurements for the hull.

24 hours, remove the pieces and lay them on fine wires stretched horizontally so that they may dry from both sides, which drying should be completed in about six hours. Then they are jointed and built up with "Durofix," which is another cellulose cement. The use of the lacquer will strengthen the model and render it quite waterproof. Everything which cannot be soldered on the model must be stuck with Durofix, and the whole superstructure can be so cemented to the middle portion of the deck. At all important angles it will be advisable to insert lengths of squared wood, about ⅛in. square, to strengthen the joints. The strips will be stuck in and completely surrounded with Durofix.

The Funnel

I have drawn this circular in the plan, Fig. 1, but actually it is a little longer in a fore and aft direction than it is athwart ship. To make the funnel, obtain a piece of wood and turn it circular; then, on opposite sides, either plane or file it to 1/16in. less each side, blending off the two flats to make a nice sweeping oval. Now wrap a piece of fairly stout paper around it and next a piece of Basildon Bond notepaper. Coat the outside of this with the lacquer or with Durofix, and then put on successive layers of the notepaper until you have formed an elliptical tube a full 1/32in. thick. Slide this off the wood, remove the first paper, see that the shape of the tube remains correct and lay it on one side to dry.

When it is dry stick with lacquer four threads around it with a rather thicker thread at the top. Again allow to dry and then cut the tube to its correct height, square with the centre line at the top and at the correct raking angle at the bottom.

The Boats

These can be planed to a uniform section in one length; the section is shown in Fig. 6. This wooden strip is then cross-cut for the eight boats all to equal lengths shaped with a chisel or a penknife at the ends for bows and sterns. The davits can be cut either in Bristol-board with the knife or fretsaw from plywood, but I advocate using the cardboard.

Cranes or hoists are shown in Fig. 7. These are simple but fiddling to make and so are the winches (Fig. 8). The crane uprights had better be made from ⅛in. square boxwood, unless it is preferred to make them from brass tubing of the same diameter. The tube will give a perfectly true outline, but there is a difficulty in making attachments to it except by soldering and the bottom ends would have to be wood filled in order to cement them to the decks. If the boxwood is used take a length measuring exactly ⅛in. each way and plane the corners off it, making it into an octagon. Then drill a ⅛in. hole through a steel plate and so make a drawplate. With a file rub around

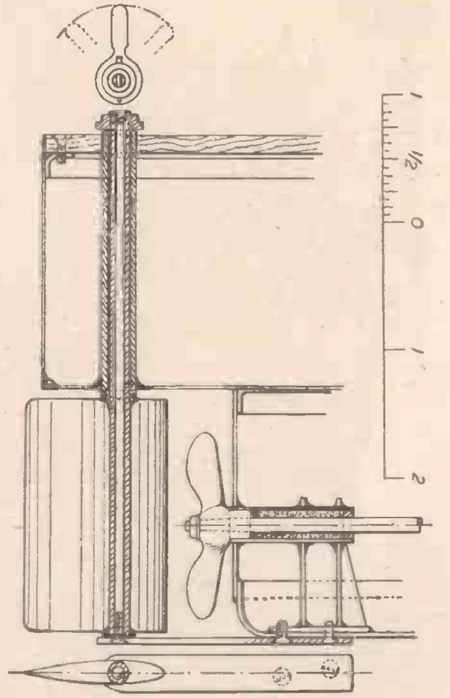


Fig. 5.—Details of the rudder and propeller

the end of the wood strip, which has been made octagonal, until it is circular, then introduce it into the hole in the plate; push it until there is enough through to pull on and continue pulling until the whole strip of wood is through. You will find that the edges of the plate are sufficiently sharp around the hole to cut the wood and convert the octagonal form to circular. The booms will be a little smaller in diameter but greater in length and each one tapers at both ends. Each of the uprights and booms will have blocks upon them: these can be made with threads of silk, having little oval pieces of cardboard cemented on each side with the thread between. When the cardboard pieces are blacked they will make good representations of blocks. If wood is used for the crane uprights they should be cemented into holes in the decks for making them secure.

The Winches

Fig. 8 is a near enough drawing of one of the crane winches to be looked upon as correct. The drawing is made many times larger than these winches will be on the model, as may be seen from a critical examination of the photograph Fig. 9. These winches are each driven by an electric motor and are readily made by turning the parts in boxwood. Each is made from, say, three pieces of wood; the base, which is a little square or rectangular block; then comes a turned piece for the driven shaft and last of all the motor and the worm shaft. All of these are mounted one above the other in the order and manner

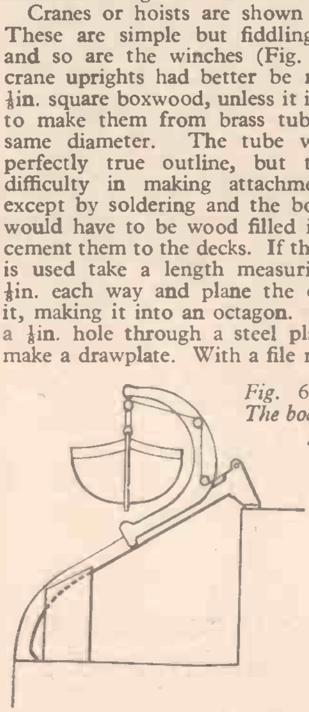
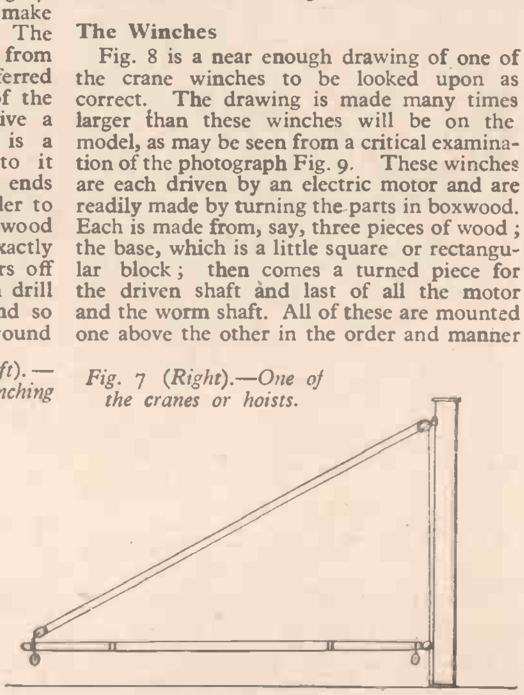


Fig. 6. (Left).—The boat launching gear.

Fig. 7 (Right).—One of the cranes or hoists.



shown. There will be in all 20 of the winches to make, so I do not expect that any fine details will be put into them, but they ought certainly to be shown on the ship even if they are of simplified form.

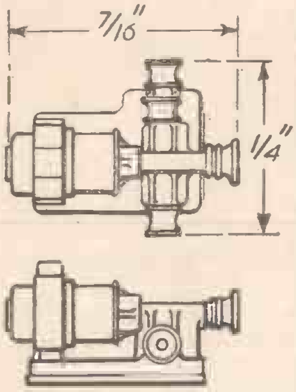


Fig. 8.—An enlarged view of one of the winches.

The hatches and deckhouses are simple rectangular blocks of wood, stuck down on the decks and call for no comment, but the docking bridge, at the extreme stern, will call for some care in making and fitting. It would be almost impossible to guard against injuring this at some time or another and, I think, that strong pins, of dressmaker's kind, inserted into the deck with the heads soldered underneath a metal, cross shaped piece of plate will be the best way in which to make it. The head of the cross, the forward portion, can be drilled and screwed down to the little wooden deckhouse which comes below it. This will involve a slight departure from the full-size ship because it will make the house a little higher than it should be, but it is of greater importance that the bridge shall be there and be strong enough to stand up to ordinary usage. The bridge is well shown in the photograph of the Bassett-Lowke model Fig. 9.

There are many bollards on the vessel, especially upon the forecastle, and there are about 20 at the stern. These are all double pins and I leave it to the model maker to decide whether he will put them in. It will be a simple matter to do so since they will be made from ordinary dressmaker's pins cut off to correct lengths under the heads and inserted, with heads uppermost, into tiny drilled holes.

Finishing

Paint and enamel the whole of the inside of the ship grey. Other parts which would be pale grey will be the mast, the crane columns, the winches, the tops of all hatches and the tops of the deckhouses. The funnel lower part will be vermilion. The funnel top will be black as will also be the vertical sides of the hatches and the whole of the outside of the hull from the waterline up to the main-deck line. All bollards and crane pulley blocks are black, also the winding drums of the winches. All deckhouses as regards the vertical sides will be pure white, including the superstructure from the top of the hull proper upwards. The stern bridge and the forecastle are also white. Then at the waterline there is a fine white line, which can be drawn with a draughtsman's ruling pen. This line marks the upper boundary of a below waterline colour, which is Indian red. All of these can be distinguished in the photographs except, perhaps, the vermilion on the funnel. The top of the funnel casing and the rectangular base on which the funnel is mounted will be black. The decks are mostly of wood colour. These actually are of wood, but I would paint them a creamy white or creamy brown. The alternative to painting will be to waterproof them with about three coats of the colourless celluloid lacquer.

The reader will have to decide where he will put the motor starting switch and to what it shall be fastened. The circuit will be most simple, just a make-and-break switch lever, opening and closing the circuit from one side of the battery and one side of the motor. It cannot be fastened to any deck because these are removable and the switch must be left in the hull when decks are off. At the stern it can be reached easiest and the best place for it will be on the starboard side fixed close up under the deck. The lever in such case can be about 1½in. long and have a total movement of only about ⅜in.

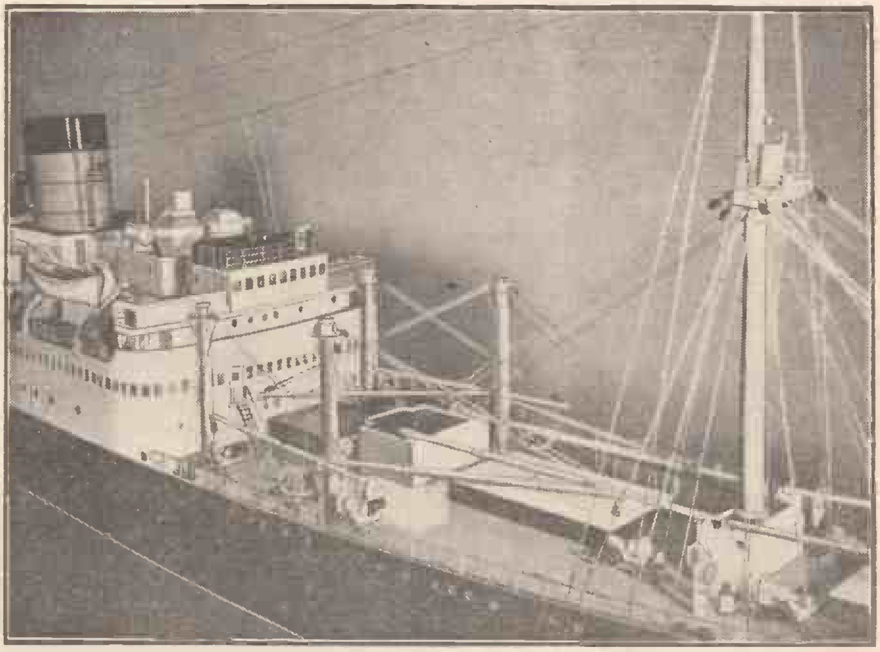


Fig. 9.—A further view of the Bassett-Lowke model showing the bridge structure.

The U.S. Space Satellite

IT has been disclosed that for the first two rocket stages in Project Vanguard, liquid fuels will be used and the third and final stage will use a solid propellant to send it speeding round the earth in outer space. A solid-propellant rocket was chosen because of its simplicity. Such a rocket consists essentially of a combustible charge in a container, an igniter and a nozzle for the escape of the gases. Liquid-fueled rockets were chosen for the first and second stages because it is easier to guide that type of rocket.

Synthesis of Granite

A FRENCH professor has succeeded, for the first time, in creating the synthesis of granite.

The experiment was carried out on natural glass, obsidian, from the Lipari islands. A few grammes of glass were subjected to a temperature of 500 degrees centigrade and a pressure of 3,000 atmospheres. In a few days the French professor obtained fragments of rock which were entirely crystalline with the mineralogic constituents of granite.

A New Sandwich

NEWEST sandwich is tubular in shape. It is moulded into the form of a Swiss roll, and the meat is injected automatically by a machine which then packs the sandwich and passes it on to the refrigerator to be stored.

Underwater Engine

AT a school of instruction run by the diesel manufacturing firm of F. Perkins, Ltd., a six-cylinder Perkins diesel engine is mounted inside a 400-gallon steel framed tank with Perspex sides. Under demonstration, the engine is started and the tank filled with water. Rising above the surface are four pipes—the air intake, the exhaust, the fuel and lubricating oil intakes.

Electronic Brain's Task

CALCULATIONS involved in a vast new British Railways mileage scheme, it is estimated, would have occupied 50 clerks for five years, but an electronic computer which the British Transport Commission has borrowed will take less than a year. Estimation of nearly 50,000,000 potential distances is involved in the scheme, which is used to calculate charges.

Ice Age Discovery

BONES of animals living as long as 20,000 years ago have been found recently on the island of Caldy, south of Tenby, Pembrokeshire. These Ice Age relics include bones and teeth of rhinoceros, mammoth and cave bear. Caldy is the westernmost place where palaeolithic remains of this early period have been found in Wales.

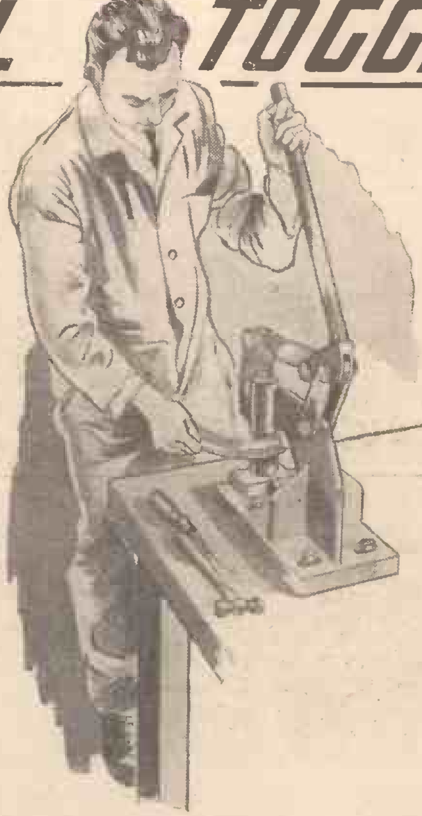
First Transatlantic Telephone Cable

THE first transatlantic telephone cable has been completed and the final length of line was brought ashore at Clarenville, Newfoundland, recently.

The "Flying Jeep"

THE E.P.9 "Flying Jeep," which has been recently introduced, is the first Percival plane for 20 years. It is a light high-wing monoplane and uses an American engine. It is designed for crop spraying but can be adapted to carry five passengers or for use as a flying ambulance.

A USEFUL TOGGLE PRESS



A Practical Tool for the Home Workshop or Garage

By K. VERDEN

THERE are numerous jobs in a garage or small home workshop where a small toggle press would prove extremely useful because the action is so quick and facilitates removal of bushes, pins or rivets in a matter of seconds. A screw type press, while exerting a high pressure, is often rather cumbersome to apply while holding the details with one hand, and though time is not really an important feature in the same way as it influences production in a workshop, nevertheless jobs which require holding with one hand while the other manipulates the press are seldom easy to perform, and the faster the machine can be operated the easier the task becomes.

With this in view the design of this toggle press was undertaken; bearing in mind what material was available and whether the processes were feasible without sub-contracting any item. For this reason welding was introduced as a means of building the body and provided there is no attempt to reduce the sections to a comparatively small thickness fabricated articles of this nature give every satisfaction—in fact, in some respects for these small presses steel is superior to iron and there is little chance the frame can distort.

This little machine is also capable of punching holes through thin steel plate if a die is made to fit the base, but readers are not advised to attempt larger holes than ½in. diameter, and not through plate greater than 1/16in. in thickness.

A variety of punches and dies ranging from round to rectangular are an asset and well worth the time taken to make them because there are frequently operations in the garage where fitting time is saved simply by having the correctly shaped tool to hand. All manner of materials are easily punched—aluminium, fibre washers, copper foil, rubber, cardboard and leather are but a few this versatile machine can handle, and if set up on a bench remote from the normal activities it can be applied as a nibbling press—nibbling being the cutting out of different shapes by merely manipulating the sheet and cutting out sections at each press stroke until the complete profile is accomplished. Such work is slow, but it frequently happens that this course is the only way to make the form other than employing hammer and chisel methods.

The Design

There is nothing original about any small press of this type—it merely follows orthodox practice, although it borders on the lightest class of machine tool, but such a design scores heavily on the grounds of simplicity because it comes within the scope of every reader.

The central frame is made from a piece of ½in. mild steel plate—black material is suitable because, other than a coat of paint after a brief rub down, finish is not important. The base immediately underneath the punch ram is a rectangular section of mild steel—again of the black variety—but if a circular bed is preferred, then a piece 2in. diameter is sufficient.

Incidentally, if a slightly larger press is envisaged, a reader can double the dimensions given here with the exception of the frame thickness of ½in.—a piece of ¾in. steel is adequate for the larger size machine. However, for general purposes these sizes are strong enough and there is little need for the larger version.

Ribs have been added to each side of this ½in. thick frame member—not because it will distort under a load, but because any additional feature likely to strengthen the machine, or to make the design more efficient, is well worth including; and these ribs are so simple and easily attached. The frame is high and deep, but at the same time a fairly deep throat has been added to facilitate the passage of any large piece of material under the punch. There is no point in making this deeper unless the reader is prepared to make the frame wider where this occurs.

Fig. 1 shows a die in position on the assembly, and these are items which, though requiring a little care, readers can undertake as the occasion arises. Similarly, the punches if made from silver steel, hardened and polished will give long service and simply mean turning the ends concentric with the shank portion. The material held in a lathe collet to ensure true rotation is the best method of locating the metal.

There is no need to make either of these details a drive fit in their mating members—an easy slide fit is preferable because it eliminates the prospect of them "sticking" and so making it difficult for anyone to remove a part should it fracture or when another of a different size is required.

To facilitate the manufacture of this fabricated frame or body the ram hole and the bore in which the dies subsequently locate are made the same diameter, and this allows the frame to be clamped to the boring table of a lathe and a boring bar to be run right through both holes without resetting the tool. In boring this hole maintain the ¾in. diameter to a close tolerance—say, $.750^{+.0005}_{-.0000}$in. Keep to the standard dimension if possible as this later assists when the dies are made; it is not then necessary to stop continually to refer to a note regarding the size the hole was previously made, and such dimensions as .753in. diameter or .747in. are avoided. A smooth hole is essential and perfect parallelism is necessary, especially where the ram hole is concerned.

Case-hardening the Details

A refinement is the case-hardening of the holes in each link, and the outside diameters of the fitting pins are an asset, as this reduces wear to a minimum and prolongs their life—in fact, if this process is carried out and the holes and pins carefully polished to remove any scale left after the heat treatment, they should never need replacing.

There are several good case-hardening powders on the market which will give a sufficient depth of case for these items. No similar recommendation is made for the frame and ram because, in the case of such large components as these parts, few readers will possess the facilities for performing the operation, as there is no advantage in hardening one part and not the other, the ram also has been left in a soft condition. However, to help compensate for any likely wear to the hole and shaft, a fairly

(Continued on page 37)

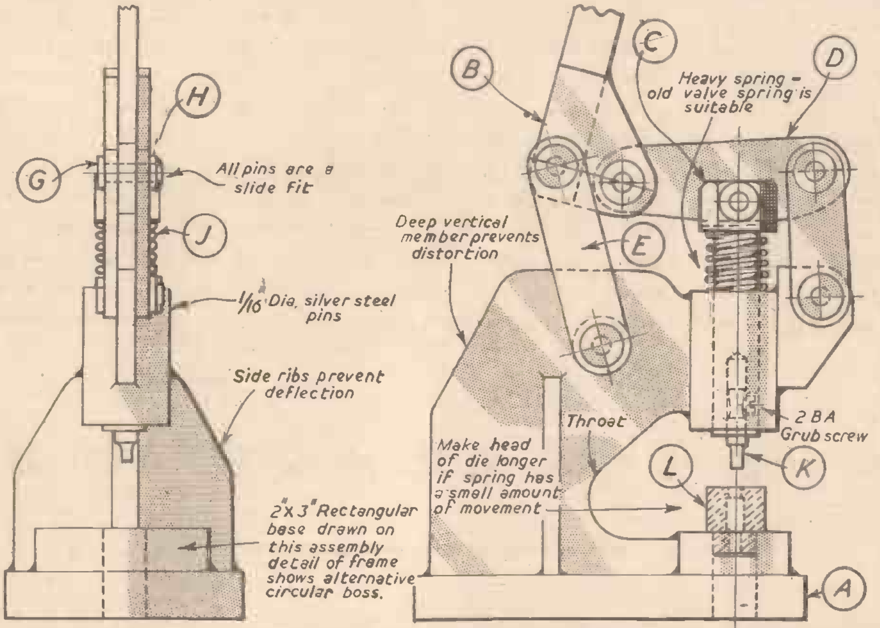


Fig. 1.—The assembly drawing of the press with a die in position; readers should note the rather massive base necessary to reduce distortion to a minimum, and the ribbed framework which will resist deflection.

long bearing has been provided and this should give many months of usage before it becomes necessary to bush the frame and touch up the shaft. Again, there is no point in performing this work at this stage and the reader can defer making the bush until the job becomes really essential.

Other Operations

Practically every process where a localised pressure is needed is feasible.

Making small vees is another example where this press is useful, and though generally the right-angled variety is associated with this type of bending obtuse or acute angles are just as easily made if the correct tools are provided. The reader could apply the press for a part and then gently push the two leaves together, making a double thickness of material.

The removal of rivets from brake shoes is perhaps the job most associated with a small press, and the construction of this simple machine will soon repay for itself on this work alone. Numerous small sheet metal brackets are possible with only the simplest of tools, and because the general repair garage is frequently called upon to attach various gadgets for customers the larger style of machine is extremely useful for this class of work. Again, it proves itself an asset and eliminates much handwork in the nature of filing and drilling.

In General

Details of the fabricated assembly and drawings showing the dimensions for the remaining parts will appear in the next issue, and these should enable any garage to construct this machine. Care in machining is, however, urged because this is eventually reflected in the work produced on the machine. For instance, a worktable perfectly square with the ram and die holes is of first-rate importance and this does much to reduce the risk of fractured punches. Users should remember that only a slight amount of misalignment will cause them to break, and when dies are also applied this usually means the edges of these parts are chipped and require regrinding before they are again of any use.

In order to prevent any distortion developing in the frame after machining, a good flat surface is necessary on which to stand the finished product, especially as there is also the risk that the holding-down bolts can cause the base to warp as pressure is applied. A surface plate is the ideal situation for the press, or alternatively a substantial wood bench some 3in. thick if the timber is not distorted.

(To be continued)

An Auto-Switch for Model Control Transmitters

A Handy Unit for the R/C Enthusiast

By "SPARKS"

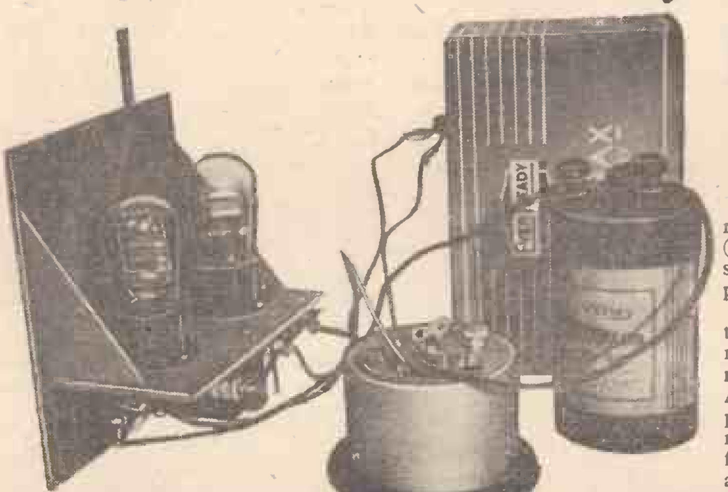


Fig. 1—The completed apparatus.

EXCEPT for a first test to see that the equipment is working, adjustment of a model control receiver requires to be done at some distance from the transmitter. Only when this is so can both transmitter and receiver have their full aerials connected, thus allowing the equipment to be adjusted under actual working conditions, and enabling maximum reliable range to be discovered. When such adjustments are being made to the receiver it is very troublesome to have to return frequently to the transmitter, to switch it on and off, if no second person is available to do this. To overcome this difficulty a simple type of clockwork switch will be found very useful, and this is the arrangement which is described here and shown in the photograph (Fig. 1).

With the auto-switch in circuit the transmitter radiates for roughly 30 seconds and is off for the remaining 30 seconds of each minute. When the signal is present the receiver can be adjusted for maximum dip in current, and tuned correctly. When radiation ceases quench adjustment for maximum anode current can be made and the relay also set appropriately. As the cycle is repeated the receiver can be carried to a greater distance and renewed adjustments made until no further improvement is possible. Finally, the receiver relay will be opening and closing regularly at 30-second intervals in accordance with the transmitter at maximum range.

The mechanism shown in Fig. 2 consists of two thin strips of brass about 2in. long and ¼in. wide, bolted to an insulating block. This block is fixed to a convenient point on the clock frame so that operation from a spindle rotating at 1 r.p.m. (e.g., that of the second hand) is possible.

The cam needs to be of small diameter or friction may stop the clock. A ¼in. diameter piece of ebonite rod about ¼in. long, filed flat one side, and drilled for the spindle, is satisfactory. If the hole is of such a size that the cam is a tight push fit no fixing is necessary. Unless the second hand is to be removed and the cam fitted in its place it will be necessary to loosen the one clock plate so that the spindle can be removed for the cam to be fitted. The parts are then replaced exactly as before.

The clock mechanism actually used was obtained from ex-Service stock, and many of these will be seen advertised. Though they only run for some hours they are very suitable for this purpose. One such mechanism widely advertised has no 1 r.p.m. spindle but one rotating once in 75 seconds, and this is equally suitable. A clock already to hand could also be used if not too small.

Wiring and Indicator

When initially tuning-in it is helpful to know when the transmitter is radiating to avoid confusion, and a bulb is wired in parallel with the transmitter L.T. circuit for this purpose. This is desirable, for otherwise the reduction in anode current often encountered near minimum settings of the receiver tuning condenser due to increased quenching may be mistaken for the carrier.

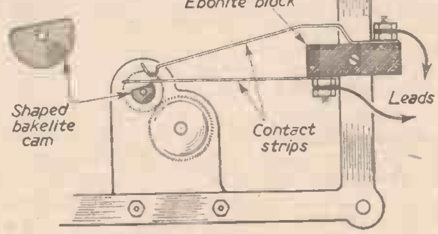


Fig. 2—Fitting contact mechanism.

Fig. 3 shows the circuit. Though the H.T. circuit is keyed the L.T. circuit is interrupted here to allow the bulb to be used without complication. With a 2 volt accumulator supply a 2 volt or 3.5 volt bulb is satisfactory, the latter also suiting a 3 volt dry battery L.T. supply. The bulb should be clearly visible, but it is no longer necessary to observe it once the receiver has been tuned, as the regular rise and fall of the anode current meter will then show when the transmitter is radiating and when it is not.

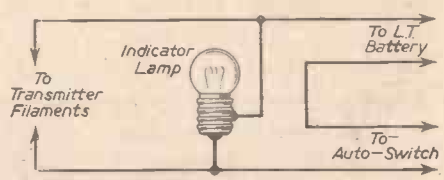


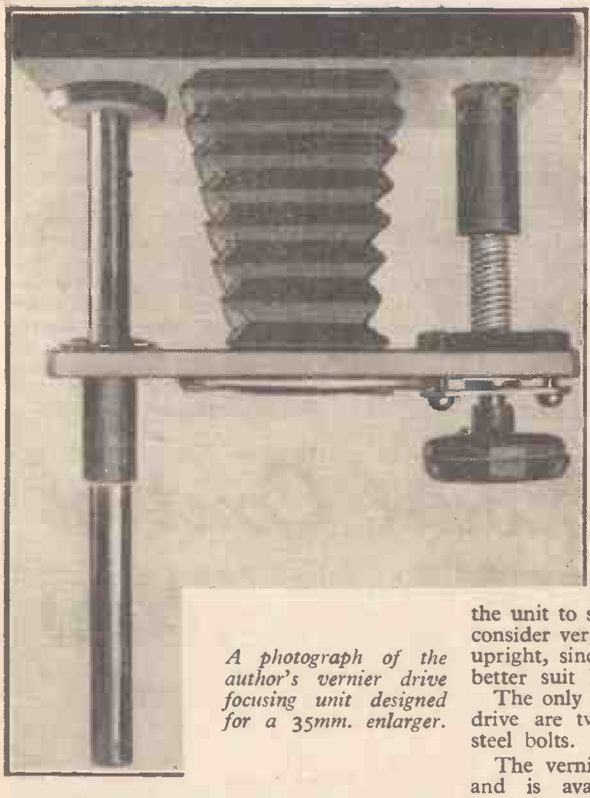
Fig. 3—Electrical circuit.

In practice maximum range will be obtained with the relay set so that it is *just* held down when the transmitter is not radiating. This can be done during any appropriate half-minute. Tuning is then adjusted, together with aerial damping and quenching, to obtain maximum drop in anode current during those periods when the transmitter is radiating. When distance between transmitter and receiver has been so increased that reliable relay operation grows impossible, then the maximum range of the equipment has been exceeded and the model must be kept inside this limit unless control of it is to be lost.

A VERNIER DRIVE FOCUSING UNIT

An Efficient, Simple and Inexpensive Component for Enlargers and Projectors

By J. C. LOWDEN



A photograph of the author's vernier drive focusing unit designed for a 35mm. enlarger.

THE unit described below costs a little under ten shillings. It can be built by any handyman using the most elementary tools, and the performance of the finished job compares well with the average commercial model.

This description is strictly that of a unit designed for 24 x 36mm. negatives, using a 2in. Wray Supar lens. At the same time it will be obvious that this construction style can be used to build a unit capable of dealing with much larger negatives.

Before commencing work the prudent constructor will assemble all his components. This is particularly essential in respect of the bellows, since the size of these determines the entire lay-out of the job.

The Vernier Drive

This piece of W.D. surplus equipment is the motive power of the unit. Originally part of an astro-navigational instrument it is constructed of the best materials, machined to a high degree of precision. The drive mechanism consists of a male threaded stem, machined from bright brass, terminating in a black rubber-covered handwheel at one end, with approximately 2in. of ⅜in. diameter thread at the other. A captive steel screw plate, with two steel bolts, is fitted above the handwheel. A fine steel shim is also provided. Above this is a removable retaining block. The retaining block is already drilled to accept the male stem and the two captive bolts, see Fig. 1.

The retaining block must be sawn in half, since in its original use the vernier drive controlled a sheet of much thinner material than the 3/16in. plywood used for the lens panel. The bolts fitted do not protrude through the block if this is not done, and it would be difficult to remove the bolts and replace them with longer ones. Furthermore, if the block was left at its original thickness the range of travel of the lens would be seriously reduced. The cutting is a simple matter with a hack saw, and both portions of the block should be retained.

The female element of the drive is a sleeve, internally threaded to accept the stem. At the top of the sleeve is a flange, which is turned over to provide a right angle bracket drilled on the upright portion to take two screws. In the model described the upright portion was sawn off to leave a flat flange. This flange was drilled to take two wood screws. A constructor who wishes to vary the unit to suit his own negative size should consider very carefully before sawing off this upright, since the right angle bracket might better suit his particular requirements.

The only additions required to the vernier drive are two 4BA nuts to suit the captive steel bolts.

The vernier drive complete costs 3s. 6d., and is available from Messrs. Millican, Brownlow Hill, Liverpool, who advertise in this journal.

The Bellows

It is hardly practicable for most workers to make a suitable bellows. Standard bellows are advertised in the classified advertisements page of PRACTICAL MECHANICS. Another fruitful source of supply is a camera repairer. My own bellows cost half-a-crown and measure approximately 1¾in. by 3in., tapering to 1¼in. by 1⅞in., and is about 4½in. long when fully extended. The constructor must be prepared to effect minor repairs to a bellows obtained from such a source, but the absolute degree of light-proofing and close folding required in a camera is not usually called for in an enlarger. In most cases a little tidying up of the ends, and a coat of bellows dope will produce an adequate result.

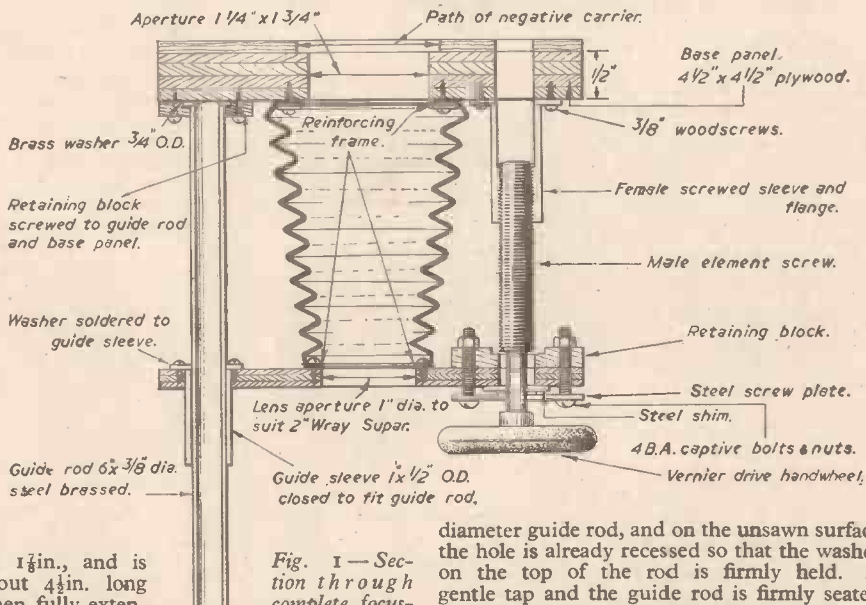


Fig. 1—Section through complete focusing unit, drawn half full size.

Bellows Frames

These are really optional, and serve only to reinforce the ends of the bellows. Two pieces of the thinnest sheet aluminium are cut to suit the last fold of each end of the bellows. The larger sheet is pierced with a rectangular aperture slightly larger than negative size. In the case of the 35 mm. model the aperture measured 1¼in. by 1¾in. A sharply pointed knife was used to cut out this aperture. The smaller frame was drilled with a 1in. diameter hole (to suit 2in. Wray lens cell). Both frames were then drilled at the corners to suit fine wood screws and carefully coated with "Joy" camera-black paint, see Fig. 1.

Guide Rod and Sleeve

This item was made from domestic curtain rod (tubing) as sold in most hardware stores. The guide rod is a 6in. length of ⅜in. diameter tube. At one end of the tube is soldered a brass washer, ¾in. outside diameter, with a ⅜in. hole. The brass coating makes the soldering a simple job, and it is not difficult to set the washer at right angles to the tube (see Fig. 2).

The spare portion of the retaining block from the vernier drive now comes in very useful. The central hole will accept the ⅜in. diameter guide rod, and on the unsawn surface the hole is already recessed so that the washer on the top of the rod is firmly held. A gentle tap and the guide rod is firmly seated in the block. Two round-headed wood screws, passing through the bolt holes were provided. These were used to fix the entire guide rod assembly to the base panel. This is shown in Fig. 1.

The guide sleeve was made from a 1in. length of the "next size" curtain rod. It was quite a loose fit on the rod when purchased, but was easily reduced. A stout bladed hack-saw was used to cut along its length. The cut

(Continued on page 41)

tube was then put in the jaws of the vice, the guide rod slid inside, and the jaws closed until a firm sliding fit was achieved. A seam of solder was run over the cut, and the bore of the sleeve was polished up with steel wool.

To secure the guide sleeve, a brass washer, pierced with a ⅜in. diameter hole, was soldered over one end of the guide sleeve. Before soldering, two holes were drilled in the washer, diametrically opposite to each other. These were to allow the guide sleeve to be screwed to the lens panel. The sleeve is shown in Fig. 2.

The exterior of the guide sleeve was then painted with "camera black"—the guide rod, of course, being left bright to avoid sticking.

The cost of the guide rod and sleeve was 8d. The tube sells at 1d. per inch, plus 1d. for the two washers.

Base and Lens Panels

These panels, as specified, were made out of stout plywood. A worker who so prefers may use metal or plastic.

After cutting to size, the panels should be set out as in Fig. 3. The base panel is drilled with the hole "A," ⅜in. clear diameter, on the centre line. This hole is to allow the passage of the threaded stem. The negative aperture "B" is cut dead centre, and measures 1¼in. by 1¾in. The dotted centre C shows the location of the upper washer of the guide rod.

The lens panel is next treated. Hole "A.1," which is ⅜in. diameter, was drilled on the centre line ½in. from the edge. Two holes 3/16in. diameter were also drilled on each side of this hole. These were to accept the captive bolts of the vernier drive. The hole "D" is the lens aperture, drilled to suit the lens available. In the case of the Wray Supar 2in., this aperture measures 1in.

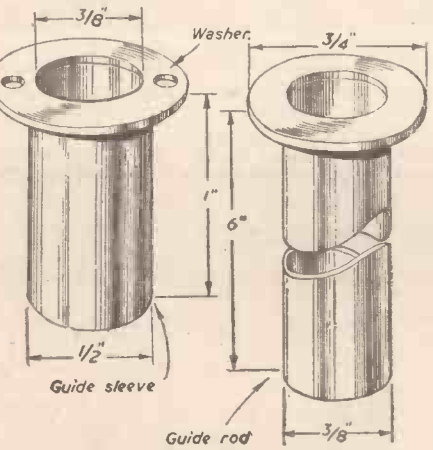


Fig. 2.—Details of the guide rod and sleeve.

diameter. Hole "E" is to accept the guide sleeve. It measures ½in. diameter and was drilled on the centre line ½in. from the edge.

When setting out the panels, it is important that the centres of the "paired" holes should coincide exactly, and it was found advisable to set out one panel and then clamp the two together. The centres were then drilled through with a fine drill. In the case of holes "A" and "A.1," these were drilled together.

After the cutting and drilling was completed, the surplus wood of the lens panel was trimmed to the dotted outlines. This trimming lightens the panel and gives it a more professional appearance. To finish, both panels were painted "camera black."

Assembling the Lens Panel

The guide sleeve is pushed through the ½in. diameter hole and the washer screwed to the upper surface of the panel. The vernier drive stem is pushed through the ⅜in. diameter hole and the captive bolts eased through the holes provided. One portion of the retaining block is slid down the stem, the bolts passing through the holes in the block. The nuts are then screwed down hard.

Assembling the Base Panel

The female element of the vernier drive is now screwed over the centre of the ⅜in. hole "A" on the base panel, and the guide rod

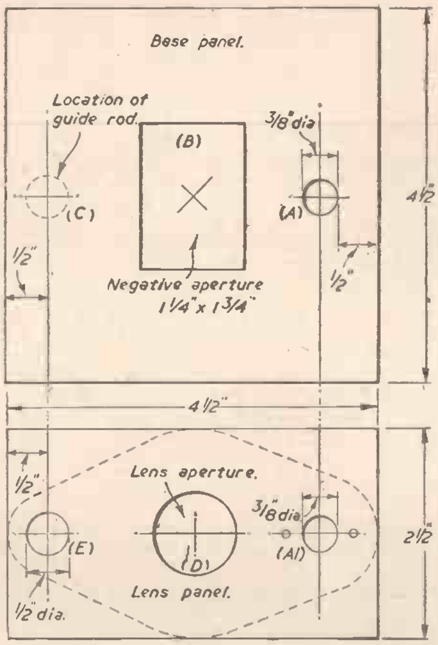


Fig. 3.—The base and the panels.

set in position over the pencilled circle. The remaining portion of the retaining block is slid over the guide rod and carefully screwed to the base panel.

The two panels are united by passing the guide rod through the sleeve, and marrying up the two elements of the vernier drive. After a preliminary test of movement only minor adjustments were needed.

After testing, the ends of the bellows were liberally coated with "Casco" casein glue. The internal frames were put in position and fine screws driven through bellows, frames, and into the base panel. The lower or lens end of the bellows was similarly secured to the lens panel.

The now completed focusing unit was screwed to the base of the lamphouse, leaving a track for the negative carrier. As there are as many different types of negative carriers and lamphouses as there are enlargers, each constructor will wish to make his own arrangements. The completed unit is shown in the heading photograph.

Performance

The movement of the unit is sweet, positive and quick, the full range of travel being achieved with fifteen turns of the handwheel. The minimum image size obtained from a 35mm. negative, with the bellows at full extension is just under ½in. by ¾in.—½ reduction. It is hardly likely that the average worker would ever require such a degree of reduction, but this is in itself a valuable safeguard. Even when working at 1 : 1, such as when printing positive slides by projection, a considerable length of thread is firmly engaged. There is no danger of any unwary extra half-turn bringing the entire lens panel assembly adrift.

At the other end of the scale, sharp focus was obtained on an image measuring 8in. by 12in.—a 64 times multiplication of area. This is very much my own limit of enlargement—a much greater degree would inevitably bring out complications of grain. For those who insist on greater enlargements, however, the maximum size could be increased by passing the female elements of the vernier drive *through* the base panel, thus bringing the lens a ½in. nearer the negative. This gain would, of course, be offset by the increase of the minimum image size.

Use in Projectors

The basic design of this unit could be used for a filmstrip and slide projector, provided that the range of travel required for the longer focus lens, usually employed in projectors was carefully worked out before commencing construction.

PARTS LIST

Base Panel 4½in. × 4½in. × ½in. plywood.
Lens Panel 4½in. × 2½in. × 3/16in. plywood.
1 Vernier Drive, complete.
1 Small Camera Bellows.
1 Guide Rod 6in. of ⅜in. (nominal) O.D. Brassed Curtain Rod.
1 Guide Sleeve 1in. of ½in. (nominal) O.D. Brassed Curtain Rod.
2 Washers, Brass, ¾in. O.D. with ⅜in. diameter hole.
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Our Junior Section

SIMPLE TELESCOPE CONSTRUCTION

The Basic Principles Involved

THE chief essentials of a refracting telescope are first a lens or combination of lenses which forms at its focus an image of any object viewed, and, secondly, a lens or system of lenses which will magnify that image. The first is called the object glass and the second constitutes the eyepiece. In practice the object glass is mounted at one end of a long tube and the eyepiece at the other end, provision being made for varying the distance between the two for focusing.

Reference to Fig. 1 shows a cheap and simple way of making a small telescope. M is the main tube, D the draw-tube for focusing, O is the object glass, C the cell carrying the latter and E the eyepiece.

The Object Glass

This can be either a double-lens achromatic combination or a single plano convex or double convex lens. "Achromatic" means that the lens does not give any false colour round objects viewed; and the terms "plano convex" and "double convex" indicate a lens flat on one side and convex on the other, and convex on both sides respectively. The double achromatic lens, of course, gives the best results and costs more, but a single lens object glass will answer quite well for a first venture. Any manufacturing optician will supply what is required; or one of the lenses from a pair of long focus circular type spectacles will do. To ascertain the focal length measure the distance from the lens to a sheet of white paper on which it forms the sharpest and smallest image of the sun or other distant object.

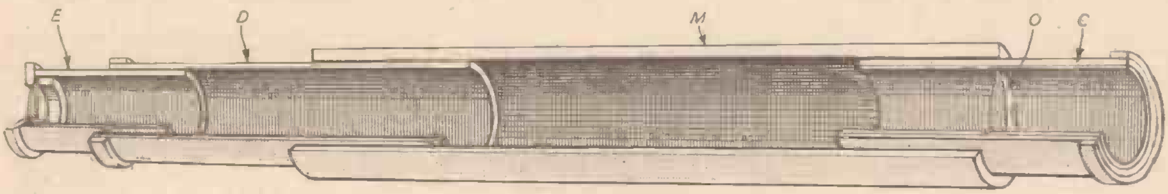

Fig. 1.—The complete telescope.

The Main Tube

Brass, tinplate or cardboard will answer the purpose, so long as the tube is straight and round. A very light and strong tube can be made by rolling paper with glue to the required thickness on a wooden or metal former. A smooth round broom handle will sometimes answer admirably. The tube should be a few inches shorter than the focal length of the objective to allow for varying the distance between it and the eyepiece for focusing, and it should be large enough inside to take the O.G. plus its mounting (see Fig. 1).

The O.G. Cell

Any small circular tinplate or cardboard box can form this part of the instrument, provided it is of correct size. The cell should be about 2½in. long and slightly larger inside than the diameter of the glass. The O.G. is pushed into the cell and held in place by a short length of tubing glued against it on either side as shown in Fig. 2. It is important to have the object glass at right angles to the axis of the tubes because if it is askew, distortion will result.

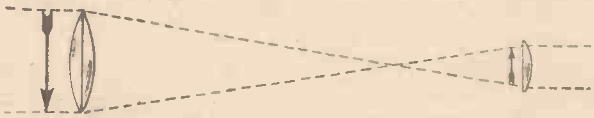

Fig. 3.—How an inverted image is formed.

The Draw Tube

This carries the eyepiece and provides for varying the distance between the latter and the objective for focusing. The draw tube should slide easily but firmly in the main tube and should be long enough for plenty of it to remain inside the latter when fully extended for use (see Fig. 1).

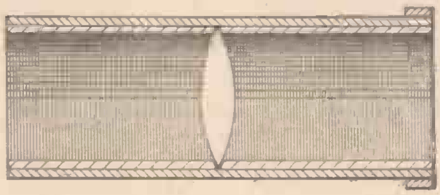

Fig. 2.—Method of mounting the object glass in its cell.

A narrow rim should be attached to the outside end of the tube to prevent it from being accidentally pushed right into the main tube. It is an advantage to have similar rims on the O.G. cell and the eyepiece for the same reason.

The Object Glass

The object glass of a telescope refracts or bends the rays of light from any object so that when they have passed through it they converge and cross, forming an inverted image of the object (Fig. 3). Astronomical eyepieces receive these rays after they have crossed at the focus, so that with such eyepieces everything looked at appears upside down. This does not matter in the least for viewing celestial objects (which have no real top or bottom), but it obviously would not do at all when the telescope is used for terrestrial purposes. For this reason a different eyepiece must be used for day use.

Professionally made telescopes have what are called "erecting" eyepieces for terrestrial purposes. These have additional lenses which put the image right way up again; usually two lenses are used. However, for the sake of simplicity, a single plano convex lens may be mounted in a short tube as shown in Fig. 4 and at E Fig. 1. If the lens is much smaller than the cardboard tube, the inside of the latter must be packed by gluing inside paper strip. The lens is held in position by being sandwiched between two packing rings as shown. The convex side is placed outermost.

Type of Lens Required

In determining what lens to buy remember that the shorter its focus the higher the power and vice versa. The rule is: focal length of eyepiece divided into focal length of object glass gives the magnifying power. For example, an eyepiece with a focal length of 1in. divided into O.G. of 18in. focal length will give a magnification of x18. This is a very suitable power for a small telescope with 1½in. O.G., especially if the latter is merely a simple spectacle lens. By doubling the focal length of the objective or reducing that of the eyepiece by half, you can double this power; i.e., make it 36 instead of 18. For day or look out purposes we must use an eyepiece which receives the rays from the O.G. before they have crossed at the point of focus, so that the object viewed will not be inverted. This means a plano concave lens must be used instead of the plano convex. A small lens of this type should be chosen with not too deep a curve, and the concave side should be placed next to the eye. It is mounted in exactly the same way as described for the other one.

Concluding Hints

Before putting the various parts together all internal surfaces should be given a coat of dead black to prevent reflection. Optician's dead black is best, but failing this, Indian ink or stencil ink will do quite well. The outside of the instrument may be varnished or painted. For viewing objects in the night sky much better results will result if some sort of stand is made.

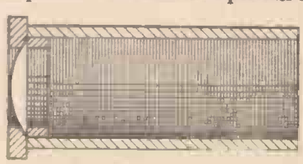

Fig. 4.—How the eye lens is mounted in a short tube.

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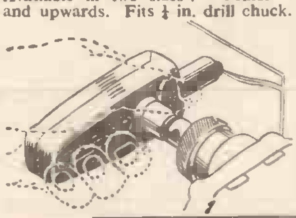

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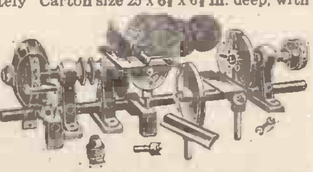

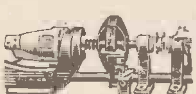

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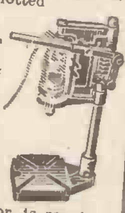

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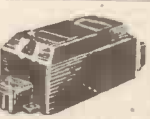

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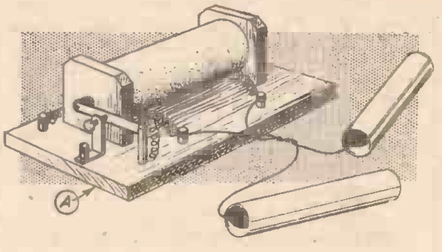


Fig. 4.—The completed shocking coil.

A SHOCKING coil, which is really an induction coil of simple form, depends for its action upon the peculiar property of electricity, by virtue of which, when one coil of insulated wire through which an intermittent current of electricity is caused to flow is placed within another coil, a current of electricity is induced in the outer coil. The inner coil in this case is called the primary coil and the outer one the secondary coil. In order that the electromotive force in the induced current shall be sufficiently high to cause a shock, the primary coil is wound round a laminated iron core, while the secondary coil consists of a much larger number of turns than the primary winding. An intermittent current is caused to flow in the primary coil by means of a rapid make-and-break device which will be described later. It is on the rapidity of the make-and-break action that the strength of the shock depends.

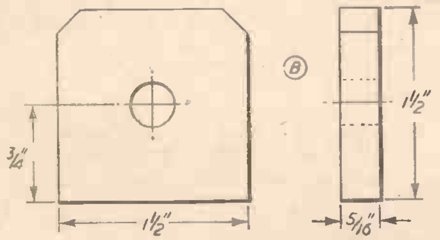


Fig. 1.—Construction of the supporting cheeks.

Construction

For the baseboard (see A in Fig. 4) a piece of wood 6in. long, 3½in. wide and ⅜in. thick will be required. Ordinary deal will answer quite well and this can afterwards be stained and polished. Two pieces of wood 1½in. square and 5/16in. thick will also be required for the end cheeks, as shown at B in Fig. 1. These support the core and windings.

With a 5/16in. centre-bit make a hole in the middle of each cheek to allow the ends of the core to pass through. Chisel off the top corners and well rub the sides and edges of the cheeks and baseboard with fine glasspaper.

For the core obtain a coil of florist's soft iron wire and without undoing the coil cut out a portion 4¼in. long. The part to be cut out must be bound round tightly with another piece of wire to prevent the strands coming loose when severed. The best way to cut the wire is to use a sharp-edged cold chisel and hammer. The bundle of wire can now be straightened out and the jagged ends filed square. To facilitate this operation apply some flux to the ends of the wire and dip them in molten solder. It will now be found that it is quite an easy matter to square up the ends with a file.

Now take the core and proceed to cover it with a layer of thin brown paper, the edges of which overlap ¼in. and are stuck down with a little glue. This paper wrapping should be 3¾in. wide so as to allow ¼in. of the core to be bare at each end, as indicated at CC (Fig. 2).

Winding the Coils

We shall now require 5yds. of No. 22 cotton-covered copper wire for the primary winding and 26yds. of No. 28 wire (also cotton covered) for the secondary winding. Take the paper-covered core and proceed to wind on the primary wire, leaving a free end of at least 6in. to start with, the same amount being left at the finishing end as shown at D (Fig. 2). The last one or two turns must be bound round tightly with thread to prevent the coil from unwinding. Apply a coating of shellac varnish and cover the coil with thin brown paper. When dry wind on the secondary wire, leaving about 6in. at each end for connections. After binding the last two turns with thread another application of shellac varnish can be given and allowed to dry.

Mounting the Coils

The coils are now ready for their casing, which consists of a cardboard tube covered with a piece of velvet, which gives the completed coil a pleasing finish. Obtain an ordinary postal tube, about 1¼in. o.d., and cut off a piece ⅜in. to ⅝in. long, keeping the ends as square as possible. Cut a piece of velvet just to cover the tube, and glue the edges down to the cardboard. Now place the coils in the tube, make little nicks in the ends of tube for the connecting wires to pass through, and then glue on the wooden cheeks. One end of the iron core should project about 1/16in. past the face of one cheek as shown in Fig. 4. Fix the coil in position on the baseboard by two screws driven into each cheek from underneath.

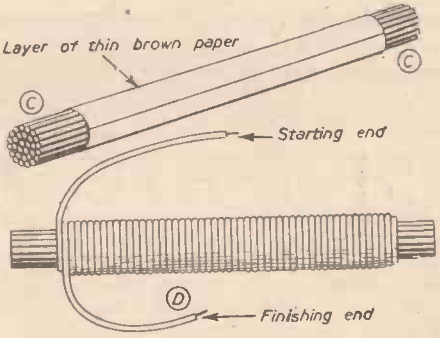


Fig. 2.—Coil winding details.

Contact Breaker

This consists of an armature spring, supporting piece, contact screw and bracket. For the armature spring cut out a piece of thin, springy sheet brass, about No. 35 gauge, to the shape shown at E (Fig. 3). The little armature is a soft iron disc ⅜in. in diameter and ⅛in. thick. A hole should be drilled through the centre of it so that it can either be screwed or riveted to the end of the spring.

The contact piece on the spring is of silver, and for this a link from an old silver watch chain can be used. Straighten the link out and, after cutting off a piece ⅛in. long, insert it in the hole made at b and burr it over on both sides of the spring by tapping with a light hammer until a flat surface of silver is formed about ⅛in. diameter.

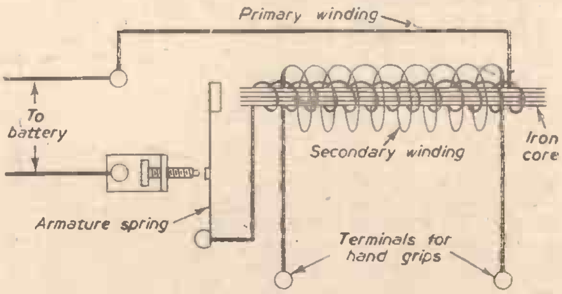


Fig. 5.—The circuit.

A piece of brass rod 3/16in. dia. and ⅞in. long will now be required, and this should have a hole drilled and tapped in one end to take the stem of a countersunk screw, as shown at F. At the top end a flat can be filed sufficient to take the width of the armature spring, which can then be neatly soldered to the pillar, as shown in Fig. 4.

The bracket G, for the contact screw, can be bent to shape from a piece of sheet brass about 1/16in. thick after drilling the two holes near one end for the fixing screw and terminal stem and drilling and tapping the hole near the other end for the contact screw. For the latter obtain a brass screw with a milled head if possible, and in the end drill a small hole and solder in a short piece of silver wire from the watch-chain link, leaving about 1/16in. projecting, as shown at H (Fig. 3). Fix the bracket to the baseboard with a small round-headed brass screw and a terminal as shown in Fig. 4. See that the end of the silver wire on the contact screw touches the centre of the silver contact piece on the armature spring when the latter is in its normal position. Screw another terminal into the baseboard in the position indicated in Fig. 4.

Making the Connections

Each piece of free wire from the coil should be formed into a spiral, as shown in Fig. 4. This is done by winding the wire around a smooth rod of either wood or metal about ¼in. dia., giving a neater appearance to the coils.

Bare each end of the covered wire by scraping with a penknife. Fix one end under the terminal near the corner of the baseboard, and clamp the other end of the primary under the brass pillar which supports the armature spring (see Fig. 4). Clamp the ends of the

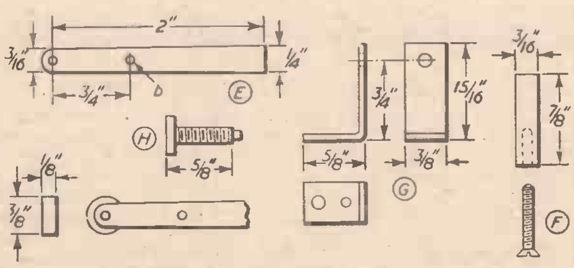


Fig. 3.—Details of the contact breaker.

secondary wire under the two terminals which are arranged to take the ends of the flexible wire attached to the hand-grips.

The coil can now be tested by connecting up to a single dry cell, the leads from the latter being connected to the two terminals at the ends of the primary winding, as shown in Fig. 5.

On adjusting the contact screw so that the silver point presses lightly against the contact piece on the spring the latter should begin to vibrate at a rapid rate and continue to do so while the current is flowing. This shows that the primary winding is all right. Now place the tip of a finger of each hand lightly on the two terminals attached to the secondary winding, when a shock will immediately be felt.

For the hand-grips two pieces of thin brass tubing about 4in. long and ⅜in. dia. will be required. A piece of ordinary twin flex, about 3ft. long, serves for the connecting leads. The wire is opened out at each end, two of the ends being soldered to the grips inside one end.

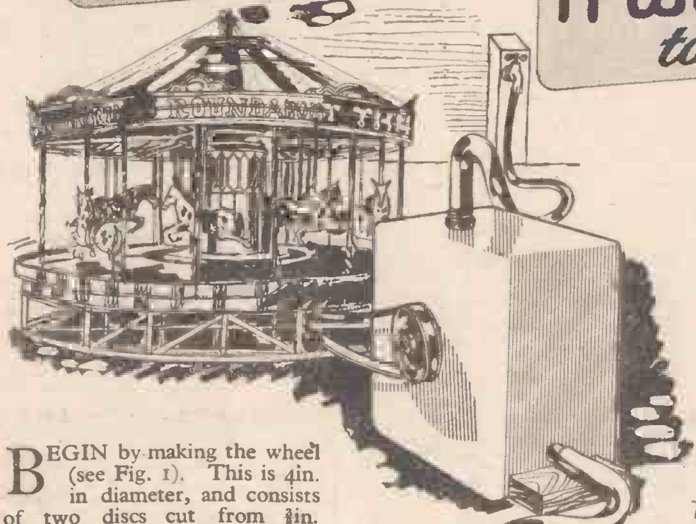
This shocking coil may also be used with a morse tapper, if the latter is available. Connect the coil in series with a pocket-lamp battery or two dry cells and a morse tapper. Depress the key and adjust the contact screw until the armature vibrates with a gentle hum. The coil should now be giving a smart shock. When using the coil in this way see that it does not get pulled off the table. The tapper key enables one to give a shock without having to manipulate loose wires. Many of the parts from an old electric bell may be used in constructing this shocking coil. It is worth pointing out that the shock felt is entirely due to *voltage*; no current flows.

The shocks delivered by the instrument described in this chapter are harmless.

Junior Section

A Water Motor to Drive Your MODELS

A Powerful and Inexpensive Source of Power Made from Simple Materials



BEGIN by making the wheel (see Fig. 1). This is 4in. in diameter, and consists of two discs cut from ⅜in. wood to the shape shown in the sketch and secured together with brass screws, the grains being crossed to prevent warping.

The Buckets

Around the periphery of the wheel are 12 buckets cut from sheet brass. The quickest way to make them is to cut a cardboard pattern to the measurements given in Fig. 2 and placing it upon the brass scribe round it. Cut out the blanks and drill them; then shape them by hammering around a piece of rod or tube ⅜in. in diameter. Bend the tabs at the dotted line and attach each bucket to the wheel with two screws (see Fig. 2). Note that all screws and metal parts used—with the exception of the shaft—should be of brass, not iron, which would quickly rust and require renewal. The shaft is a piece of mild steel rod ⅛in. in diameter and 4in. long. To ensure a non-slip drive, solder a 1in. brass disc to the shaft, and attach the disc to the centre of the wheel with three screws (see Fig. 1).

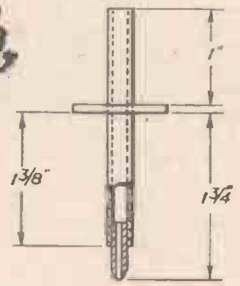


Fig. 3.—Details of the nozzle.

The Case

To make this cut, four pieces of ½in. wood and join together with screws to form a frame 7in. square and 2½in. deep. It will be noticed in Fig. 1 that the base of this frame projects 1in. at each side. This is to give a convenient means of clamping the motor in position when in use. Cut the back and the front of the case from ⅜in. wood, and at the exact centre of each drill a hole for the shaft and bush it with a small piece of brass tube.

The Nozzle

The inlet pipe with nozzle is shown in detail in Fig. 3. It is made from a piece of ⅜in. brass tube, the nozzle being formed by soldering a piece of smaller tube into the end. A flange cut from sheet brass, and having three holes drilled in it, is soldered to the tube at the position shown. Drill a hole in the top of the case to receive the tube and secure in position with three round-headed screws. The outlet pipe is a piece of ⅜in. brass tube, which fits tightly into a hole in the side of the case as close to the bottom as possible. Centre the wheel in the case by fixing two collars on the shaft either with grub screws or solder. Screw on the back and front of the case, fix a pulley on the end of the shaft and the motor is complete.

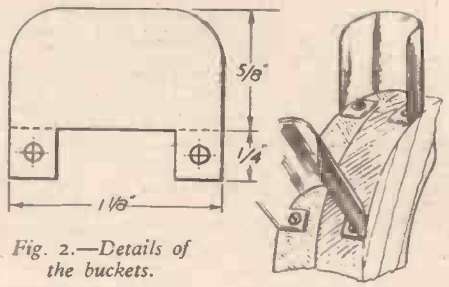


Fig. 2.—Details of the buckets.

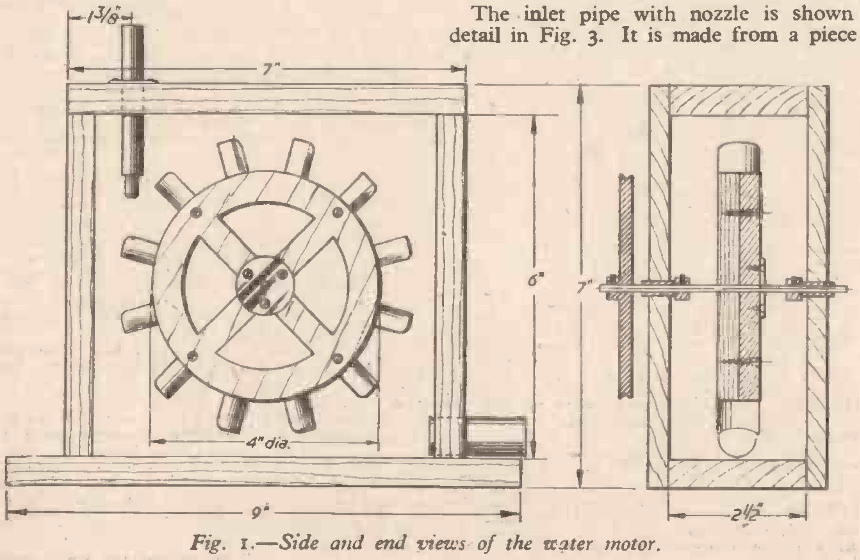


Fig. 1.—Side and end views of the water motor.

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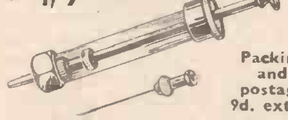

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(Continued from previous page)

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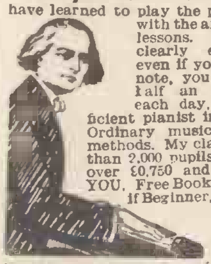

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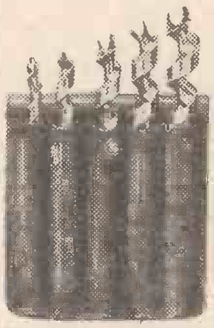

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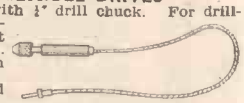

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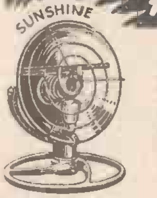

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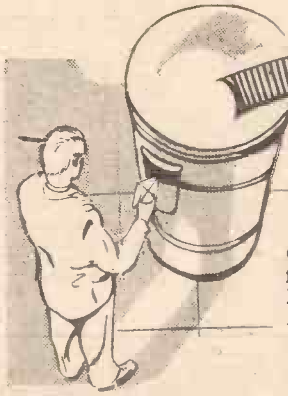
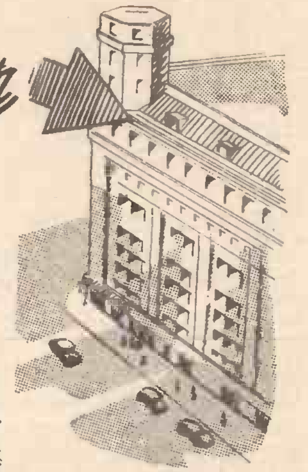


Letters to the Editor



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

Commutators for Small Electric Motors

SIR,—Having purchased three OO gauge electric locos, I have the following general observations to make in respect of these locos which may be of interest.

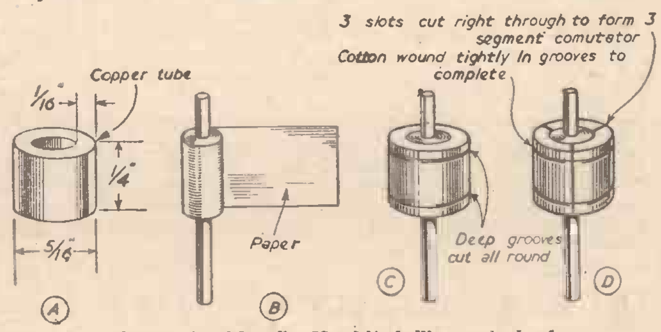
My experience is that the permanent magnets with which these locos are fitted seem to lose power in time, with the result that they lose pulling power and run slow.

The commutator is in my opinion too thin in construction and wears too quickly, possibly because of lack of thicker sections to dissipate heat. The magnets' loss of power plus early wear of the commutator cause the loco to fail electrically, it being otherwise mechanically sound.

I rewind the armatures myself and also make my own commutators and in this connection readers may be interested in the construction of these minute pieces which cannot always be purchased to exact size required.

The procedure is as follows. Select a fairly thick copper tube of outer diameter required for finished commutator and cut to correct length, forming a copper cylinder (A) in sketch, which will eventually be finished commutator. Next select a spindle same size as armature spindle and wind on the former continuous paper strip (glue each turn) to form centre for copper cylinder (B).

Glue paper centre and slip over the copper cylinder, which should be a tight fit and should run true on the spindle when spun. When glue is dry, put spindle through cylinder centre and cut two deep grooves all round the copper tube, one groove round the top and one groove at the bottom; this is done with a fret saw (fine blade). The grooves must be deep, but be careful not to go right through, see C in sketch.



Stages in Mr. J. H. Mitchell's method of making small commutators.

The next stage is to cut carefully through the cylinder longitudinally in three places (with fretsaw). Do this carefully so that the segments are not disturbed and remain on the paper centre.

To complete, tightly wind about five turns of cotton thread in the top and bottom grooves (D) and wipe glue in to fix. The cotton must not stand proud of the grooves.

By this method I made a very true commutator at the first attempt; soldered the armature connections to it and fitted it to a model loco, which operates perfectly.

Because of the apparent loss of power of the permanent magnet I turned it into an electro magnet by fitting a distance piece between the pole pieces and winding with similar size wire as on the armature. Better results are obtainable if slightly larger gauge wire is used.

A piece was cut out of the chassis to accommodate the now electro magnet.

The loco so fitted now operates well on either A.C. or D.C., at 15 to 20 volts, but it is not so easily reversible as with permanent magnet fitting.

Probably a smaller cylindrical commutator than that used in OO gauge locos would never be required and it is doubtful if a commutator so small, *solid* and so accurate could be made at home by any other method than that described.

The use of thick copper tube is important in my view to allow for heat dissipation and to give the commutator long life. The actual measurements of commutator made for OO loco are given at A in the sketch.—J. H. MITCHELL (Leamington Spa).

Making a Transfer

SIR,—In reply to D. G. Brinjes' (Maidenhead) query in the July issue of PRACTICAL MECHANICS, make a solution of water, starch and washing "blue" to the consistency of cream (the amount of "blue" gives the depth of colouring).

This is then applied to, say, tracing or grease-proof paper on which is drawn the desired design.

When dry it can be transferred to the most delicate of cloths by means of a warm iron.

Used needlework papers can be re-used by this method, the advantage being that when the fabric is washed it leaves neither stain nor mark.—D. E. BANKS (Workington).

Garden Fountain

SIR,—Regarding the query from F. Evans (page 430, July issue), many advertisers in PRACTICAL MECHANICS offer small 24-volt motors and pump units. I would suggest that one of these be purchased together with a suitable transformer. The transformer should be kept in the house and the low voltage only taken outside.

A drain hole from the pool should be about ½in. bore and the fountain pipe proper be about ¼in or 5/16in. with a 3/16in. jet.

It is difficult to give more precise dimensions without a definite motor and pump but I would suggest the fountain pipe does not project more than 1ft. above the water.—JAMES K. NICHOLSON (Lancs.).

Air Compressor Safety Valves

SIR,—On page 486 in the August issue of PRACTICAL MECHANICS, a query regarding Air Compressor Safety Valves is dealt with and the reader is referred by you to various firms.

As you will observe from the displayed advertisement relating to our products on page 438 of the same issue we are manufacturers of spray painting equipment and we are in a position to supply the type of equipment which is the subject of your reader's enquiry.—B. E. N. PATENTS, LTD.

Chinese Concentric Balls; Tube Bending Machine

SIR,—*Re* your reply on Chinese Balls, page 486 August issue; these were not "carved," but turned and bored. The whole process is described in Volume IV of Holtzapfels "Turning," which every turner should read. It gives the basic principles of all mechanical work and the methods used a century ago, employing simple tools.

Regarding the Tube Bending Machine, page 451 of the August issue, it would be simpler and quicker, when forming the half-round groove in the guide, to place two pieces of plate together and drill edgewise through where they meet, discarding one piece.—J. E. D. (Tyne Dock).

Flying Saucers

SIR,—My question on the above subject is: "Having got so near to the Earth, why don't these things land?" Several writers have pointed out that there is nothing new about them; they were seen (under a different name, of course) in various parts of Europe some 300 years ago.

Then (disregarding the "known" landings, now almost universally discredited), why are they taking such a long time to make up their minds to land? It cannot be gravity difficulties because they have been seen at low levels where gravity has about the same value as at surface.

It cannot be atmospheric trouble either. If they had only been seen about 50 miles up, like small noctilucent clouds, their protagonists would have a strong argument: "They are afraid to enter our atmosphere because they have not yet conquered the problem of motion through such a dense medium . . . they have no materials that will stand up to the pressure when travelling through at high speed . . ." Landing implies emerging from the vessel, and I admit there could be trouble with pressure on their bodies, but, as a supporting point, it can be negatived. Someday our own spaceships will get within a few hundred miles of the Moon. Does anyone believe it will take another 300 years to obtain the knowledge that will implement a landing? I do not think so.

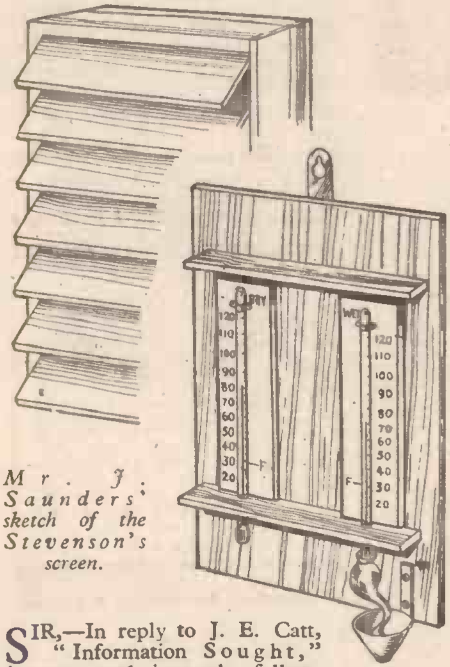
Supporters of the F.S. could reply plausibly that, after a hundred years and more of experiment in diving technique, men have only been able to descend a few trivial fathoms—and the 7-mile depth still faces them. This, too, can be negatived, for if in course of time men get down 6¾ miles (as they may well do), I am prompted to repeat my question: "Does anyone believe it will take 300 years to cover the remaining ¼ mile?" Are the Martians afraid we may be hostile? Did that stop our early explorers from landing among aggressive peoples? Our hope is that the planets may be inhabited. My view on the F.S. coincides, I think, with yours and with the great majority of your readers, which is, that there could be such things and, if so, they will be strictly of terrestrial origin. If they are manned, their occupants, instead of being those funny little wights beloved by cartoonists, would prove to be just the plain *homines* we rub shoulders with in the street.—P. BOWN (Northampton).

Stevenson's Screen

SIR,—In reply to Mr. J. E. Catt, "Information Sought," August, 1956, issue, regarding the housing of meteorological instruments, may I suggest that he buys an excellent Meteorological Office publication on this subject entitled "Instructions for Making Thermometer Screens of the Stevenson Type" (Form 63). It is published by the Stationery Office, York House, Kingsway, London, W.C.2, price one shilling.

This booklet gives constructional details down to the last nail and inch of wood, quoting dimensions which are standardised and make the temperature readings comparable to others and useful.

Both the Bilham and Stevenson screens are given, the difference being in size, the Bilham having accommodation only for thermometers, i.e., generally smaller dimensions.—M. H. O. HODDINOTT (Chester).



Mr. J. Saunders' sketch of the Stevenson's screen.

SIR,—In reply to J. E. Catt, "Information Sought," August, 1956, issue, the following may be of use. As the sketch shows, the screen is a simple box, about the size of a domestic medicine cabinet, with a louvred door which allows the free passage of air but prevents the entry of rain. Naturally, the size of the screen depends upon the size of the thermometers, but should be as large as possible so that ventilation may be complete. So that the effects of radiated heat from the sun may not influence the readings of the thermometers the screen is usually painted white.

The screen is used to cover the hygrometer which is an instrument for measuring the moisture content of the atmosphere. The most widely used hygrometer is based on Mason's principle and consists of a combination of two thermometers, placed within not less than 3in. of each other. The bulb of one is kept damp with a small piece of cambric tied loosely on, and a few strands of lamp wick, two or 3in. long, hang down into a cup of water.

The hygrometer measures the humidity of the air. Evaporation takes place when air is dry and so the moisture dries off the cambric thus reducing the temperature of the wet bulb thermometer. Consequently, the drier the air the greater will be the evaporation. When the air is moist there is less evaporation and the difference between the readings is correspondingly less. On the other hand, in very dry weather the wet bulb is sometimes as much as 10 degs. lower than the dry bulb.

—JAMES SAUNDERS (Cardiff).

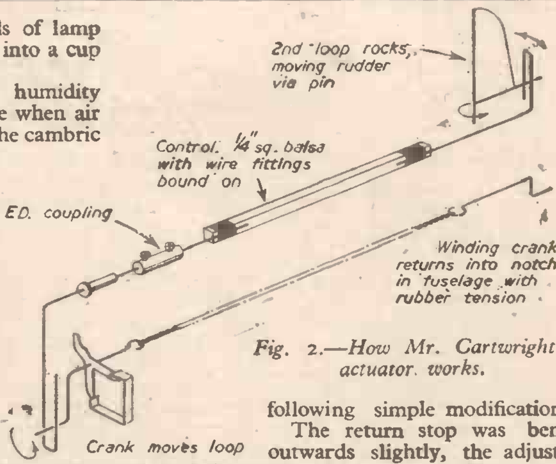


Fig. 2.—How Mr. Cartwright's actuator works.

Actuator Modification for Radio Controlled Aircraft

SIR,—Having just purchased an E.D. standard actuator and converted it to the "Bonnerised" system described in your July issue of PRACTICAL MECHANICS, I was very puzzled to find that I could not stop the starwheel in the intermediate positions. Presuming that the escapement wheel pawls required slowing, I weighted them, still with negative results. I then found what your contributor seems to have overlooked—that the current saving device was only giving sufficient pull at the first signal.

Subsequent signals were passing through the full coil resistance, cutting the amps down, so that unless I reduced the air gap between magnet and armature or put up with 300 mA consumption in the hold-on positions, I could do nothing but stop left rudder.

To avoid the complications involved in reducing the air gap, I decided upon the following simple modification. The return stop was bent outwards slightly, the adjustment being restored by an 8 B.A. setscrew mounted in a "split and nipped" tapped hole in a stout bracket, which was mounted on the paxolin panel just clear of the actuator chassis. The lead was then carefully removed from the existing springy-bronze contact and soldered to the new back stop. The shorting circuit is thus completed at every return of the armature and not as before at every complete revolution of the neutral star arm. I would stress that the new fitting must be rigid otherwise a buzzer action will be experienced. Mine was made from a short piece of ⅛in. wide silver solder strip, see sketch, Figs. 1 and 2.

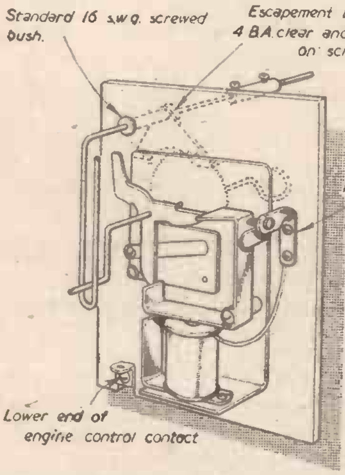


Fig. 1.—Mr. Cartwright's improved actuator.

I use a standard chain sprocket from a toy construction kit, 1½in. dia. and with 18 teeth. A new bush is fitted having 9/16in. hole.

Returning the drive spindle to the same side as the rubber hook enables the actuator to be mounted just behind the receiver amidships. This keeps the weight in the right place and increases the length of the rubber motor. Winding can be done from the rear without access to the interior, and wiring, having possible capacity effect, is shortened considerably.—EDWARD CARTWRIGHT (Lincs).

Wind Generator Plant

SIR,—In reply to A. J. Banwell in July P.M. I have a 12 volt Sims-Bosch 4-pole slow speed dynamo that required rather a high speed to start generating. I cut the connections between the two field coils, and connected one brush to end of one coil and the other end of coil to other brush. The first brush again to starting end of the other coil and other end of coil to the other brush. Thus I can coil string around the shaft and it generates at (I should imagine) about a hundred r.p.m. There is a snag: when driven by windmill after about a week the commutator becomes black and fails to generate. I use a home-made wooden propeller 6ft. long, 4in. wide and 2in. thick.—J. W. B. (Stoke-on-Trent).

Trade Notes

The Solascope

PRODUCED by H. H. Freeman & Co., 44, London Road, Kingston, Surrey, the Solascope is a rotary guide on similar lines to the more familiar photographic exposure calculator. However, instead of indicating exposure, movement of the centre disc reveals a mine of information relating to the solar system. Over 1,000 facts and figures are included pertaining to the sun and planets, including space travel computations. Three models are available: one, of double-sided three-piece construction and showing all the planets, costs 9s. 6d. and two others, each of two-piece construction and showing half of the planetary system, cost 5s. 6d. each.

New Range of Wolf Portable Electric Drills

MESSRS. WOLF ELECTRIC TOOLS, LTD., have started production of a new range of industrial portable electric drills. They range from ¼in. to ⅜in. capacity and are an extension of the existing range of ½in. to ¾in. heavy duty industrial drills. The most important new feature of these machines is that the inside of the switch handle and switch handle cover adjacent to the live switch parts are covered with a permanently moulded layer of insulating material. A further feature of interest is that they are fitted with continuously rated motors, giving them extremely high penetration speeds. Prices range from £17 15s. to £20 5s.

The new Wolf electric drill.

Fonadek Telephone Amplifier

THE unit shown in the photograph is brought into operation when a call is received by placing the receiver on it (an act which leaves the user's hands free). This action switches on a microphone and loudspeaker, enabling any number of persons to join in the conversation, speaking at some distance from the telephone, and listening by means of the loudspeaker at the same distance. If greater amplification is required an external loudspeaker may be used and a multi-amplifier for connecting the Fonadek with loudspeakers in other parts of a building is available.

Prices are—

Battery-operated model, 16 guineas;
All-electric model, £23 10s. 0d.;
Multi-amplifier, £12 10s. 0d.;
External loudspeaker, 3 guineas.

The manufacturers are Messrs. Fonadek (Branson) Limited, Knightsdowne House, Vivian Road, Birmingham, 17, and the unit is also obtainable from leading office equipment dealers and radio and TV suppliers.

The Fonadek telephone amplifier, which incorporates a loudspeaker and a microphone.

Sawing and Woodturning Booklet

FROM Messrs. Black and Decker we have received No. 3 of a series of booklets published by them on the use of their tools and accessories; this one is entitled "Sawing and Woodturning" and contains hints and tips on the use of the relevant Black and Decker units in some of the many jobs on which they can be employed. The previous two booklets were "Drilling" and "Sanding and Polishing." All three booklets are available free to owners of home handyman electric tools and application should be made to Black and Decker Limited, Harmondsworth, Middlesex.

The "Do-it-yourself" Soldering Kit

THIS kit is a combination of some of the latest soldering products of Perdeck Solder Products Ltd., Waltham Abbey, Essex, and the Valtock "2000" blowlamp, made by Valtock Ltd., 6, Sherwood Street, Piccadilly Circus, London, W.1. No soldering iron is necessary. The small and lightweight blowlamp is constructed of solid brass, nickel plated and produces a small but intense pencil flame. If required it may be carried in the pocket.

The terms "paint," "paste" and "putty" when applied to these solder products are illustrative of the texture of the solders and each is designed for use in different types of soldering work. Also included in the kit is a "tinning salt," which is used for tinning through rust, paint or other corrosion. The chief advantages are simplicity and economy in use, combined with high efficiency. A photograph of the kit appears on this page; it includes tins of solder paint, solder paste and tinning salt, Valtock blowlamp, mixing dish, a brush and a wiper. The price of the kit is 39s. 6d.

(Right)—The "Do-it-yourself" soldering kit.

Dunlop Valve Inserts

ALL roadster type cycle tubes made by Dunlop for the replacement home market from now on will be fitted with the Dunlop Easypump valve insert. The insert is interchangeable with the rubber sleeve type and replacements can be purchased for 1s. per packet of two. Use of the Easypump insert means that far less effort is needed to inflate a tyre, air retention is improved and pressure checking is possible.

The G.20 Dunlop pressure gauge is available for this purpose and retails at 8s. 6d. (Two inserts are included with each gauge.)

Mawhood Bros. Ltd. Address—Correction

WE have been informed that the address given for the above firm on this page in our August issue was not correct. The correct address is: Palm Tree Works, Trippet Lane, Sheffield, 1.

Your Queries *Answered*

Storing Cement

I BUY cement in the usual 1 cwt. bags, but often do not use it all at one time. What is the best way to keep it ?—R. C. Duffus (Angus).

A VERY simple way of overcoming your difficulty is to keep the cement in its original three-ply paper container and to drop the whole package into an ordinary, well-lidded galvanised dustbin of the common type. The dustbin should be kept in a warm place, preferably above an oven, stove or near hot-water pipes.

If you cannot avail yourself of the necessary warm, dry situation, the only alternative is to lay over the top of the open ended dustbin (after the cement bag has been placed therein), several layers of sacking (hessian) which have been impregnated with oil. The top is then pressed down over these layers, making a forcible, tight fit. The dustbin should be stood on several bricks at a height of about 1 ft. above the ground, thus enabling a good draught to be set up underneath it. The oiled sacking will act as a barrier to the ingress of moisture and will keep the cement in good condition for months.

A combination of the above methods is, of course, very good, but, provided you can avail yourself of a good, warm situation, we find that the provision of oiled sacking across the top of a bin is not necessary.

Flexible Gloss Finish on Rubber

WHAT is the solution or hard gloss finish that is applied to rubber Wellington boots ? I have experimented with several solutions on scrap rubber, and have obtained a good glossy black finish, but after rough handling the solution runs into minute cracks. Is there a suitable lasting finish that can be applied ?—L. V. Cole (Northants).

A SIMPLE solution to provide a good gloss on rubber Wellington boots is a solution of shellac in methylated spirit. This is made to about paint consistency and is wiped on thinly with a soft pad or flannel. This resists water and is readily removed from the rubber by means of methylated spirit. It is also capable of taking a semi-matt wax finish by the use of any good floor polish.

If you want to colour the shellac finish merely dissolve a little black or brown dye, in the shellac polish. The dyes must, of course be of the spirit-soluble variety. Another solution would be made by dissolving 15 parts of polyvinyl acetate in 85 parts of warm methylated spirit. This may be dyed in a similar way and it can be applied with a brush. Polyvinyl acetate is obtainable from most of our advertisers of plastic materials.

Vinyl Products, Ltd., Butter Hill, Carshalton, Surrey, have, also, a good range of synthetic lacquers which you could also use for the above purpose, taking care not to employ those which dry with a slight permanent tackiness.

Casting Materials

I WISH to make some model seagulls with outstretched wings to ornament ash trays I have made. I have an ideal model with about a 3in. wing span which is made of metal.

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.

I have purchased some Fleximould and have succeeded in making a good mould. What is a suitable casting mixture for use with the Fleximould ?—F. Aust (Plymouth).

FOR making the model seagull you could use ordinary plaster of Paris slaked to paste consistency with a solution of 10 parts of gelatine in 90 parts of water. This would be slow setting, but the method is a cheap one and it would not involve the use of heat and thus destroy the mould.

If you require to use a metal you should employ Wood's metal which can be obtained from British Drug Houses, Ltd., Poole, Dorset. This alloy melts about 68 deg. C. and costs about 21s. a lb.

Another possibility is the use of Vinamould resin which is obtainable from Vinyl Products, Ltd., Butter Hill, Carshalton, Surrey.

A further alternative would be to use "Catacast" resin supplied by Catalin, Ltd., Waltham Abbey, Essex. This is a phenol-formaldehyde synthetic resin, which is supplied in the form of a syrup and which, after mixing with a small amount of "acid accelerator," sets within about 24 hours to a transparent mass.

Protection Against Paint Solvents

CAN you please tell me of a solution which I could apply to the ends of a cylinder made from bitumised cardboard, which would make the cardboard roller impervious to paint solvents, particularly turps, and also which would be waterproof?—R. Colebourne (Southsea).

THERE are very many different kinds of paint solvents, and there is no single substance with which you could coat the cardboard and which would render it impervious to every possible type. For most purposes a thick coating of shellac dissolved in methylated spirit would be quite suitable. This would hardly disturb the bitumen within the cardboard but it would *not* render the cardboard impervious to any solution of paint softener containing alcohol. It would be quite resistant to turpentine (genuine or substitute) and also to paraffin, naphtha, etc. It would also be waterproof.

Another very cheap method is to use a rather thick solution of ordinary glue. Paint this on hot with a brush in three separate layers, giving each layer time to dry before the next one is applied. You will, in the end, thus obtain a shiny coating like varnish on the surface. When this has been attained, brush it over with a mixture of commercial formalin and water (equal proportions) and then allow it to dry. The formalin treatment will insolubilise the glue layers, rendering them waterproof and the glue itself will be impervious to most paint solvent liquids, including all alcohols and methylated spirit.

Heat Proofing Saucepan Handles

CAN you tell me of any substance that I can use to mould over metal saucepan handles and so render them heatproof ?—R. Bamber (Surrey).

HEAT-RESISTING saucepan handles are generally moulded and pressed on to the existing metal handle of the pan in a specially designed press. On a small scale this would hardly be possible for individual working. We suggest that you wrap the metal handle tightly with fine string. A wooden or cardboard mould must then be constructed to slip over the string-bound handle, giving about ½in. clearance. Both handle and mould are then clamped rigidly in a vertical position and the casting mixture poured into the mould and allowed to set. One good mixture is equal quantities of magnesite and fine asbestos powder, this being slaked to mortar consistency with a solution prepared by dissolving 40 parts of magnesium chloride in 60 parts of water. Another mixture can be prepared by making a thick paste of bakelite varnish and powdered asbestos.

Asbestos powder in various grades is obtainable from Turner Bros., Asbestos Co., Ltd., Rochdale, Lancs., or from Bell's Asbestos and Engineering Ltd., Bestobel Works, Slough, Bucks. Magnesite can be obtained from Messrs. Everitt and Co., Ltd., 40, Chapel Street, Liverpool 3. Magnesium chloride is supplied by Messrs. S. Pitt and Co., Ltd., 95, Bath Street, Glasgow.

Silver-grey Finish on Steel

I WISH to obtain, on steel, the silver-grey finish which is rapidly becoming popular on such things as front lamps of cycles. Can you help?—R. E. Matthews (S.E.5).

THERE is no satisfactory method of obtaining the silver-grey finish on steel by chemical methods alone. This finish on commercial articles is always an applied lacquer. Two good lacquers of this type are available from Messrs. Wm. Canning Co., Ltd., Gt. Hampton Street, Birmingham, 18. They are "Auralene No. 699," which is a cellulose medium to which bronzing powders have to be added and "Colorite No. 1304," which is a transparent coloured cellulose lacquer. One or other of these, we feel sure, would fulfil your purpose.

If, however, you wish to attempt the colouration by purely chemical methods the steel would have to be brass-plated beforehand and then immersed in the following bath until the colouration has developed:—

Arsenious oxide	... 75 grams
Hydrochloric acid	... 1 litre

(the arsenic oxide is dissolved in the acid, during which highly poisonous fumes are evolved).

Since, however, this solution gives a rather dark-grey colouration we doubt whether it would be suitable for the purpose which you have in mind. The plain or pigment-lacquering method is undoubtedly the one for your needs, this, as we have stated, being the commercial procedure.

Waterproofing an Elm Bowl

I HAVE an elm rose bowl which is porous. Would you please inform me of a method of making this permanently waterproof without destroying the polished surface?—R. Crocker (Bracknell).

YOU do not tell us whether the elm rose-bowl is polished within or without, but, in actual fact, it will be a rather difficult matter to make the bowl permanently waterproof without injuring its present polish. The only way we can suggest is that you give both inside and outside of the bowl three separate coatings of a suitable moisture-resisting synthetic varnish. We recommend for this purpose the toluene solution of polybutyl methacrylate which is made by Vinyl Products Ltd., Butter Hill, Carshalton, Surrey. This varnish dries within about 30 hours at ordinary temperatures and it will impart a high continuous glaze to the surface on which it is laid.

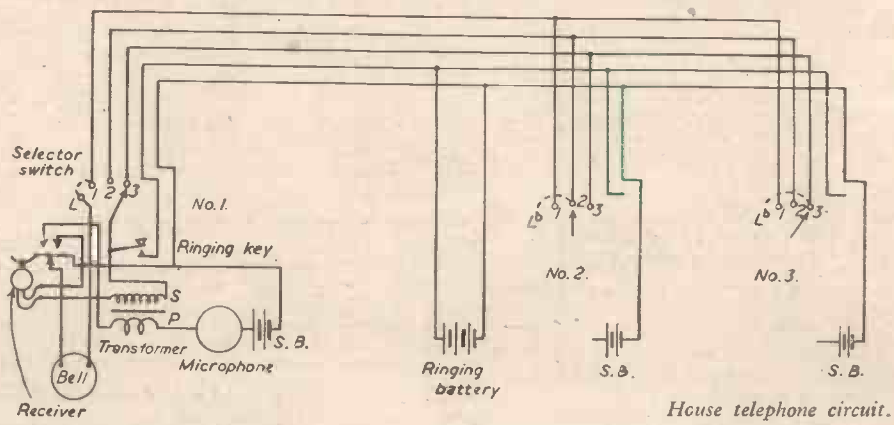
A Honing Stone

I WANT to make a honing stone and would like to know what bonding substance to use with such materials as corundum, carborundum and emery. Also whether it is possible to use other materials for padding, and sources from which these can be obtained.—E. Williams (Leicester).

A VARIETY of bonding materials can be used in the construction of modern abrasive wheels, these including various clays, mineral cements, rubber compounds and various synthetic resins. Each of these materials has its own particular advantages—and disadvantages. For average use the following formula for a grinding wheel material is quite effective:

Abrasive grains	... 100 parts (by measure).
China clay ...	... 12.5 „ „
Sodium silicate (waterglass)	... 12.5 „ „

Mix the ingredients well. Tamp the resulting paste into moulds, allow to air-dry until the block can be handled safely. Then heat it to 300-400 deg. F. for a day or more until the reaction between the clay and the silicate has produced an insoluble bonding material.



House telephone circuit.

House Telephone Circuit

COULD you let me have a circuit for a three-way house telephone system preferably using a central battery? I can fix up a two-way system satisfactorily but I am having trouble with the polarity of batteries on a three-way system. The handsets I am using are ex-G.P.O., similar to the ones in present use. I am also using a switch hook arrangement to charge connectings from bell to handset.—L. Harwood (Middlesbrough).

THE following circuit diagram may be suitable for your purpose. Each set of instrument connections are identical except that the L connection from the bell of No. 1 set is connected to No. 1 stud of the selector switch; whilst the L connection of No. 2 set is connected to No. 2 stud of the selector switch and so on. A central ringing battery is employed, with individual speaking batteries.

Information Sought

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

Wire Bending Jig

PLEASE give details for the construction of a jig for bending wire to make fittings to hook on to a pegboard.—J. McDonnell (Southend).

Using Ex-Government Equipment

CAN ex-R.A.F. elbow telescopes be used for ordinary land observation without any alteration?

I have some Ex-Naval telescopic gun sights, but these have no magnification. How can they be altered for use as an ordinary telescope?—C. O'Leary (Dublin).

Stoved Varnish

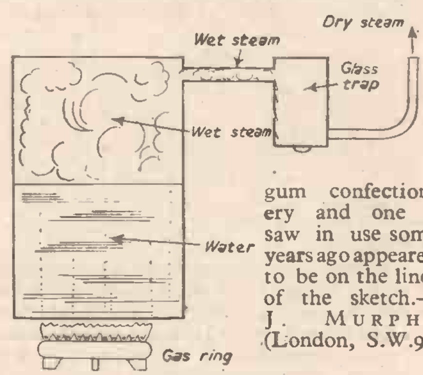
PLEASE give me a formula for stoved varnish, temp. 150-200 deg. F. and shellac based if possible. It is for use on small wood carvings, etc., on which I wish to obtain a finish superior to normal brushwork, and also to seal the wood more effectively.—E. J. Allen (Beds).

"Wet—Dry" Indicator Mechanism

I WISH to repair the "Wet—Dry" indicator on a 30in. mercurial barometer of which all the mechanism is missing, only the dial being left, at the top of the barometer case. Can you tell me the principle of the mechanism, which I believe involves the use of straw and gut?—W. Hancock (Radnor).

Producing Dry Steam

I WISH to produce a small jet of dry steam, which will be required to last about 15 minutes. Can you give me the address of a firm making such apparatus or tell me how to make it myself? It is required to glaze



gum confectionery and one I saw in use some years ago appeared to be on the lines of the sketch.—J. Murphy (London, S.W.9).

Telescope Optical System

WHAT is the order of assembly of the following parts, which comprise a "Fairfax" 18x telescope (length extended, 11¾in.)?

Two lenses ¾in. focal length.

One lens 1⅛in. focal length.

One light-stop, aperture 5/16in.

One hollow fibre spacing-piece 9/16in. long.

One hollow fibre spacing-piece 2⅞in. long.

All these parts are 9/16in. external diameter. The eyeshield which screws on to the end of the tube has an aperture of 7/16in. and the object-glass is ⅞in. effective diameter, with a focal length of 7in.

Would you also explain the principle governing the magnification factor?—W. May (Essex).

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

WHAT I THINK By F. J. C.

Under Government Control

THE much debated clause introduced as an amendment at a very late stage has now become law and it will become operative as soon as the Minister " appoints " a day. It is unlikely, however, in view of what the Minister has since learned, from me and from others, that the clause will be rigidly interpreted. Yorkshiremen have been behind the opposition from start to finish. They have been determined to impose their will, right or wrong, with the arrogant pugnacity of some who come from the county of broad acres. Unfortunately, however, their methods have recoiled on them. They hoped to eliminate the trouble between the various bodies over massed-start races (not " in line " if you please !) by the underhand method of inspiring a last-minute clause in the Road Traffic Bill.

It will be to the lasting discredit of the National Cycling Union that they first started the attack on the B.L.R.C. by underhand methods when the League was first formed by approaching the Ministry of Transport in an effort to get League racing stopped. My own investigation in this matter at the time showed that the only opposition received by the M.o.T. had been promoted by the N.C.U. and the R.T.T.C. As a result of our representation, the League was left for about a dozen years to run its events and those 12 years have proved that this form of racing has none of the dangers attached to it which were thought up. It has a much cleaner record year for year than time trials, and although the clause has now become law we have told the Minister that he would be ill-advised to act upon it. Contrary to ill-formed statements in a contemporary, the R.T.T.C. did nothing to stave off the threat of Government control. The League was the first to do that. That particular journal has continued to attack the League, in support of the Yorkshire point of view, right from the start, and it has on many occasions misstated the facts or suppressed them altogether. It is certain that had all of the bodies combined to quash the clause it would have been withdrawn. Two bodies, however, saw a chance of killing the League. Cyclists will, therefore, know to whom to apportion the discredit of the manœuvre which brought about Government control of road sport. As I have said, however, the Minister is now aware of the vendetta which has been waged against the League, and it is unlikely that the efforts of the Yorkshiremen will have much effect.

100 Miles in Less than 4 Hours !

R. C. BOOTY, of the Ericsson Wheelers, returned the astonishing time of 3 h. 58 m. 28 s. in the Bath Road Hundred Scratch Time Trial which took place on Monday, August 6th. This is the first time in the history of sport that anyone has averaged just over 25 miles an hour for four hours in an unpaced trial.

This is cycling history and we hope that the cycle trade, which is usually so tardy in acknowledging the feats of those who bring so much publicity to the sport and industry, will suitably acknowledge this great milestone in the history of cycling sport.

Incidentally, it is noted that of the 100 entrants, of whom 93 started and 74 finished, not one was a member of the Bath Road Cycling Club Ltd., whose activities to-day are very much limited to social functions, arguments and internecine conflicts, with an annual dinner thrown in where they can exhibit the " Barf Road Spirit." What a pity it is that it does not give some time to training riders of the calibre which made the club famous some years ago. No Barf-roader has won the B.R. 100 since 1920—when Leon Meredith was the winner.

The " Oats "

THE " Oats," the thousand-mile amateur cycle race organised by the B.L.R.C., is undoubtedly the toughest stage race ever put on in Britain. This year's race, the third, started in Skegness on August 11th, the eight stages finishing at Manchester, Morecambe, Rhyl, Aberystwyth, Barry, Weston-super-Mare, Lee-on-Solent and Worthing. All stages were of 115 miles or more in length, except the last one, which was of 85 miles. The race organiser, Mr. Vic Humphrey, who was mainly responsible for the route, had picked a really tough course. Weather conditions, however, were often so bad that at the finish of the event only 45 riders were left of the original entry of 79.

Strong westerly winds and gales impeded the riders for the first six stages and made the race a punishing one for them. Some of the roads used were merely rough and narrow tracks, and flints and stones caused numerous punctures and spills. The hilly nature of the road made hard work for both riders and the following caravan of cars and service vehicles.

In spite of these appalling conditions, however, the machines stood up to the battering they received remarkably well. Only one case of frame breakage was reported —this frame was of foreign make. The winners of the team prize were the Southern Counties Team, the King of the Mountains was J. Nicholson of the Tees Side team, and in the general classification, the winner was R. McNeal, of the North-Eastern Counties team, the second being G. Taylor, of the Warwickshire team, and the third being R. Killey, of the Merseyside team.

Clatterford Shute - a picturesque lane leading from Carisbrooke Castle to the village . . .

Safety Bumpers and Canal Tracks

A MIDLAND cyclist has made two suggestions which he thinks would make for safety. One is that cars should have pneumatic buffers which he thinks, in case of collision, would cause less injury than the present somewhat useless steel bumpers. Unfortunately, for this idea, it would not work. The impact of a car weighing one and a half tons travelling at a speed of, say, 40 miles an hour, even with pneumatic bumpers would cause serious injury, and if the unfortunate person collided with did bounce from the bumper he would probably bounce under another vehicle. Another of this cyclist's ideas, which seems excellent on the face of it until one stops to think about it, is that the disused canals in this country (and there are many of them) should be filled in and used as exclusive roads. Unfortunately for him, however, he could not have worked out the quantity of material required, nor the cost of filling in. That alone would make the idea quite impracticable. The idea of a cow-catcher bumper of the type fitted to American locomotives has often been suggested. Under test, however, it was found that the " body " (in this case a well-stuffed sack) was merely precipitated under the wheels of vehicles passing the other way.

480 in 24 Hours

DENIS WHITE recently covered 480 miles in 24 hours. This was in the Wessex 24. To average 20 miles an hour for 24 hours' continuous riding ranks with the performance of R. C. Booty as the two outstanding events of the last decade of cycling history and, as with Booty, I hope these events will be suitably recognised by the industry, as well as by the sporting bodies. Unfortunately, neither of these two events received much publicity in the daily Press.

Choosing the Right Bicycle

Make Sure the Bicycle You Buy Will Suit All Your Requirements

Fig. 1.—A typical cycle for daily use—the Hercules Artisan.

BUYING a cycle is not the simple matter that it may at first appear. Many people walk into a shop, look at the range offered for their inspection and then choose the one that is enamelled in their favourite colour or the one advocated by the dealer. It is probably not until they come to use it that they find out it is not really suitable for their needs.

Decide first what the cycle is to be used for, i.e., cycling to work, touring, or camping, or perhaps racing or club riding, then exactly what type of machine will do the job best.

The Utility Cycle

There is a wide choice of makes and it is up to the purchaser to ensure that the one he chooses has all the features he will need. The machine should, primarily, be robust so that it will be a long time before it is necessary to replace worn parts. The most suitable model is the upright type, equipped with a comfortable, well-sprung saddle, strongly made wheels, shod with heavy tyres, dynamo lighting, rubber pedals, rod and lever brakes and—most important—adequate mudguards. A chain-case is not an absolute necessity, but may be preferred by the purchaser. If the daily journey is over a hilly road, a hub three speed will be found of great benefit, but make sure that the "normal" gear is between 65 and 70 and a little lower on a lady's machine. Useful also is a carrier over the rear wheel for dispatch case or tool bag, etc. All the major firms of cycle manufacturers produce a machine of this type and a typical example is shown in Fig. 1.

The Machine for the Tourist

The tourist's requirements are likely to be more specialised and individual and the type of mount most suitable will vary accordingly. In general, the best machine for the tourist will have a light frame, made from Reynolds 531 tubing, wheels with rims of the Endrick type, shod with one of the many medium weight touring tyres available. Cable brakes are necessary with Endrick rims and there is a wide choice available. The very well-known and well-tried cantilever brake is now back on the market and this is ideal for the discerning tourist. Many riders who carry a great deal of weight prefer to use hub brakes.

The rider who travels with little baggage will easily be able to carry this in a large touring bag, fitted under the saddle and carried on one of the lightweight supports now available. Those who prefer to carry more of their worldly goods with them, and particularly the camper, will require panniers.

The Hand-built Frame

Hand-built frames are by no means for the racing man only, and many touring enthusiasts have frames made to their own specification. Usually they specify 531 or other lightweight tubing and prefer a frame of stouter construction and longer wheel-base than that of the racing man. A long wheel-base (42-44in.), when combined with frame angles of 72 deg. parallel and long fork rake, as shown at A in Fig. 3, gives the maximum stability and comfort to the long-distance rider. Ordering a frame in this way also enables the purchaser to suit himself about such things as the type of headset, siting of pump pegs for a 15in. or 18in. pump, position of lamp brackets, grease nipples, etc., incorporation of special fittings for derailleur gears and brake cables. The camping enthusiast would, no doubt, specify special lugs on the seat-stays for fitting panniers, obviating once and for all the nuisance of slipping pannier frames.

The Machine for the Clubman

The clubman has the widest choice of all. A lot depends on whether his club is a touring club or a racing club and also on what type of racing he is likely to favour. There are many mass-produced cycles on the market similar to that shown in Fig. 2 designed specifically for the club rider, but the majority of them still prefer to order their own frame and accessories to build up the machine themselves. The newcomer to club riding would be wise to order a good all-round machine. The frame could be of either lugged or welded construction, being built from lightweight tubing.

Frame size will depend upon the physique of the purchaser, but he should be able to sit on the saddle, with the ball of the foot on the pedal at its lowest point, and the leg being still comfortably bent at the knee. A further test is to be able to pedal comfortably using the heels. To find the most suitable frame size by measurement, take the inside leg measurement and from it subtract 10in. to account for crank length and height of saddle and saddle pillar. Frame size is measured from top of saddle lug to centre of bottom bracket spindle.

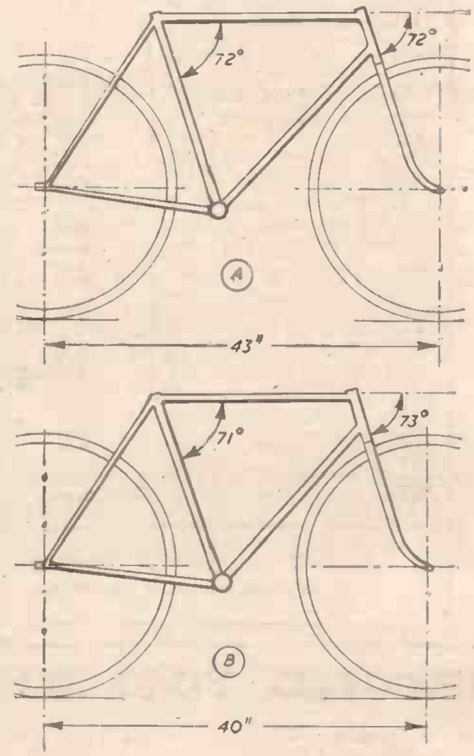

Fig. 3.—Frames for the tourist and club rider.

A frame slightly smaller than is really required is far better than one that is too large. Frame angles should be either 73 deg. head and 71 deg. seat tube, as shown at B, Fig. 3, or 72 deg. parallel. Bottom bracket height should be adequate to ensure clearance when cornering on a fixed wheel and there should be sufficient clearance in the rear triangle to enable 27in. wheels to be used. All the usual brazed on fittings should be specified.

A very wide choice of accessories is available, but the clubman, in general, is conservative in his choice. Wheels consist usually of lightweight hubs, double-butted spokes and steel road-racing rims, fitted with lightweight tyres. For handlebars, handlebar extensions and saddle-pillars, alloy is often favoured, although many riders prefer the heavier steel fittings. Handlebar extensions are usually from 2in. to 3in. in length and one of the most popular shapes of handlebar bend is the "Maes." Narrow, unsprung leather saddles of the Brooks B17 type are most popular and brakes of the alloy hooded lever variety are almost universal.

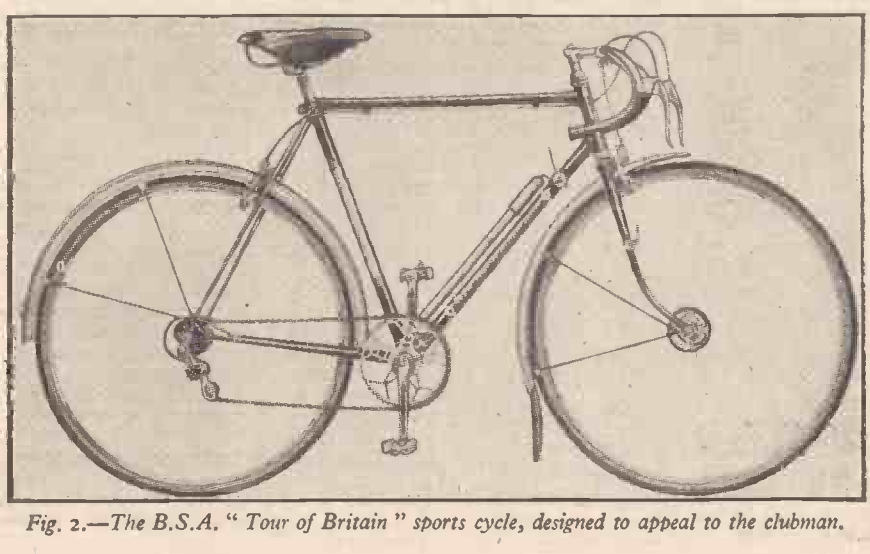

Fig. 2.—The B.S.A. "Tour of Britain" sports cycle, designed to appeal to the clubman.

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Road Safety
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MILLER Cycle Dynamo Lighting—with its sturdy design and construction, steady powerful beam at all speeds, and unfailing trouble-free service—is the most efficient and economical cycle lighting on the road to-day.
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