An Electric Pottery Kiln

NEWNES

PRACTICAL MECHANICS

1/3

EDITOR : F. J. CAMM
OCTOBER: 1957

CONTENTS

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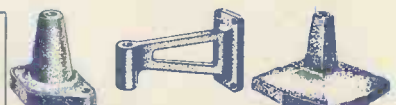

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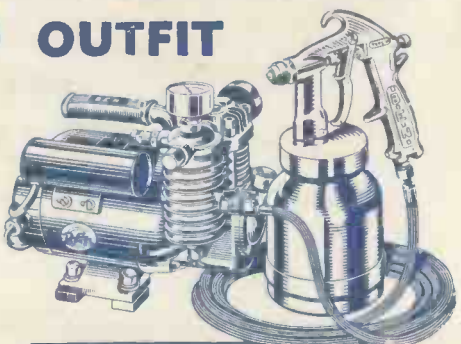

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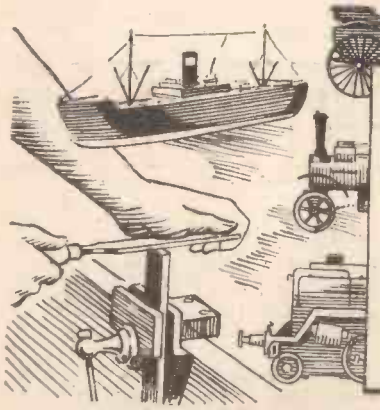

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CONTRIBUTIONS

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

FAIR COMMENT

"PRACTICAL HOME MONEY MAKER"
OUR GREAT NEW COMPANION JOURNAL

ON Wednesday, September 18th, the first issue of my new monthly companion magazine, PRACTICAL HOME MONEY MAKER, came on sale throughout the British Isles. It is in the same style and price as PRACTICAL MECHANICS, and bearing in mind the many thousands who were disappointed because they could not obtain the early issues of our companion journal, *The Practical Householder* (net sales over 934,000 a month), I thought readers of P.M. would welcome this early intimation of the newcomer so that they can ensure obtaining a copy by placing an order with a newsagent for its regular delivery. That is the only means by which you can ensure obtaining a copy. It is a magazine which essentially will interest every reader of P.M., for it teaches you how to apply your skill to make welcome extra pounds a week. I have often received requests from readers for instructions on how they can conduct their hobbies on a profit-making basis, and hundreds of them have asked for a special journal. Well, here it is!

During the past 20 years a large and expanding industry supplying all the materials, tools and equipment for the home moneymaker has grown up, making easy the way to those extra pounds each week.

The object of the new magazine, which strikes an entirely new note in journalism, is to tell readers how to make for profit a wide variety of articles, and how to market them. It explains how to make toys, ornaments, novelties in wood, glass and metal, articles of household equipment and pottery, glassware, mechanical toys, lampshades, jewellery, basketwork, knitwear, articles in plastic, leather handbags and wallets, rugs—to mention but a few of the subjects which will appear in early issues. Every possible avenue of profit earning at home is being dealt with. We shall include articles on rabbit breeding, aquaria, photography, poultry breeding and garden produce. Other articles will deal with marketing methods, costing, and the business side of home working.

There is thus a duality of purpose in this new journal, for it will cater for all those who are interested in the various home crafts for the pleasure of achievement and also for those who wish to combine profit with pleasure. Whilst P.M. tells readers how to *save* money, PRACTICAL HOME MONEY MAKER will tell them how to *make* it.

Only by placing a regular order can you be quite certain of obtaining your copy. Turn to page 7 of this issue and read the full announcement concerning our new journal.

NEXT MONTH'S SPECIAL ISSUE OF "PRACTICAL MECHANICS"

NEXT month's issue, dated November and on sale Thursday, October 31st, will be greatly enlarged and will contain many new features. This special issue will be packed with topical articles, many of which break new ground. These will be additional to our normal articles and regular features. It will be nationally advertised and this is an additional reason why your newsagent should receive your order for the November issue forthwith.—F. J. C.

A BEDSIDE TABLE

Details for Making a Useful Item of Bedroom Furniture

By A. E. SMITH

Fig. 1.—The completed table.

THIS table, as seen from Figs. 1 and 4, is attractive in appearance, strong, and straightforward in construction. The design is easily adaptable to other sizes of table and although the method of making the legs may seem more complicated than

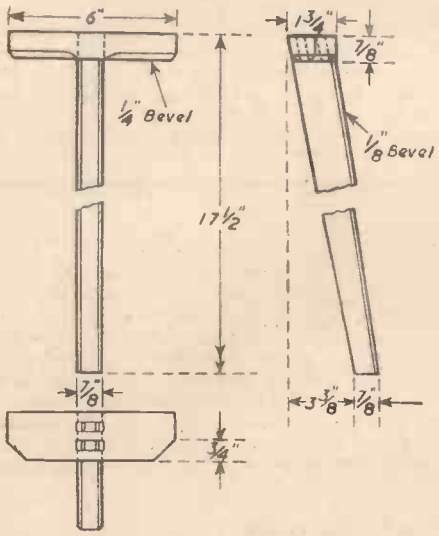


Fig. 2.—Details of the legs.

usual it is very strong and well worth the extra work involved.

Construction

Before commencing work a full-sized drawing of the side of the leg must be made from Fig. 2, so that the correct angles for marking out can be set on a sliding bevel. The length of the legs is also taken from this drawing. Each leg is fixed to a crosspiece with twin wedged mortice and tenon joints (Fig. 3). Allow 18½in. × 1¾in. for each leg and plane face side, face edge and thickness. All marking out is done from the face edge which is the inner edge of the leg.

The crosspieces are left in one piece, 25in. long and the face edge planed to the correct angle, testing with a sliding bevel set from the drawing. The width of 1¾in. is across the top surface. The shoulders of the tenons and the bottom of the leg are marked with the same setting of the bevel, working from the face edge, and the waste sawn off the bottom of the legs. The tenons are about ⅜in. thick and these and the mortices are marked with a mortice gauge.

Cut the joints and fit together. Mark the width of the top of the legs level with the edge of the crosspiece and taper to ⅞in. at the bottom. This taper is planed off and ¼in. bevels cut on the edges. Separate the crosspieces and shape and bevel as in Fig 3. Open the tops of the mortices about 3/32in. at each end to allow the tenons to expand when the wedges are driven in and saw down the tenons about ¼in. from the edges. Cut the wedges from a piece of wood the same thickness as the tenons and clean up all the components with smoothing plane and glasspaper. Glue together, ensuring that the legs are at right angles to the crosspieces, and when the glue has set clean off the projecting tenons.

The Top

This is a piece of ½in. plywood 14½in. square covered with Marleyfilm. The edges are concealed with a strip of ¼in. wood mitred at the corners and glued and pinned in position. Alternatively the Marleyfilm can be taken round the edges, in which case the top must be cut 15in. square. The legs are fixed in position with glue and two 1½in. countersunk screws up through each crosspiece.

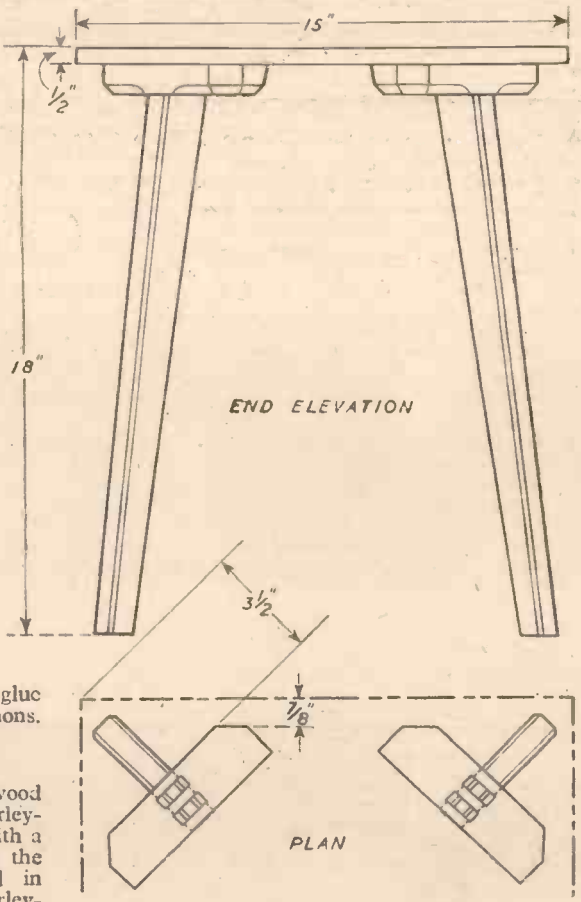


Fig. 4.—General arrangement of the table.

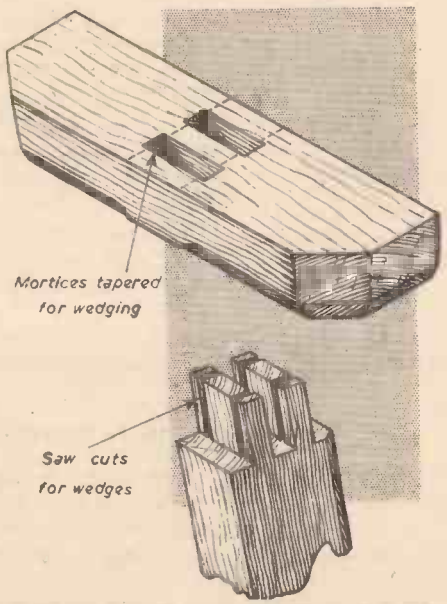


Fig. 3.—The twin wedged mortice and tenon joint.

Ultrasonic Flaw Detection in Trees

FUNGUS diseases which infect and destroy timber may soon be detected by means of ultrasonic equipment. To use the equipment, the bark of the tree is stripped on the area of the test and the wood smoothed and coated with a coupling agent, such as petroleum jelly, to ensure good contact. High frequency sound waves generated by the equipment are then passed through the wood and reduction of ultrasonic penetration reveals the presence of flaws. Quite small faults are detectable by this method.

The new technique will substantially reduce the financial losses due to disease in trees. Diseases are often present for many years in valuable trees, sometimes causing complete destruction of the tree before they are detected.

Chess Table—Correction

WE regret that some of the dimensions were omitted from the article last month on Making a Chess Table. The overall length of the feet is 15in. and the total height of the table 19in.

An ELECTRIC POTTERY KILN

An Efficient Appliance with 1 Cu. Ft. Capacity which can be Built for Under £25

By R. HUGHES

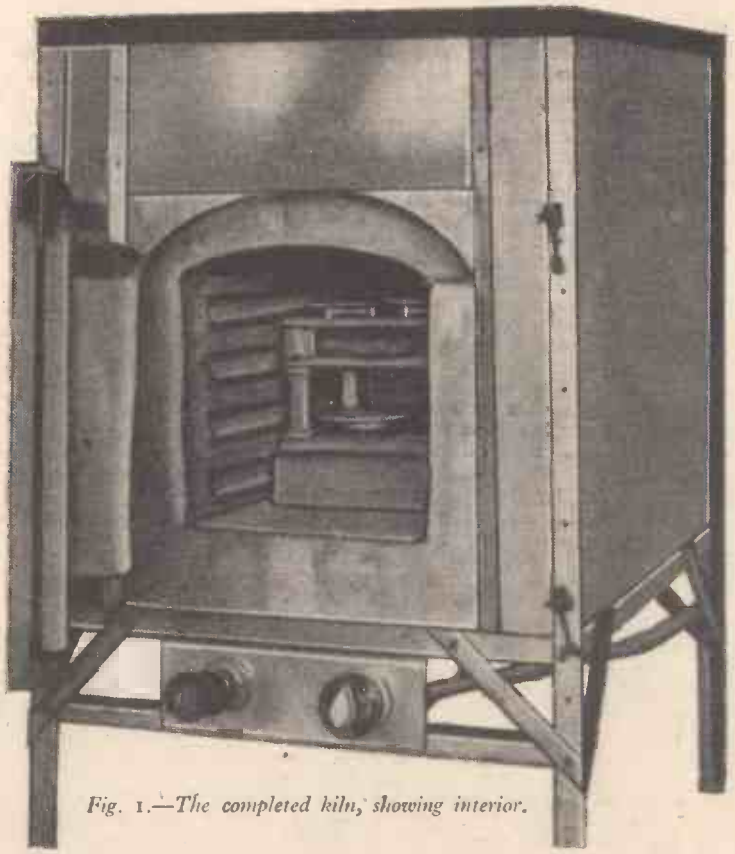


Fig. 1.—The completed kiln, showing interior.

THIS kiln is the final result of a series of experiments over a period of two years. It is not difficult to build a pottery kiln of reasonable size if unlimited power is available, and if there is no limitation upon the amount of insulation, and its ultimate physical size.

As the original kiln was to be used in a school craft room where children would be working every day, it had to be safe, reasonable in size, and be capable of reaching a temperature of about 1,080 deg. C. in a normal school day. The minimum useful internal volume would have to be one cubic foot, or larger if possible. The only power available was a standard 15 amp. wall socket.

Experiments proved that with about 4in. to 6in. of insulation, and using good quality firebricks for the interior walls, it was possible to reach a reasonable temperature with only 15 amps. of current.

The prototype kiln is larger than 1 cubic foot, but a kiln of 1 cubic foot internal volume will be described first, and suggestions made later on how it could be made larger, and still give the same performance. The kiln in Fig. 1 is 12in. wide, 12in. high and 18in. long, internal dimensions.

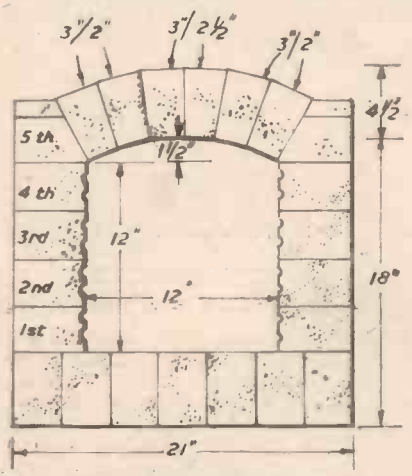


Fig. 2.—Front view, showing element slots, etc.

The kiln can be built for less than £25.

Basic Design

The kiln design is based upon the use of special "hot-faced low heat storage" M.I. insulating refractory bricks supplied by Morgan Refractories, and coiled hairpin elements made from Kanthal wire. These elements can be obtained with a piece of Kanthal rod ¼in. diameter welded on to the end of the element, and by being threaded at the "cold" end they simplify the method of connecting up the eight hairpin elements in series to make up the total load of 15 amps.

The kiln can be built successfully on any kind of base which is non-inflammable, and capable of taking the weight. It is suggested that the kiln be built on an angle iron frame clear of the floor. This is useful in a craft room where it may be necessary to move the kiln from time to time.

The Framework

The frame was made from 1½in. angle iron. A piece of steel sheeting, size 28in. × 38in., happened to be available, and the bottom section of the frame was made to take this size. In actual fact a wider piece of metal would have been better, as the more width you have at the sides of the kiln the more insulation is possible, and within limits the better the performance. If a piece of metal is not obtainable, no doubt pieces of angle iron could be used. If, however, the kiln is built on a permanent brick foundation, then a foot space or more each side for insulation would be ideal.

Construction of the Frame

The construction of the frame can be seen from the photograph, Fig. 1. Two sections are made, one for the top and one for the bottom. The four legs are cut to length, and bolted to the main frame. To make the structure steady, bracing pieces of metal are bolted from the legs to the bottom section. The top section should be made so that the back piece can be removed separately, as this facilitates construction and future maintenance.

The bottom section takes the base plate (in this case a steel sheet) and then a piece of asbestos sheet is cut to size and placed on it, rough side up. (The rough side helps the special cement to adhere.) The two sheets are now drilled and bolted to the bottom section of the frame with countersunk bolts. The top section can be removed during construction of the kiln walls, and the frame will be quite steady without it.

Materials Required

M.I.28 Insulating Refractory Bricks	**Morgan Refractories, London**
60 9in. x 4½in. x 3in. squares	For hearth and walls
8 9in. x 4½in. x 3in./2in. arch	
4 9in. x 4½in. x 3in./2½in. „	
10 9in. x 4½in. x 3in. squares	For door
½ cwt. M.I. High temp. cement	

Kanthal Elements.
Hall & Pickles, Ltd., Port St., Manchester, 1

8 Hair-Pin elements. Each.	Resistance. 1.91Ω
	Wire quality. Kanthal A
	Wire size. 15 s.w.g.
	Wire length. 12ft.
	Mandrel size. ¼in. diam.
	Str./Length Leg. 12in.

Distance between centres, 1in.
Leads 15in. long. ¼in. Kanthal "D" welded to the element and threaded ¼in. Whit. for connecting.

Asbestos Fibre. **Local heating engineers.** ½ to 1 cwt.

Brickwork

The hearth is 21in. wide and 27in. long, and it is a good plan to mark out this rectangle in coloured chalk on the asbestos sheet. The front edge of the hearth should be about ½in. away from the inside edge of the angle iron, and the space each side divided equally according to the width of the frame, and this space is where the insulating asbestos fibre is placed. The space behind the hearth will be for the connections from the elements, and later on is filled in with asbestos fibre.

Laying the Hearth

The hearth consists of 21 bricks laid on edge in three rows each 7 bricks wide. The high temperature cement is mixed with water to the consistency of putty so that it can be spread easily. It is important to use the cement lightly, and the bricks are laid dry.

A thin layer of cement is spread on the rectangle marked out on the base sheet, and each brick is "buttered" with a coating of cement about ¼in. thick. A pointing trowel, and an old household knife are useful tools for this part of the job.

When the bricks are set in position, the hearth should be left undisturbed for about 48 hours to dry out. In the meantime the walls can be erected dry on a separate table, marked out for the elements, and the grooves cut.

Main Walls

The walls consist of four courses, and they can be bonded in the normal manner

for a single wall. Mark out a 12in. square, and starting with half a brick arrange the first course around the outside of the square. The other courses are placed on in turn. The bricks which can be cut easily with a hacksaw are reasonably strong, but care should be taken to see that they are not chipped. When the bricks have been cut to size and arranged to fit in with the back wall, mark each course clearly with coloured chalk, and number the bricks so that they can be put back in the same order after the element grooves have been cut. The grooves are ideally cut as shown in Fig. 2. The main aim is to make the grooves wide enough to allow the elements to do their work, yet so shaped that the elements do not become tight when they expand, or fall out. It is also important with a view to future maintenance that the elements should be easily withdrawn and replaced without undue difficulty.

The position for the grooves can now be marked. Each course of bricks takes one complete hairpin element, so that each brick course will need two grooves cut lengthwise. The grooves, which can be seen clearly, are spaced at a distance of 1in. for each hairpin. It would be wise to wait until you have the elements to hand before cutting the grooves.

Cutting the Grooves

There are no doubt many ways in which these grooves could be cut, but as the bricks are so easily worked it was found quite easy to cut each brick separately by hand. The groove can be cut roughly to shape by making two downward cuts with a hacksaw, removing the triangular shaped piece, and then hollowing out to size, and shaping exactly with a blade held in the hand.

Elements

The elements are coiled and have a diameter of ⅛in. A piece of dowel rod can be used to check the shape of the bottom of the groove. As the edges of the bricks are now very thin, care must be taken not to force the dowel rod through the grooves. It must slide in easily, and it is a good tip to sharpen the end of the dowel like a chisel and rotate it as it is pushed in. In fact, a tool of this kind is very useful for drilling holes in this type of brick, as the abrasive action soon ruins metal tools. The piece of dowel can be sharpened frequently and can also be used in a carpenter's brace.

The grooves need not be cut in the first 3in. of the courses, as this is cut away to leave space for the stepped part of the door to fit in. Similarly, the bricks which bond into the back wall need not be grooved, but can be drilled. This part of the back wall will carry the connecting rods for the elements.

Erecting the Walls

As soon as the base is dry the walls can be erected. The same method of cementing is used again, and it is a good plan to make only as much cement as is needed for each stage. When the walls are set, the grooves can be lined up by using a piece of tapered dowel rod in a brace. If all the bricks and courses are replaced as originally lettered and numbered there should be no danger of putting a brick in the wrong place or upside down. Before leaving the walls, it is quite a simple matter to check that they are vertical and square, and to see that the width across the top corresponds with the width of the base.

The top of the kiln is arched, and the bricks are obtained cut to shape. A former should be made the same shape as the arch, and with a depth of about 11in. The former, made from thin box wood, is placed inside the kiln and wedged up to the correct height. When the kiln is eventually completed the wedges are withdrawn and the former removed. To give a smooth surface to the top of the former a piece of cardboard can be placed over the top.

Erecting the Arch

When the walls are quite set and dry, the arch bricks can be tried out with a piece of thin cardboard between each one (to represent the thickness of the cement). The top course can be measured and cut away to fit, as shown in the drawing. Once again a small allowance should be made for the cement. When the arch is a good tight fit the pieces of cardboard can be removed, and the arch set finally in position with cement. It is important that the arch should be erected very carefully.

The back wall and the small spaces at the top of the fifth course can be filled in with offcuts. When all is dry a ⅛in. hole

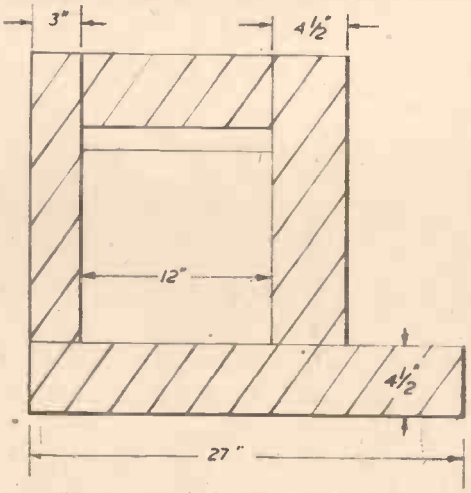


Fig. 3.—Sectional view of the kiln.

is drilled in the centre of the fourth course in the back wall. This hole serves the double purpose of allowing the steam to escape during the early stages of firing, and also acts as a safety vent.

Drying Out

The kiln should be left for a day or two, and after the arch former has been removed (just remove the wedges), any spaces should be filled in with cement.

The Door

The door is made from a layer of half bricks cemented together. If a liberal coating of cement is used, and the bricks lightly cramped together, a sound solid brick slab results. It is a good plan to make a cardboard template the same size as the door opening, and this is placed on the brick slab and marked out with coloured chalk. The door is stepped, and the amount which actually enters the kiln is only about 3in., so that when the step has been sawn and shaped there will be an overlap of 1½in.

The door is made and cut on the large size, and finally completed when it is fitted in position on its hinge. There is no need for special hinges, or specially designed cut-away portions which are difficult to mark out and cut; so long as the door blocks up the kiln opening, and has an overlap which is a reasonably exact fit, it will be quite satisfactory.

The Door Hinges

Two pieces of angle iron the same length as the width of the frame are used to support the door and also act as the hinge. The angle is placed on the door as shown in Fig. 1, and four holes are marked out and drilled, two each side of the centre, and through the course of bricks. Through these holes pieces of ⅛in. rod, threaded at both ends are inserted, and fastened with nuts and washers. Care should be taken to see that the nuts are not tightened too much. The ends of the two pieces of angle also form the hinge. Two holes are drilled out ⅛in., and another threaded ⅛in. rod inserted. Where the rod will pivot mount two L-shaped brackets on the left-hand side of the front framework, but do not drill them. The brackets should be placed in such a position that when they are drilled they will form the other part of the hinge. The other ends of the angle are slotted. There are many ways of fastening the door, but wing nuts and bolts which slide into the slots are very effective and keep the door tight.

When the door is shaped to fit it is offered up to the front opening of the kiln and gently eased and shaped until it is a good, straight push fit. The holes for the hinge brackets are now located on the frame and drilled. The long bolt can now be tried and fitted. The bolt is now removed, and the door taken out. The door is now fitted on to its hinge in the open position, and gently eased in and out of the kiln opening until the abrasive action of brick upon brick wears away sufficient material to allow the door to swing to without any difficulty. The door is shown closed in Fig. 4.

Elements

These are placed in position and carefully guided through until they protrude a few inches at the back. Care must be taken to see that they are not pushed through too far without support, as the connecting rods are very heavy. A piece of asbestos sheeting is cut to fit inside the frame and slid along inside until it touches the ends of the elements. The positions of the elements are marked, and the holes drilled. Each connecting rod requires two ⅛in. Whitworth nuts, two washers and a wing nut. Before the rods are finally pulled through the back sheet into position, the

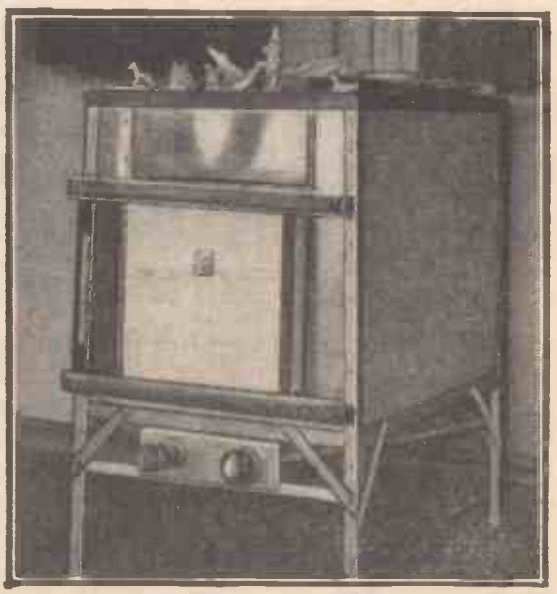


Fig. 4.—A further view of the completed kiln showing door construction.

first nut is threaded on as far as it will go. Then the rods are pushed through and secured on the other side with another nut. When all the elements are assembled, the asbestos sheet is pushed back to the rear framework and bolted. This will then be the back of the kiln. The two washers and the wing nut are used to make the connections between the elements.

Connecting Up

The method of connecting is quite simple, and details are shown in Fig. 5. The top link is better if it is insulated with porcelain fish-spine beads. Two separate ¼in. bolts are fitted on the back sheet at a convenient point, and these are used to anchor the leads from the elements that will be connected to the flex going to the mains plug. If no indicator light or switch are required at the front of the kiln, the connections are taken direct to the mains. A yard of standard, asbestos-insulated, three-core power cable is used. The red and the black wires are connected to the two mains bolts, and the third "earth" wire is connected very carefully by means of a nut and bolt to the metal framework. The other ends of the cable are taken to a 15-amp plug. Once again care must be taken to ensure that the earth connection is correctly made. Details of connections for both a switch and an indicator light will be given later on in the article.

Sheeting the Framework

The framework can be covered with either asbestos or aluminium sheet. The aluminium, about 22 s.w.g., is more expensive but is permanent. Asbestos tends to crack unless it is very loosely secured, and in any case becomes distorted with the heat. The easiest method of securing either type of sheet is with self-tapping screws from the outside.

The top section is bolted to the main framework last of all, and then the top sheet is fastened with self-tapping screws.

Electrical Connections

For safety's sake the connections at the back of the kiln should be covered at all times when the kiln is plugged in. The covering can be a simple box lid shape, secured with small brackets. If the box lid is drilled with some holes it will improve the ventilation, although with the type of connecting rods used there is very little heat at this end of the kiln. Great care must be taken to see that when connections are made the washers and wing nuts are tightened very firmly as loose connections cause arcing.

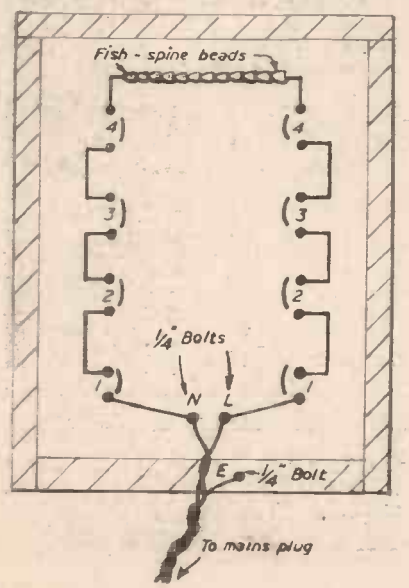


Fig. 5.—Connecting the elements in series.

Front of the Kiln

The metal sheeting to the front of the kiln is carried out last of all. A piece of sheet aluminium is cut to form a mask around the front opening. The ⅛in. allowance between the front of the hearth and the angle iron bottom frame will be just enough space to force the mask in. It will only need an overlap of about 1½in., and will be improved if the inside edges are bent in slightly.

Testing

There should be no difficulties with the electrical connections, and the kiln should "Buzz" when it is first switched on. It is a simple matter to test for continuity with a battery and bulb if there seems to be any fault. This test will, of course, only be carried out with the mains plug disconnected. The elements do not glow very brightly with the door open, but once the door is closed for a short time they will begin to glow clearly. The kiln should be dried out with the door open for a few hours. Care must be taken not to touch the elements once they have been in use as they become very brittle.

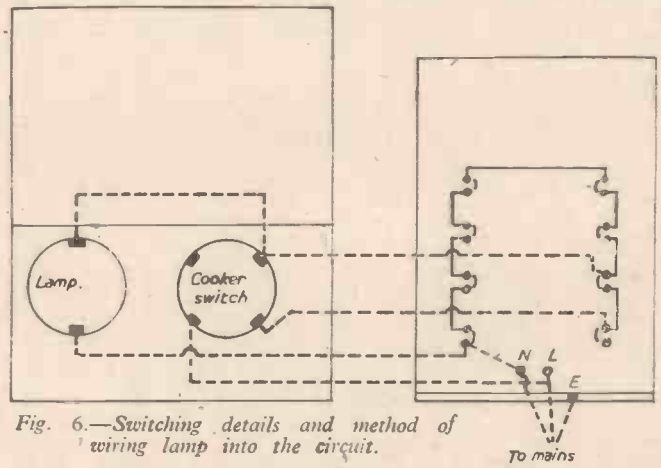


Fig. 6.—Switching details and method of wiring lamp into the circuit.

Performance

Biscuit firing to about 950-1,000 deg. C. should take about 6½ hours, and glaze firings to about 1,080 deg. C. about 7-7½ hours. These figures will, of course, vary with different loadings, and they can be considerably improved with extra insulation, particularly at the sides and top.

Insulation Material

When the kiln has been tested, the spaces between the walls and the outside sheeting are loosely packed with asbestos fibre. The fibre tends to powder after many firings, and a certain amount of bulk will be lost. The top sheet should be made so that it can be removed easily, in order to replenish the fibre from time to time. In general about ½ to 1 cwt. of fibre will be needed. The interior of the kiln should be brushed out occasionally, and great care must be taken to see that the elements are not disturbed.

Element life cannot, of course, be guaranteed, but if the kiln is moved about as little as possible, and if the firings are carefully controlled their life will be extended. The greatest danger to elements is over-firing.

Modifications

The same basic design can be modified to make a larger kiln without much difficulty.

Only a small amount of extra power, and an additional hour or two of firing time are needed to reach a temperature of 1,100 deg. C. with an internal volume of 12in. × 12in. × 18in. The small amount of extra power needed will not overload the power point; and with a little experimenting the results can be well worth while.

Modifications for Larger Kiln

Use same size hearth, but extend the walls to 18in. internal length. Cut half arch brick using full arch bricks as template. Construct as before but make the back wall outside the outer walls, which will give the extra length needed on the same hearth. Bond as before.

Elements

The same elements can be obtained with a stretched length of 18in., or can be stretched easily and safely when new.

If the extra time alone is not sufficient to reach the desired temperature, an extra elements is made from either Kanthal or Nichrome wire. This extra element is housed in three bricks cemented together and slotted just like an ordinary electrical boiling ring. This element can be placed on the hearth, or made to fit against the back wall.

The connections are brought out through two holes in the back wall, and connected up in parallel with the main element. The space occupied by this small heater is amply compensated for by the all round increase in internal volume.

Alternatively, of course, the extra element could be fitted into the floor bricks, and covered with a piece of Sillimanite shelving.

When winding the element by trial and error, the aim is to cut the wire to such a length that it will not glow red until it is covered with a shelf.

In this way the current consumption is kept low, and it will have a reasonably long life.

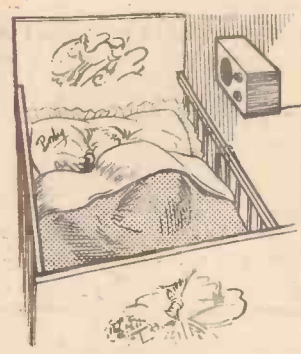
In the prototype kiln the element was wound from Nichrome wire of about 22 s.w.g. and about 60ft. were needed.

Hall & Pickles can also supply suitable wire for this heater, and if it is desired to arrange switching, the same total loading of 15 amps. can be obtained for the main elements, arranging them in two banks. The only drawback is that there would be six elements in each bank and it would, therefore, be necessary to use the hearth bricks to take elements as a total of 12 grooves are necessary.

Another possibility if the kiln reaches nearly the correct temperature without the additional heater, is to arrange to short out one hairpin element. This should be done for example at the seventh hour if on trial an eight hour firing does not quite reach the desired temperature. Provided this is not overdone, it should not shorten the life of the elements appreciably, and is a worthwhile tip.

Details of switching from the front of the kiln are given in Fig. 6, and also the connections for an indicator light. Any wires taken from the back of the kiln to the front should run underneath, with a clearance from the bottom of the kiln of about 6in. These wires should run in metal tubing of some sort, which can be fastened to the main frame with screws, etc.

All metal parts should be bonded to the main kiln, and earthed. For extra safety in, say a school, a wire guard is desirable.



MAKE THIS AUDIO AMPLIFIER FOR USE AS A BABY ALARM or INTERCOM UNIT

Details of a Well-tried Circuit and Method of Construction

By M. W. KIRBY

THIS amplifier makes no claim to originality, but, in view of the high cost of its commercial counterpart and the fact that wireless experimenters will probably have many of the parts to hand, it will probably be of interest to people requiring such a unit on account of its simplicity and wide application of uses. The circuit is shown in Fig. 1. It may be used as a baby alarm, when the output can either be fed into the speaker or into the audio stages of a radio or t.v., the volume control being so arranged to swamp the programme should the baby start crying. With the simple switch shown in Fig. 2 it is possible to use the amplifier as a two-way intercom. system. The amplifier may also be used as an amplifier for use with a record player or for the multitude of other uses for which an audio amplifier is required.

In the loudspeaker cabinet is the best place to build the amplifier and power supply. This keeps the unit compact, the only leads being for microphone (or record player) and mains.

The Circuit

The circuit is simple and its construction is within the capabilities of anyone who can follow a diagram accurately. The valve used is an ECL80. Being a double valve it will give good output with very little input voltage. The overall gain is controlled by the volume control and a tone control is fitted for use when used as a record player or audio amplifier.

A moving coil microphone was used on the original but, by using the appropriate input circuit, carbon, moving coil or crystal microphones can be used. When a carbon microphones is used it requires a bias voltage and this is most easily obtained by using a small 4½-volt dry cell wired in series with one half of the D.P. D.T. mains switch, so that the battery is only connected when the amplifier is in use. A condenser microphone is not advised as the output is insufficient to drive the amplifier fully without the use of a pre-amplifier.

S.2 is optional and may be omitted if two-way communication is not required. The mains power supply is fed via an isolating transformer as this gives less chance of the amplifier ever becoming alive due to the mains plug being connected the wrong way round and is well worth the extra cost if it is to be used where there are babies or young children. The microphone lead may be any reasonable length, although with a crystal microphone some loss may occur. Screened cable should be used if a crystal microphone is used, but this is not as important when a low impedance input, i.e., carbon or moving coil, is used. If there is some television type co-axial cable about this is satisfactory as microphone cable.

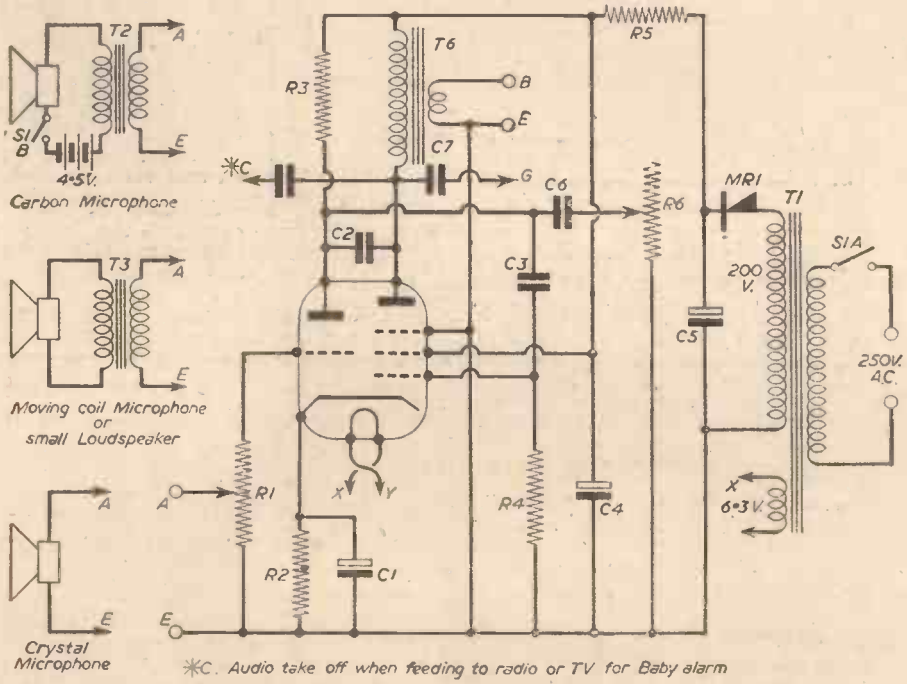


Fig. 1. — The theoretical circuit, showing input circuits for carbon, moving coil and crystal microphones.

COMPONENTS LIST

R 1. 500 KΩ potentiometer (with d.p. switch).
R 2. 330Ω, 1-watt.
R 3. 680 KΩ, 1-watt.
R 4. 500 KΩ, ½-watt.
R 5. 1,000 Ω, 5-watt.
R 6. 50 KΩ potentiometer.
C 1. 8μF. 50 v. electrolytic.
C 2. 20 pF.
C 3. .002 μF.
C 4. 16 μF. 350 v. electrolytic.
C 5. 32 μF. 350 v. electrolytic.
C 6. .01 μF.
C 7. .1 μF.
S 1a. Back of R 1.
S 1b. Back of R 1 (for carbon microphones only).
S 2. D.P. D.T. toggle switch (for intercom. only).
T 1. Mains transformer 250 v. primary 200 v. 30 m. A. and 6.3 v. 1A.
T 2. 60 : 1 microphone transformer.
T 3. 100 : 1 microphone transformer.
T 4, T 5 and T 6. 60 : 1 L.S. transformers.

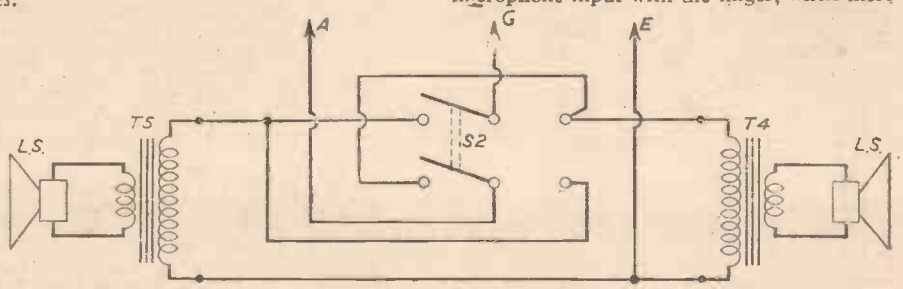


Fig. 2—Switching arrangements to use the circuit as a two-way intercom.

Construction

The amplifier and power supply can be built on a chassis 8in. x 6in. x 2in. and can easily be built into a reasonably sized loudspeaker cabinet. The on/off volume control and the tone control are mounted on the front so that the spindles protrude through the cabinet. The mains lead and the terminal panel can then be mounted at the back and the switch S.2 if fitted can be mounted between the two front controls. No trouble should be experienced in getting the amplifier to work, but before connecting the mains, check that the wiring is correct. Switch on and allow to warm up. When warm turn the volume control to maximum and touch the grid connection of the crystal microphone input with the finger, when there should be a loud hum in the speaker (this test is done with the switch S.2 in the send position).

Use as an Intercom.

When the unit is to be used as an intercom. unit it must be remembered that

(*Concluded on page* 48).

The setting and sharpening of saws

Equipment and Methods for Both Hand and Circular Saws

By A SAW DOCTOR

THE first thing required is a vice, which should be mounted between 43in. and 48in. from the ground. The one in Fig. 1 is suitable for handsaws, ranging from dovetails up to cross cuts. Fit a block on the bench to take overhang when working on the end of a long cross-cut saw. The vice jaws are 1½in. x ¾in. beech, the uprights 8in. x 1¾in. deal.

The backboard extends past the hinges so that the vice can be fixed to the bench either in the woodworking vice or by clamps. Length therefore is left to suit individual requirements.

A circular saw vice is shown in Fig. 2 and hardwood is advised throughout for its construction. When boring the holes for the saw bolt, clamp the boards together and bore slightly upwards to ensure a good fit and prevent saws slipping off when fitting the front board.

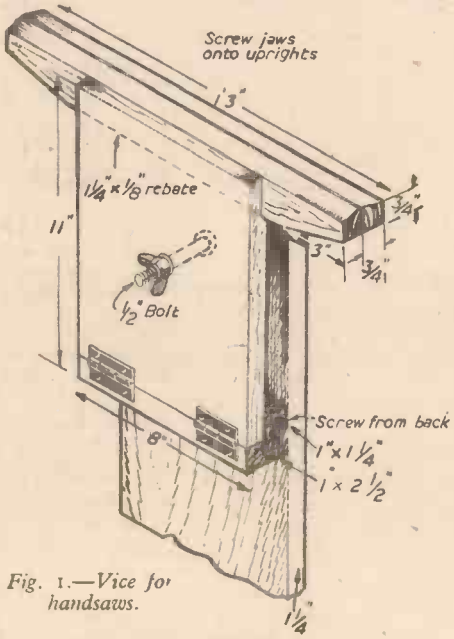


Fig. 1.—Vice for handsaws.

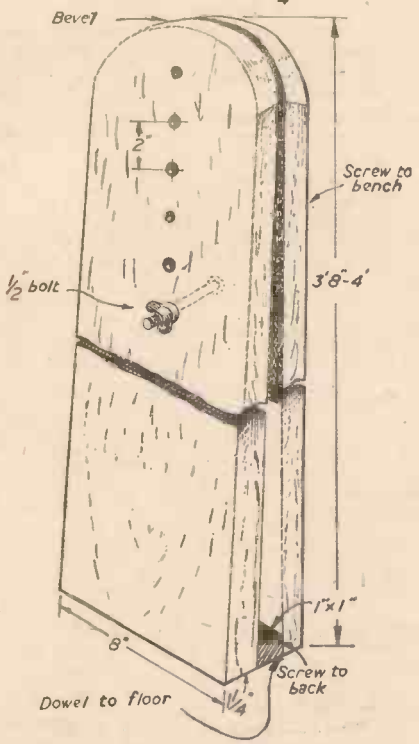


Fig. 2.—Vice for circular saw blades.

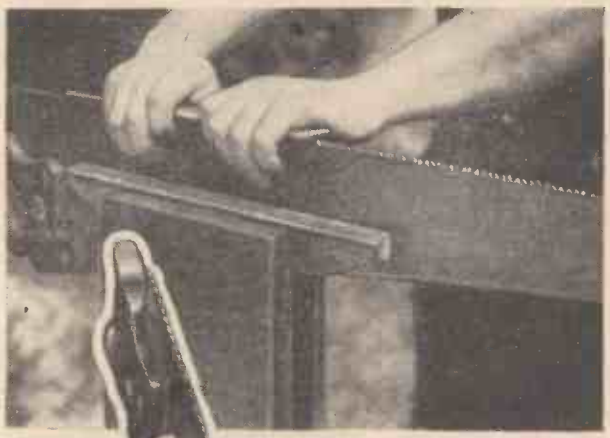


Fig. 5.—(Centre) Setting the saw.
Fig. 6.—With a well set and sharpened saw it should be possible to slide a needle down its edge without it falling off.

Types of Teeth

There are only two basic shapes of saw teeth, the rip and cross cut. The rip tooth is chisel shaped and is used for cutting with the grain. The cross cut is knife shaped to cut cleanly across the fibres where a rip would tear them. No matter what finished shape the teeth have they are all based on these two patterns.

New Saws and Rusty Saws

It is usual to set a saw before sharpening but there are two exceptions.

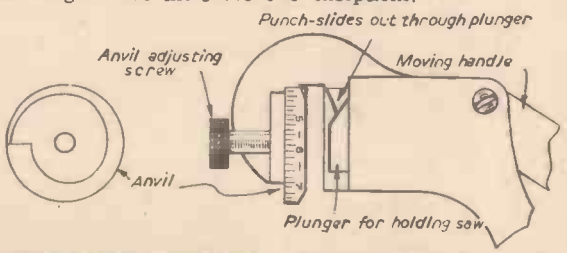


Fig. 4.—The handsaw set.

Fig. 3.—(Left) Rubbing down a handsaw. If the file has warped a little in tempering; bend the tang the same way as the file warps and it will slide more easily over the saw.

In the process of manufacture saws may become brittle at the teeth edge; file them well down, before setting and sharpening in the usual way, this will break the hard skin and prevent cracked teeth.

Rust causes a brittle skin, and rusty saws should be treated in the same way as new ones.

Rubbing Down

To keep a saw true an old 8in. or 10in. flat file is rubbed along the teeth edge.

The file is held in the palms of the hands, the fingers resting against the saw blade; this will steady the file and keep it level. Dovetail and tenon saws should be straight, handsaws should be slightly rounded. Look along the teeth edge after rubbing down to ensure their being true. Rubbing down is shown in progress in Fig. 3.

Setting

The handsaw set looks rather like a pair of pliers, one handle moves and operates the punch, the other is generally incorporated in the body of the set, to which is attached the anvil, a rotating disc with a graduated bevel on its face and numbers on its edge (Fig. 4).

The numbers represent the points—not teeth—per inch of saw; the larger the teeth the lower the number and the greater the set on the saw. Do not use a lower number than advised by the makers or you will strain the blade at the root of the tooth, making the saw slack—a common mistake in dovetail and tenon saws.

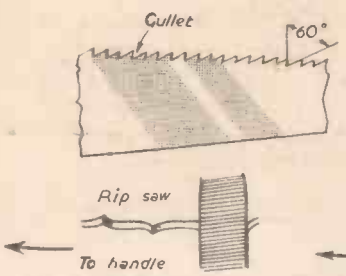


Fig. 7.—Filing rip saw teeth.

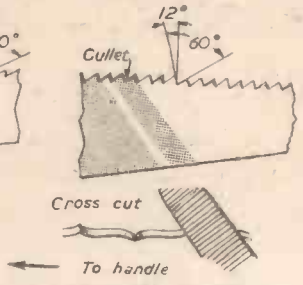


Fig. 8.—Filing cross-cut saw teeth.

Place the set over the saw with the required number on the top of the anvil, squeeze the handles and the large plunger will hold the saw firm as the punch pushes the tooth over against the anvil (Fig. 5). A favourite test is shown in Fig. 6.

Files

As a general rule sharp cornered files are required for handsaws, round cornered for machine saws. Make sure they are single cut; double cut files will tear out when used on saw steel.

To Sharpen Handsaws

The face of a tooth is that portion which does the work on the forward thrust, the rip saw face is vertical (Fig. 7).

Hold the file level but pointed very slightly towards the saw handle.

The cross cut face is laid back 12 degrees and the file is pointed up to 45 degrees towards the handle (Fig. 8).

By filing towards the handle the resulting burr is on the back of the tooth giving the harder working face a little extra sharpness. Keep the saw low in the vice to reduce chatter. Always hold the file level and give three or four strokes to every other gullet, sharpening the face of one tooth and the back of the next; then turn the saw round and do the same for the other teeth.

To sharpen the saw properly you may have to turn it round another three or even four more times; it's better to do that than to spoil it.

Circular Saws

Saws with a rim speed of 9,000 to 10,000ft. per min. should be stoned down to keep them true. An old piece of carborundum wheel, large enough to hold in safety, is held in both hands, the edge of the palms and the edge of the stone are rested on the saw bench, as in Fig. 9.

With the saw running the stone is carefully moved forward until the teeth just impinge upon it, a few seconds will be enough to bring down any high teeth.

Always make sure the saw is fitted in the same position, make a mark on the fixed collar and on the saw, fit the saw in your bench with the marks at the top to counteract any play in spindle or bearings.

To Set

Unless of the fine peg tooth kind, where a handsaw set can be used, a gauge (Fig. 10) and wrench type set (Fig. 11) are used.

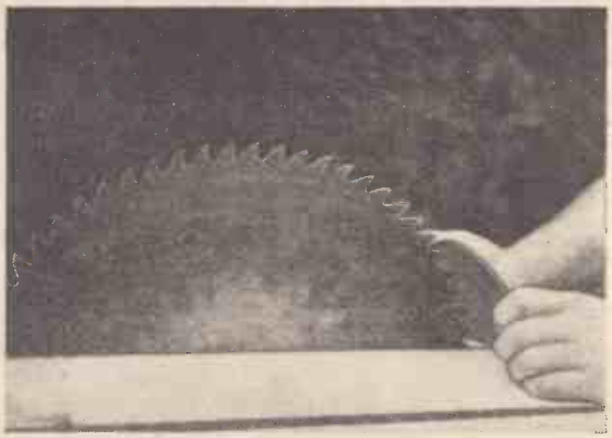


Fig. 9.—Stoning down a circular saw. The guard is removed and saw stopped for demonstration.

Place the gauge against the side of the saw (Fig. 12) and move it gently to and fro, the tooth should just touch, if not, place the appropriate slot over the tooth and carefully bend it; test it again and keep making adjustments until it is exact. Correct setting is just as important as correct sharpening.

Hollow ground saws do not require setting, the hollow grinding gives them clearance.

To Sharpen

The shape and variety of circular saws is immense and it is impossible to give detailed instructions here, but a few pointers will help.

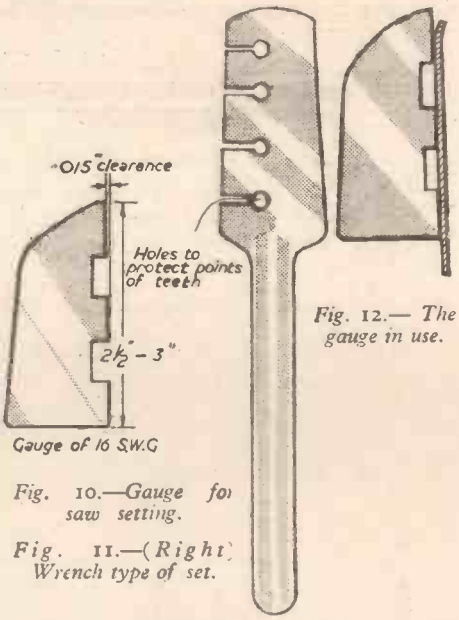


Fig. 10.—Gauge for saw setting.

Fig. 11.—(Right) Wrench type of set.

Fig. 12.— The gauge in use.

Take a rubbing of a new saw and refer to it now and again so that your sharpening will not distort tooth shape too much.

Use round-edged files to relieve strain in the bottoms of the gullets.

Avoid too much face bevel; the sideways pull of the teeth will often cause a crack.

If a saw should crack and it is not more than 1/6th the radius of the saw, drill a ¼in. or 5/16in. hole where the crack ends to stop it spreading.

If it is more than 1/6th, do not use it again; it is not safe.

Latest Element

A NEW element, number 102, has been created by an international team of scientists from the Nobel Institute of Physics, Stockholm, Harwell in Britain and the Argonne National Laboratory in America. The element was discovered by bombarding another synthetic element, Curium, with carbon ions accelerated to great speeds in the cyclotron of the Nobel Institute. Nobelium is the suggested name for the new element. It is very unstable, having a half-life of about ten minutes, and the atomic mass number has been reported as 253.

New Helicopter

NAMED the Fairy Rotodyne, a new helicopter with stub wings fitted with turboprop engines for forward propulsion is being built. The rotor blades will have pressure jets on their tips and the 48 passengers will be carried at a maximum speed of 170 m.p.h.

Balloon Lift

SAID to be the world's largest, a balloon in the United States has carried almost two tons of military equipment to a height of over 104,000ft. The diameter of the balloon is 200ft.

Ceramic Wings for Aircraft?

PRELIMINARY research has been commenced on this project to overcome the problem posed by aerodynamic heating at very high speeds, raising aircraft surface temperatures beyond that which can be withstood by available metal alloys. Ceramic materials can withstand very high temperatures but normally are too brittle for aircraft structures. The use of tension cables for pre-stressing overcomes this difficulty.

Gas Turbine Vehicles Practicable

AMERICAN engineers have stated that the use of gas turbines is practical and feasible in heavy vehicles. Tests have shown that it compares favourably in performance with the standard lorry engine. The main drawback to production is the necessity for special alloys to withstand heat, but this is expected to be overcome in the near future.

Shrinking Aircraft Floor

SHORT BROS. AND HARLAND have designed a special floor for R.A.F. Transport Command Britannia 253s. The floor will move as the fuselage skin of the aircraft contracts in low temperatures at great heights, and it is able to do this because it is constructed in sections with spaces between. If the metal floor, which is capable of carrying heavy military equipment, had no give, metal fatigue might result.

New Jet Fuels

INCREASED ranges of up to 50 per cent. and the elimination of high altitude engine failures are two of the attributes of new fuels being developed for the U.S. Air Force. The new compounds are based on derivatives of boron.

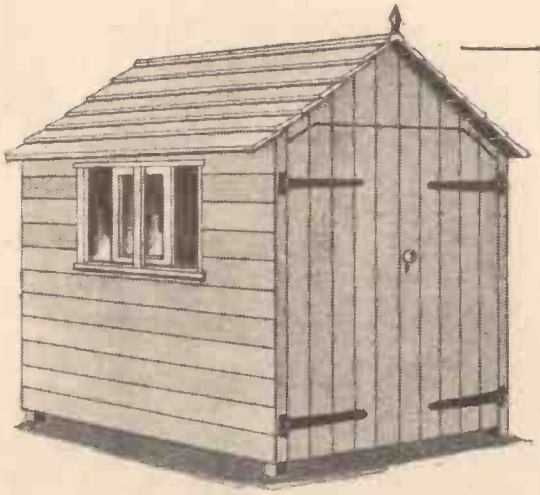


Fig. 1.—*The completed shed.*

BUILD THIS USEFUL TOOLSHED

Small, Sturdy and Designed for the Small Garden

THE dimensions of this small shed make it ideal for erection in a small garden, and it can be used either for storing tools and garden implements or as a small workshop. It measures 6ft. × 5ft. and is 7ft. 4in. high. As can be seen from the heading picture (Fig. 1), it has a large double door at one end and two large sliding windows, one at either side. The sides are of tongued and grooved matchboard and the roof is ordinary weather boarding; this will make a sound roof but tarred felt can be added if preferred.

The Two Ends

The material used for the end framing is 2in. × 2in., except the roof pieces which are 2in. × 1in. The dimensions and construction are clearly shown in Fig. 2. It will be noticed that the crossbeam at the door end is 1ft. higher than the one of the other end; this to allow for greater door height.

The back end has a crosspiece 2ft. 6in. from the floor and another vertical one down the middle. The floor supports are fitted so as to leave 2in. legs. All the joints are scarf joints and before being finally screwed together they should be creosoted to prevent rot.

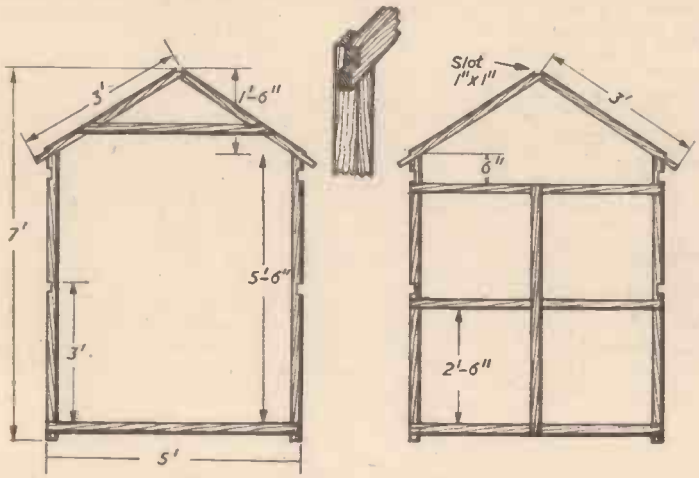


Fig. 2.—*Details of the two ends.*

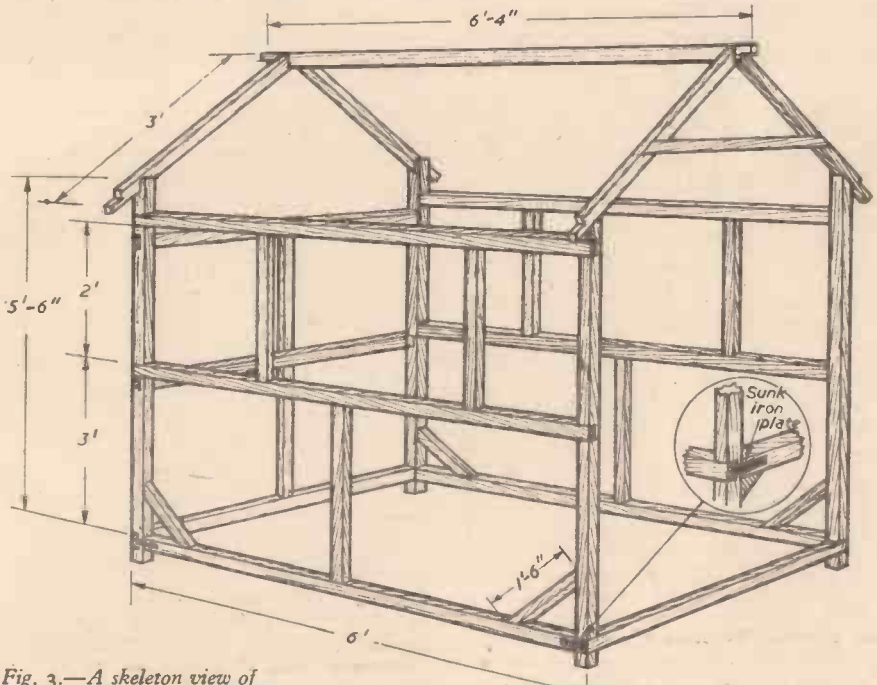


Fig. 3.—*A skeleton view of the framework.*

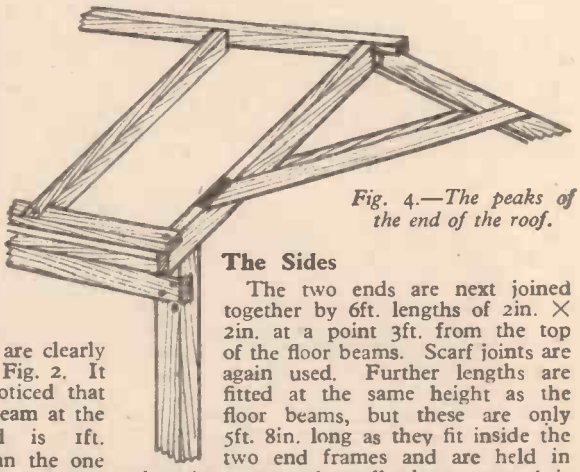


Fig. 4.—*The peaks of the end of the roof.*

The Sides

The two ends are next joined together by 6ft. lengths of 2in. × 2in. at a point 3ft. from the top of the floor beams. Scarf joints are again used. Further lengths are fitted at the same height as the floor beams, but these are only 5ft. 8in. long as they fit inside the two end frames and are held in place by means of small plates screwed in position as shown in Fig. 3. A shaped chock of wood is also nailed in place as shown. If the plates cannot be obtained from an ironmonger's they can be made quite easily. They should be about 3in. long × 1in. wide and ⅛in. thick, with two screw holes at either end.

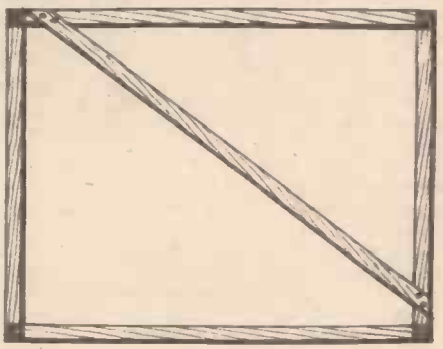


Fig. 5.—*The floor support.*

Two further lengths of 2in. × 2in. wood are used to tie the two end frames together and these are scarf jointed in position as shown in Fig. 3.

The peaks of the ends of the roof are joined by a 6ft. 4in. length of 2in. × 1in. wood as shown in Fig. 4. It is overlapped 2in. at each end.

Fig. 6.—*The door end of the floorboards.*

The Corner Pieces

These corner supports, which are shown in Fig. 3, strengthen the whole framework. They are pieces of 2in. × 2in. material about 18in. long, with their ends cut at an angle and screwed into place as shown. The side frames of the windows are added next and positioned 18in. from each end and thus leaving a window space of 3ft. Also fix a

supporting piece in the centre of the window frame spaces.

To support the floor a 2in. × 2in. member is scarf jointed in a transverse position as shown in Fig. 5.

All that remains now to complete the framework is the fitting of the roof slats and the method of doing this is shown in Fig. 4.

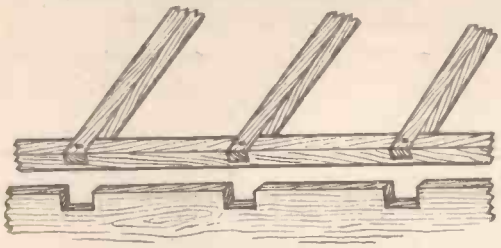


Fig. 7.—How the roof is fitted.

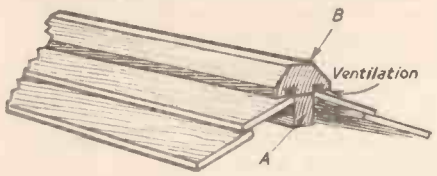


Fig. 8.—Planking the roof.

They are placed 1ft. apart and there are five of them on each side, 3ft. long, and 1in. × ½in. in section. The ends are scarf jointed into a piece of 1in. × ½in. which runs the length of the shed.

The Floorboards

These are of 6in. × 1in. planking and run lengthways from door to back. Do not take the boards right up to the edge of the floorbeam, but lap them about an inch on to it. Along the inch space lay a length of 1in. × 1in. wood to give the floor a good finish.

Fig. 6 shows one end of the floorboards laid with the finishing strip. The dotted line is the extent of overlap on to the floorbeam.

Planking

Start with the back and sides and use tongued and grooved boards, if possible without the beaded edge. If this is unobtainable, use the beaded type, but plank up with the beaded edge on the inside. Six-inch boards are the best size to use.

Plank the back end horizontally across. Every plank should be nailed twice at each beam it crosses. The best nails for the job are 2in. galvanised.

The side planking consists of 6ft. 0½in. lengths of the same material. The extra half inch is to cover the depth of the planking on the back. To bring the top plank to meet the roof, small pieces will have to be chiselled out to take the roof slats (Fig. 7). The position of these slots can best be ascertained by positioning the plank and marking from the slat. Do not forget to leave the window space open.

To make a pleasing contrast from the horizontal planking the small part over the door is vertically planked so that the aperture is filled and also the two sloping roof frames covered, see Fig. 1. A half-inch wide strip of the horizontal beam is left uncovered, so that the door can close on it.

The End Planks

Run the two end planks right down the side beams, flush on the inside, but overlapping on the outside to cover the end of the side planking. If it is found that the boards do not fill the area to be covered, they must be split down the entire width.

For the roof 6ft. 4in. lengths of weatherboarding should be used; they overlap 2in. at each end of the shed. When laying the first plank (Fig. 8), leave it about ¼in. away from the tie (A). To prevent the roof from leaking at this point a piece (B) is firmly nailed along the ridge. Grooves are cut along the whole length with a rabbeting plane, to prevent drips running in. The whole purpose of this arrangement is good ventilation.

The planks must be firmly nailed at each slat. Should any gap appear between the weatherboarding, a screw put in from the underside will soon remedy it.

The Windows

These are, for convenience, made to slide. First of all construct two frames from 1½in. × 1½in. window sash, each to measure 1ft. 10½in. high × 1ft. 7¾in. When these two frames are overlapped 1½in. they should fit into the window space; the overlap is to prevent wind and rain finding a direct entrance when the window is closed.

Having made the frames so that the glass can be fitted from the outside and puttied, obtain some ¾in. planking and cut out a sill as in Fig. 9, 3ft. long and 4½in. wide; also cut a top piece 3in. wide × 3ft. long. Take one of the window frames and screw it on to these pieces in the position shown in Fig. 9 and then screw the whole assembly into the window space. Running strips will have to be fitted for the second frame to slide in. The frame must be made to run quite loosely, otherwise the damp will swell the wood and the window will stick. A similar framework is constructed for the other window.

The Doors

These are built from tongued and grooved wood similar to the walls. The planking

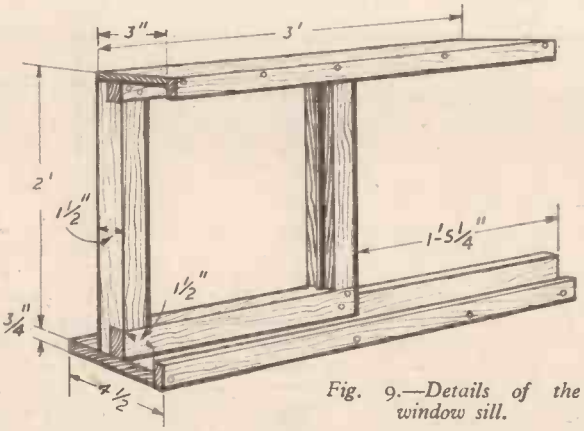


Fig. 9.—Details of the window sill.

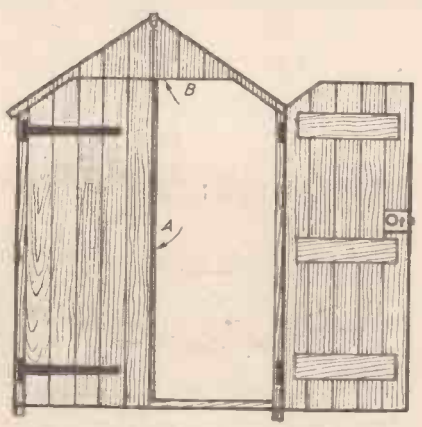


Fig. 10.—The two doors in position.

though is vertical; each door measures 6ft. 2in. high × 2ft. 4in. except where the corners are cut off at each hinge side. It will be found best to construct the door to its full dimensions and cut off the corners afterwards by marking from the actual shed. They are tied together with 4in. × 1in. battens in three places, see Fig. 11.

The outside planks with the tongue left on should be planed down until it is

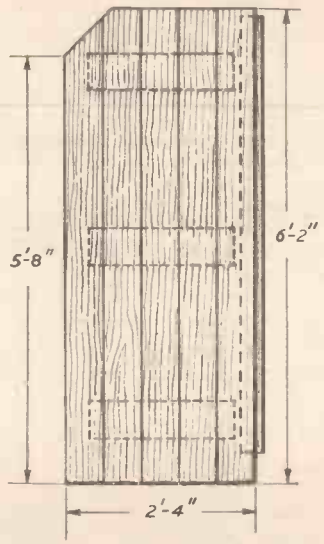


Fig. 11.—The left-hand door.

removed. To hang the doors, obtain some large gate hinges which should come nearly half way across the doors and screw them on the outside over the position of the battens. The left-hand door has a strip of wood (A, Fig. 10) 2in. × ½in. screwed to the back and overlapping 1in.; it runs the whole length of the door except for ½in. at the top and 2in. at the bottom. The ½in. space at the top is where the door shuts on the beam. A bolt should be fitted top and bottom of the left-hand door, one to drive into the floor and the other into the top beam. The other door can be secured either by a button or hasp and padlock or, better still, a lock and key.

Latest Careers Booklet

THE latest booklet in the "Choice of Careers" series issued by the Central Youth Employment Executive is "The Electrician" (No. 79 H.M.S.O., 1s. 9d.).

The boy who is thinking of becoming an electrician will find in this booklet information of what he has to learn about the installation, repair and maintenance of all kinds of electrical wiring and equipment. He will also find details of the personal qualities required, the arrangements for apprenticeships and for studies, and promotion opportunities.

Like others in the series this booklet is intended primarily for young people deciding what kind of work to take up on leaving school, but it will also be of interest to parents, teachers and others who are concerned in helping young people to make a wise choice of career.

A RADIO CONTROLLED MODEL OF THE ROYAL YACHT

Part Two of a Series Describing the Construction of a 6ft.-long Boat, Electrically Driven

By G. W. PATTISON

THE plank ends are simply glued and nailed, allowing an overlap of about 1in., these being tapered away with a file later to blend with the stem and stern block. No great care need be taken to make a sound joint between each plank as water-tightness will be achieved later with the covering. Even a gap of 1/16in. can be tolerated, although for neatness it should be as close as possible. Extreme care should, however, be taken to see that all planks follow the line of the hull closely between frames, where occasionally a plank may stand proud of its neighbours, but this is only likely to occur near the bow and along the bilges. Ribands about ¼in. wide of planking material may be glued to the edges of the offending planks on the inside to pull them flush, but the difficulty, if it does occur, can usually be cured by stitching the plank edges together with linen thread and a brushful of glue. When set the thread can be filed off the outside of the hull.

After having completed the planking the entire hull is given a rub down to smooth off any projections, not forgetting to file away the ends of all the planks which overlap the solid stem and stern. The bulwarks, being only the same length as the planking, will later have brass stem and stern counterparts fitted.

Fit the bilge keels next. They are best made from ¼in. square mahogany, glued and screwed through the planking into the frames. All sharp edges can then be removed and dressed slightly taper towards bow and stern.

Fitting the Stern Tubes

Having completed the hull so far, the next and probably the most difficult job is the fitting of the stern tubes. It can be done quite easily if the procedure outlined is followed. Two holes have already been drilled in mould 4, through which the forward ends of the propeller shafts have to pass. All that is necessary is to take another mould, marked and drilled to the dimensions shown in Fig. 5, and fix this to the building board hard up against the stern of the boat. Be quite sure that it is correctly centred and not tilted over to one side or the other, otherwise the shafts will not line up and the boat will have a tendency to run off course. The shafts are 7/32in. diameter stainless steel rod, ground to size, and can be bought in 2ft. lengths. Thread a length of rod through one of the holes in this after mould and judging as accurately as possible, pierce the planking and push the rod into the corresponding hole in No. 4 mould. No doubt it will be out of line, so file the hole until the rod clears the planking. Repeat this for the other shaft and here it will be easier to hit the exact spot where the rod passes through the planking. The stern tubes are made from drawn brass tube, ¼in. outside diameter, with a brass bush pressed into each end and reamed 7/32in. for the shaft. Having made the stern tubes, thread them on to the shafts, enlarging the holes in the planking if necessary and let them butt up against No. 4 mould. This will ensure that they project the right distance from the hull bottom. The wedge shaped web between stern tube and hull bottom supports the overhanging end and is roughly tee-shaped in section, the top of this tee being bolted through the planking. A sketch of this is shown in Fig. 6. Cut the top plate first from thin sheet brass about ¾in. wide, drill a hole, which must be elongated, to fit neatly over the stern tube and fasten to the planking with 8 B.A. countersunk head brass bolts. Strips of wood 3/16in. thick, glued inside the hull, will form a firm foundation for the bolts to pass through and be tightened up with nuts on the inside.

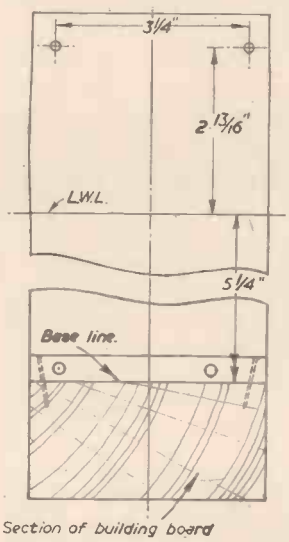


Fig. 5.—Drilling for the stern tubes.

The web is first cut from ¼in. wood, shaped neatly to fit in place as shown in Fig. 6. It is slanted off at its after end and tapers slightly aft in plan. When it fits, cover it with tinplate and solder to hull plate and stern tube. Careful soldering will keep the wood interior watertight, and any superfluous solder can be filed off.

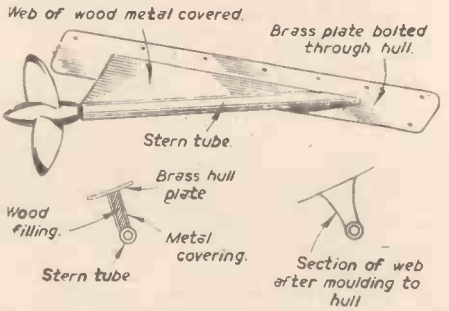


Fig. 6.—Fixing the stern tubes.

Covering

The entire hull is covered inside and out with linen or cotton strips, impregnated with resin glue. This "one-shot" resin glue should be mixed according to the directions on the container which will result in a mixture about the consistency of thick cream. Brush over a portion of the hull first with the glue, then lay on a strip of dry linen or cotton bandage. Thoroughly soak this with more glue and continue until the entire hull has been covered, wrapping the bandage around the whole of the solid stem and stern and smoothing off with glue. Allow to dry (drying can be accelerated by holding an electric fire over it), then follow with layer upon layer, drying out each one before starting the next. Should any slight hollows develop, fill in level with short pieces of bandage before putting on the final layer. Layers should be criss-crossed in all

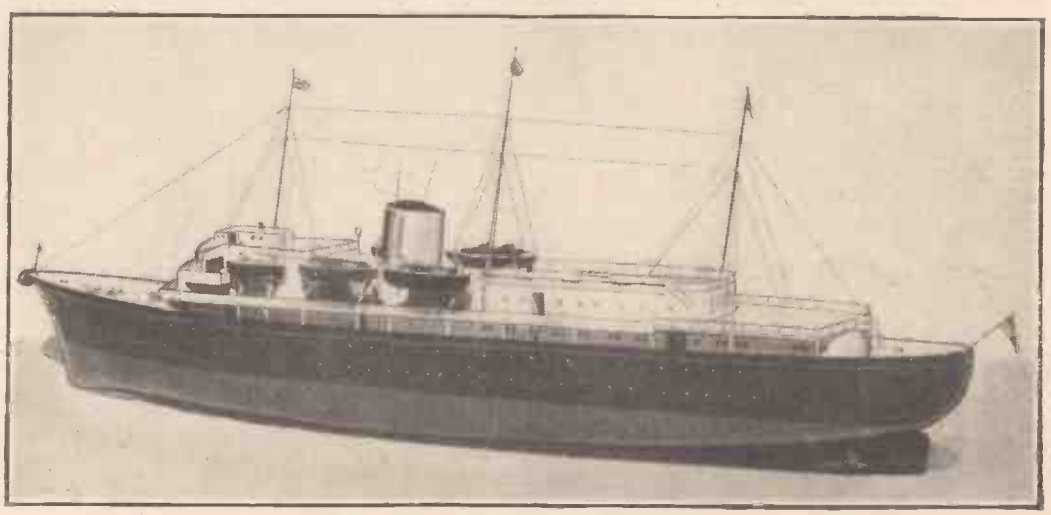


Fig. 7.—A view of the completed model.

directions with the last two laid in a horizontal direction from stem to stern. Any bandage overlapping the bulwark can be left until dry when it can be filed or snipped off later. The stern tubes are neatly covered with the material which can be easily moulded whilst wet to fill in all the sharp angles and form fillets, so that the final result will make them look as though they had been cast in a mould with the rest of the hull. Quite a lot of dressing up can be done with the hull still rigidly anchored to the building board.

The easiest way to separate the hull from the building board is to saw through each mould just above the base line and withdraw the screws holding stem and stern extensions. This is simpler than trying to pull out the nails. When the hull is upright, fit the two remaining inner deck stringers and saw through each of the moulds in turn to remove the centre waste; also unscrew the two supports attached to moulds 0 and 19.

Deck Supports

Frames 16, 17, 18 at the fore end will need beams to support the deck as will No. 1 for the afterdeck. These are cut from ¼in. wood, not ply, about ¾in. deep at their centres and cambered by the use of the cardboard template. They are notched at the ends to bring them level with the deck stringers and glued and nailed to the side face of the frames. Double beams, one on either side of the frame, are fixed to Nos. 4, 9, 13 to strengthen the hull and act as lifting handles. These need not necessarily be cambered, being simply straight lengths of wood notched out for the deck stringers and glued and nailed to the frame.

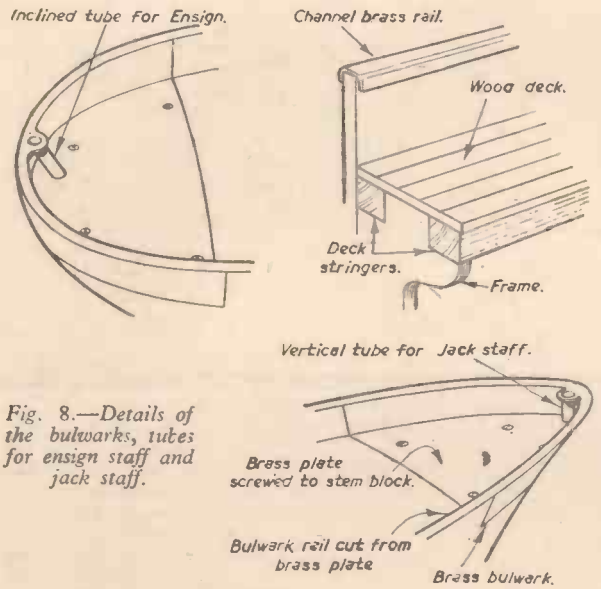


Fig. 8.—Details of the bulwarks, tubes for ensign staff and jack staff.

The whole of the interior of the hull can now be given at least two layers of bandage and glue, covering all planking and frames and again moulding the bandage around the stern tubes. Next measure up to the bulwark rail and file or plane the top edges to the sheer line.

The Bulwarks

Before fitting the decks, the bulwarks at stem and stern must be fitted. Taking the bow first, a brass plate is cut to the shape of the deck at the fore end and secured to the solid stem with screws. A thin card template is then carefully bent and fitted, exactly representing the fore end of the bulwarks and continuing aft to overlap the wood bulwarks by ¼in. The shape of the template is then transferred to a piece of brass plate, and having got this to fit accurately it is soldered to the deck plate. Similar treatment is given to the bulwark around the stern, first fixing the brass deck plate and then soldering the bulwark to it. A sketch of this arrangement is shown in Fig. 8, which also shows a section of the wood bulwark amidships. The rail which will be fitted to this wood bulwark is of channel brass ¼in. wide, and to get a continuation of this, the bow and stern rails are cut from sheet brass and shaped exactly to rest on top of the brass bulwarks. These are soldered in position, projecting equally on either side and forming a tee section. They are also shaped to accommodate the jack staff at the bows and ensign staff at the stern, a short length of brass tube being soldered between rail and deck plate to act as a socket or ferrule into which the staffs may be screwed or soldered.

The outsides of these brass bulwarks can now be covered with bandage and glue to mould them to the rest of the hull, and when dry finally smoothed off to make the joint almost invisible.

The channel brass used to cap the wood bulwarks and the railings on the shelter deck was purchased from Whistons, of Stockport, but failing this it could be readily formed from brass shim-stock. Short lengths were used and neatly soldered at the joints. To fix the channel it was filled with thick resin glue and pressed over the wood bulwark and held down by weights until dry. The ends were then soldered to the stem and stern rails. Drill the holes for the fairleads and file them oval—a rim of 22-gauge wire can be stuck on with glue to improve the appearance if desired.

Holes to lighten the solid nose and stern blocks were not drilled in the original, but if preferred can be used to save an ounce or two of weight. They will have to be drilled before the brass plates are screwed on, but remember that two quite large chunks have to be cut in the sides of the nose block to house the anchors, and from these holes are drilled up through to the deck for the hawse pipes. It is just as well to drill these first and keep any lightening holes well clear. The anchor cable passes up through the hawse pipe, through the chain stopper at the top, then along the deck and round the capstan, then forward again, where it disappears through a hooded opening into the chain locker below.

The decks are cut from the same material as the planking. Cut the foredeck and chamfer underneath the edge to fit neatly against the sloping bulwark. Glue and nail to nose block, stringers and deck beams. The afterdeck can then be fitted in the same manner.

Preliminary Painting

This consists of a priming coat and two undercoats on the outside, rubbing down between each. Do the same to the inside, less the rubbing down, and follow on the inside only with a coat of enamel. The decks can be given a coat of flat buff paint and, when dry, lined off to represent planks with a hard, sharp-pointed pencil, spacing the lines about 1/16in. apart. After this give a coat of varnish to fix the lines and protect the surface from being soiled. Later it can be washed and rubbed down and given a final coat. A curved breakwater is fitted to the foredeck and locates the fore end of the superstructure, making an almost invisible joint. It is of aluminium angle and can be conveniently cut from a length of curtain rail. The ¼in. side is pinned to the deck and the side which stands at right angles to it is left standing a ¼in. high, against which butts the fore end of the superstructure. A similar fitting could be fitted to the afterdeck to locate the after-end of the superstructure, but this was found to be unnecessary, the weight of the upper deck works holding it in position. Some idea of the appearance of the completed hull can be gained from Fig. 7.

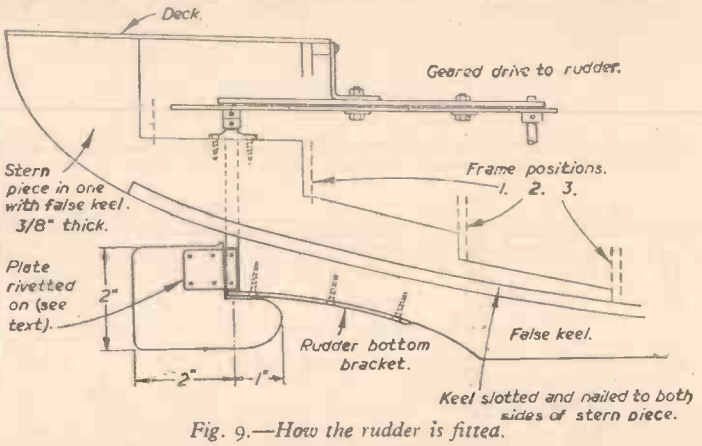


Fig. 9.—How the rudder is fitted.

The Rudder

Make this from 1/16in. sheet brass. If brazing facilities exist a short length of tube to accommodate the operating rod can be brazed direct to the brass. Failing this, wrap a strip of thin brass around the rod and rivet to the rudder plate and sweat the whole assembly with soft solder. Now dress it up with a file until it blends with the plate. These details are shown in Fig. 9. The rod is of bronze or stainless steel riveted in position and, if of bronze, soldered as well. There is just sufficient clearance between the foot of the rod and the balanced part of the rudder to admit the bottom bearing. This bearing is a hole drilled in a strip of ⅜in. by 1/16in. brass, bent and screwed to the false keel. A collar is attached to the upper end of the rod on which the weight is taken, and above this is a gearwheel. The distance from the centre of the rudder post to the centre of the ratchet motor shaft is 6in., but this can be varied to suit the size of gearwheels available.

The maximum arc traversed by the rudder is about 30 deg. either side of the centre line. In the present case a 2½in. gearwheel is attached to the rudder and a 1in. pinion on the driving motor. This means that the driving motor covers an arc of 75 deg. either side. Although the driving motor was amply powerful enough to operate the rudder direct, it was purposely geared down to spread out the operating contacts. Two of these latter contacts are positioned some 3 deg. at either side of the centre line and only used to correct drift due to wind direction, etc., when on a straight course.

(To be continued)

NETTING FOR BEGINNERS

General Notes and Details for Making a Hammock

NETTING is not difficult to learn, and the materials necessary are not expensive. All the implements needed are a meshstick and shuttle, which can be cut from suitable wood with a fretsaw and finished with glass-paper.

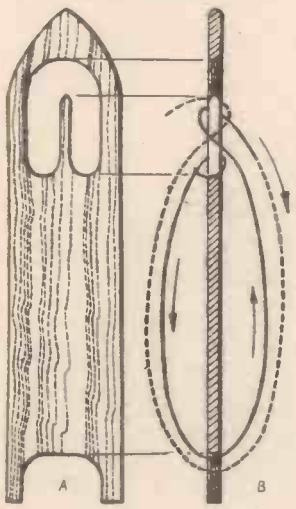


Fig. 1.—(A) The shuttle and (B) the directions for filling it.

The meshstick need only be a 12in. wood rule; that being about 1in. wide would give a 2in. mesh. The shuttle (A in Fig. 1) should be about 8in. long and 1in. or more wide.

The Twine

Common twine is quite good enough, but, of course, Seine twine, which is smoother to work, can be used. If the twine is bought in a skein, it should be wound, as it is handier in a ball.

Having collected the implements and twine, the shuttle should be filled. This operation is started by making fast the end of the twine to the tine, as the inside point of the shuttle is termed, then leading the twine under the crutch at the foot, up the other side and over the tine again, back under the crutch up the other side, over the tine, and so on, as shown at B, Fig. 1, until the shuttle is full.

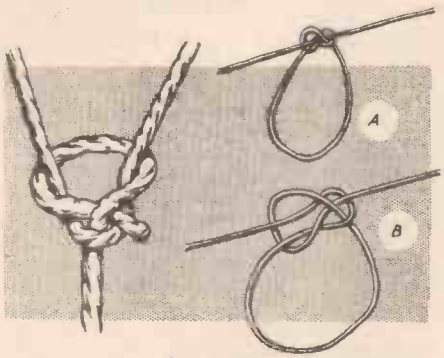


Fig. 2.—The becket hitch.

Fig. 3.—(A) The first loop to begin and the end made fast to hook; (B) Method of forming loop with becket hitch.

The Becket Hitch

Fig. 2 shows a becket hitch, which can easily be followed from the illustration. All that is necessary to know now is how to start about making the net, as netting is simply a succession of becket hitches.

There are several ways in which to start netting; it depends on the choice of the worker and what the net is to be used for. If a hammock is required or any square or oblong piece of netting, the usual way of starting is to make a loop 3in. or 4in. from the end of the twine, as shown at A, Fig. 3, and make fast the end of the twine to a hook or nail driven in somewhere at a convenient height to allow comfort in working. The loop can be made with a becket hitch; (B) in Fig. 3 clearly shows the manner in which the becket hitch is made for this purpose.

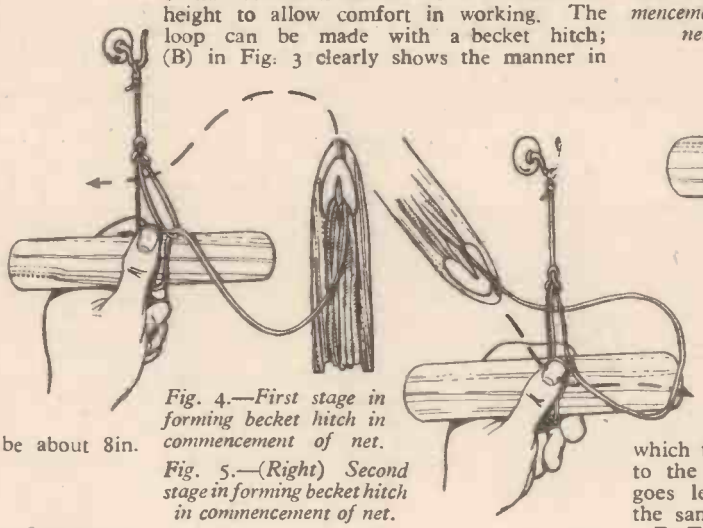


Fig. 4.—First stage in forming becket hitch in commencement of net.

Fig. 5.—(Right) Second stage in forming becket hitch in commencement of net.

Having made the loop and made fast the end of the twine to the hook or nail, the meshstick is laid over the twine, below the loop. The shuttle is brought forward and upwards, bringing the twine over the meshstick. The twine is held to the meshstick under the thumb and the shuttle reeved up through the loop from back to front and pulled until the upper edge of the meshstick touches the lower part of the loop (Fig. 4). The loop with the twine through it is held under the thumb and the shuttle passed round behind the loop and the single part behind it (Fig. 5). The shuttle is then brought forward and down through the bight from left to right (Fig. 6) and pulled in the direction of the arrow.

Working the Meshstick

The meshstick is slipped from the mesh just made and the same procedure carried out for the next one below it, and so on, until enough have been made. If a hammock with 2in. mesh is being made, it should be about 50 meshes wide. Therefore, 50 meshes or so should be worked and the result so far should look something like B, Fig. 7. A, Fig. 7, is a close-up of a portion of the first two rows of meshes worked in this way, showing the hitches.

When the required number of meshes for the width have been worked, take the work off the hook and reeve a piece of twine or cord through all the meshes on one side, in other words, through one row. Now the cord, with the work on it, should either be stretched between two firm objects horizontally, a foot or two apart, or the ends of it reef-knotted together, and put over the hook or round a toe. The work can be fixed up in any of these ways ready for working down the length. The end at which the width was finished off should be to the left (A, Fig. 8) so that the work goes left to right, making each mesh in the same manner as for the width.

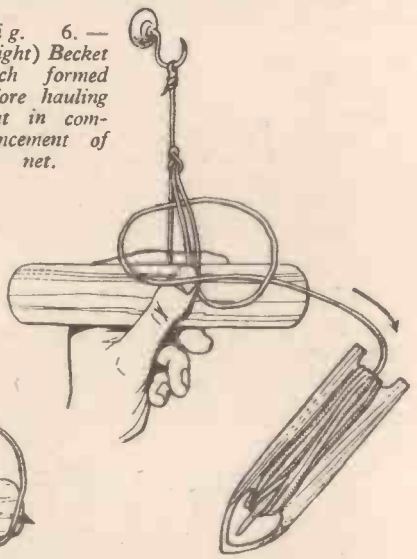


Fig. 6.—(Right) Becket hitch formed before hauling taut in commencement of net.

B, Fig. 8, shows the continuation of the third row, the first two having been worked across the width in the beginning.

On finishing this third row, which is the first row made since reeving the cord through the end meshes, and putting it up one way or another, if it is found to be awkward with the left hand, the work should be turned over, or, if it is on the stretch, the other side worked, when it will be possible to work from left to right as before. If this is not done, the meshstick will have to be used in the right hand and the shuttle in the left to do the work properly and this may be found awkward.

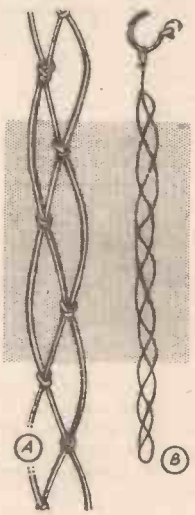


Fig. 7.—(Left) (A) Enlarged portion of B showing hitches. (B) First two rows of net complete, forming the width.

Another Method

There is another method which may be better and quicker. This is how to proceed.

A piece of wire or cord (preferably wire) is stretched horizontally between two

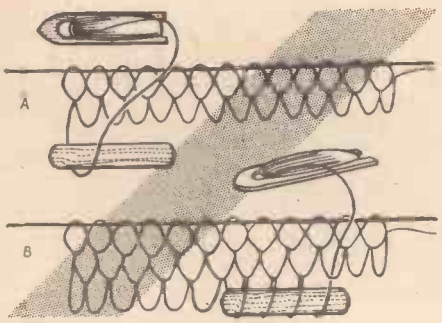


Fig. 8.—(A) First two rows on a stretch ready to start working third row from left to right ; (B) Continuation of third row.

firm objects a foot or two apart. The end of the twine is made fast to the right-hand end of the wire with a clove hitch, which is shown in Fig. 9. Now the meshstick is taken in the left hand and placed over the twine below the clove hitch, and the twine brought towards the operator and up over the meshstick to the wire. Another clove hitch is made, and so on, as in Fig. 10.

To make a hammock with 2in. mesh starting this way, fifty or so bights or loops should be made along the wire by means of the clove hitches, working from right to left. The second row is carried on with the becket hitch on the loop as before, from left to right, and so on, until enough is made.

Why wire is preferable to cord upon which to commence the work is because, when the length is finished, all the clove hitches put in at the start can be run off the end of the wire. Any kinks in the wire caused by its having been made fast at each end, which might interfere with the running off of the clove hitches, can be nipped off. Whereas, if the work was stretched on cord to begin with, all the clove hitches would have to be eased up before they could be run off the end.

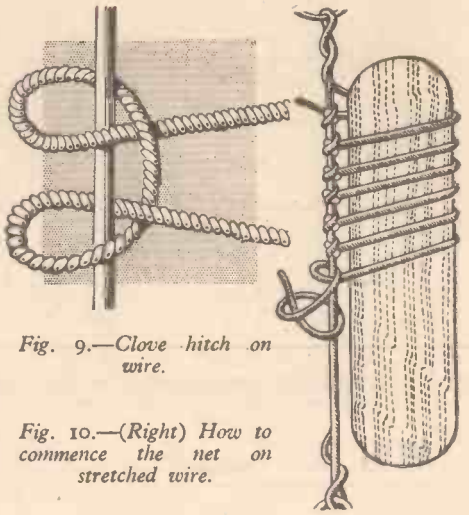


Fig. 9.—Clove hitch on wire.

Fig. 10.—(Right) How to commence the net on stretched wire.

Make Your Own Draught Excluder

A Device Which Rises to Clear the Carpet When the Door is Opened

By P. W. EDWARDS

THIS device is basically a flap at the bottom of the door that will effectively seal even the largest gap when the door is closed, but will rise and clear floor or carpet when it is opened.

Materials

Items required are a length of wood 1½in. wide by about ⅜in. thick, a pair of small hinges, a letter-box spring (a small coiled spring with ends about 1½in. long), a fibre tap washer, a few screws and drawing pins and a strip of rubber 1in. by 1/16in. thick. This latter may be purchased, cut from a motor-car inner tube or alternatively a length of knife-edge section draught exclusion rubber may be used.

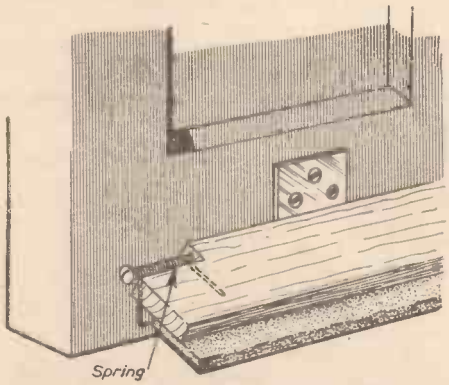


Fig. 1.—A view of the completed device.

First of all cut the wood to a length slightly less than the width of the door aperture, then glue a similar length of the rubber strip along one face of the wood, leaving about ⅛in. protruding along the entire length and secure with drawing pins before the glue sets. If the knife edge section rubber is used, it can be secured by means of small screws with washers under the heads and will not require gluing.

Next, holding the wood with the rubber strip at the back and protruding beyond the lower edge, cut away a small piece of wood from the upper left-hand corner sufficient to accommodate the letter-box spring, usually about 1in. long. Secure the spring in position by passing a long thin screw through the spring and into the end of the wood, being careful to first drill a hole to receive the screw. Another small hole should be drilled into the wood at right angles to the first to receive one end of the spring, the other end being left free to bear against the door.

Next screw the two hinges to the wood about 2in. from each end, on the same side as, but the opposite edge to the rubber strip.

The flap is now ready for fixing to the door. First close the door, then place the flap firmly against the bottom of the door and press down until the rubber just begins to double over and seals any gap between floor and door.

Holding it in this position, screw the free leaves of the hinges to the door. When released the flap should raise itself clear of the floor by reason of the spring bearing against the door.

If the flap is again pressed down and the fibre tap washer screwed to the bottom of the pillar of the door frame in such a position as to hold the flap down but left free to revolve, then it will depress the flap each time the door is closed and being free to revolve, the action will be smooth and will not be felt by anyone closing the door.

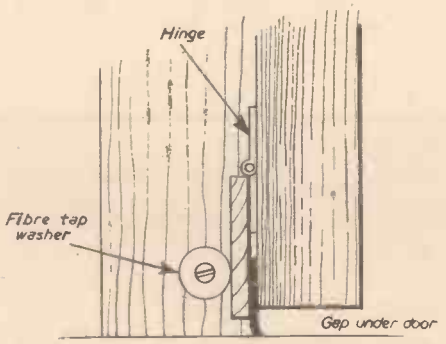


Fig. 2.—The position of the fibre tap washer.

To ensure that the flap engages with the washer each time, it may be necessary to limit the amount by which the flap raises itself; this can easily be done by using a small screw as a stop in the door itself.

If the excluder including the hinges be painted to match the door, it becomes very unobtrusive and is in fact hardly noticed.

PUZZLE CORNER

HERE are some algebraical swindles which may amuse you. The fallacy will be obvious to the mathematician, but those whose algebra has not been refreshed since schooldays may have some difficulty in finding it.

Suppose $a=b$ then

$$ab=a^2$$
$$ab-b^2=a^2-b^2$$
$$b(a-b)=(a+b)(a-b)$$
$$b=a+b$$
$$b=2b$$

therefore : $1=2$

Here is another bogus calculation, in which 5 is proved to equal 4.

$$+5\times+5=25$$
$$-5\times-5=25$$
$$\sqrt{25}=\pm5$$

Euclid said that things which are equal to the same thing are equal to each other :

therefore $+5=-5$
and as $+5=+5$

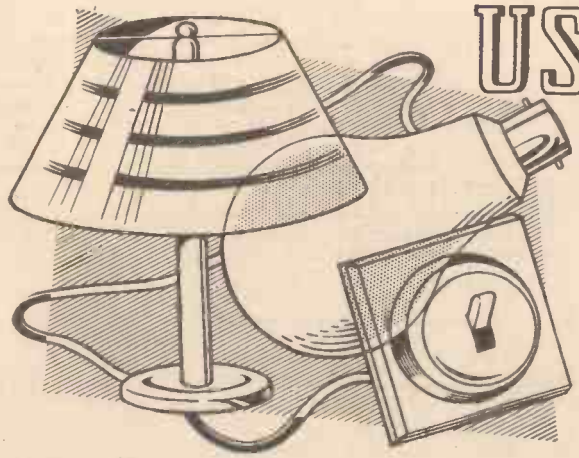
we can add to get $+10=0$

Similarly we can prove

$+4=-4$
$+4=+4$

so by addition $+8=0$

therefore : if both 10 and $8=0$
$10=8$
and $5=4$ Q. E. D.



USEFUL SWITCHING ARRANGEMENTS

Some Wiring Details and Circuits for Household Lighting

By J. L. WATTS

THERE are many circuits for which the usual single and two-way switches are not adequate, and for which less common switches are more suitable.

Use of Time-lag Switches

There is a little known time-lag switch which may be obtained either as a metal-clad switch, or may have a case of moulded insulating material for surface or semi-recessed mounting. This switch may be obtained as a single-pole single-way switch, or as a single-pole two-way switch. The special feature of this switch is that a push-button is pressed to make contact; after the contact has been made the switch is controlled by means of a small dashpot so that after a given delay, which may be adjusted for any period from two seconds to one hour, the switch contacts are opened automatically. The switch may also be arranged so that the contacts opened when the push button is pressed and automatically closed after a pre-set period.

The switch is suitable for many purposes such as the control of lights on staircases, corridors, cupboards, bathrooms, toilets, cloakrooms, garages, window displays, radio sets, etc. The switch may be used to control an outside light to illuminate the approach to the coal shed, etc. It is by no means uncommon for a shed or garage at the end of a garden to have an electricity supply provided through an underground or overhead cable. In this case great care is often necessary in moving from the house to the garage, or vice versa, during the long winter evenings. If an external light is fitted outside the house and controlled by a time-lag switch in the house, with a similar lamp outside the garage which is controlled by a time-lag switch in the garage, the problem may be solved without running cables between the house and garage for two-way switches. On leaving the house the button on the house switch is pressed and the lamp remains lit long enough to illuminate the path to the garage, the lamp then being switched off automatically.

The switch can also be used to control a cupboard light, in which case it is advisable to experiment with a lamp in different positions before wiring up permanently. The best lighting position for a cupboard having deep shelves is often outside the cupboard at about 6ft. from the floor.

Additions to a Lighting Circuit

This raises the question of additions to lighting circuits. In this connection it is important that no addition should be made to any circuit which will overload the circuit, and that the rating of the cables used should be equal to the current-rate of the fuse which protects the circuit. Subject to these provisions it is permissible to add one or two low-current points, such as lighting points, an electric clock socket-outlet, or a socket-outlet rated at not more than 5 amps. to a circuit rated up to 15 amps. The total assumed current loading must not exceed 15 amps., however. In calculating the assumed loading at least ½ amp. must be reckoned for a 2-amp. socket-outlet, an electric clock may be neglected, 5 amps. must be reckoned for a 5-amp. socket-outlet and, for each lampholder 100 watts must be reckoned, or the actual wattage of the lamp if greater than 100 watts. The current loading (amps.) of a lamp is equal to $\frac{\text{Watts}}{\text{Volts}}$ A circuit having a rating exceeding 15 amps. must supply no more than one point, except where the circuit is a ring circuit supplying 13 amp. socket-outlets with fused plugs. In the case of a 30-amp. circuit which supplies a 30-amp. cooker unit, however, one socket-outlet may be included on the cooker unit.

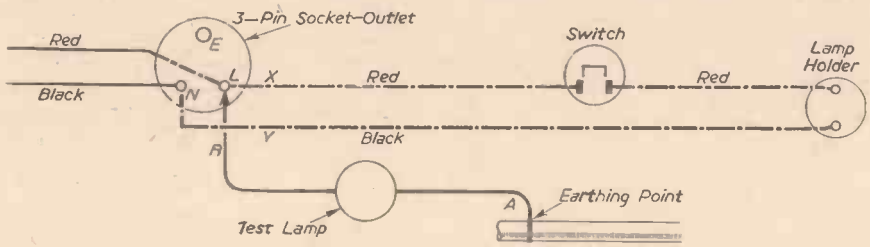


Fig. 1.—Use of test lamp.

Locating the Feeding Points

The next point to consider is where additional wiring may be connected into an existing circuit. In all cases the feed must be taken from two points on the circuit, one of which must be a "live" pole and the other a neutral pole. Where a small socket-outlet is connected in the circuit the connections are quite suitable as "live" (L) and neutral (N) terminals are available at the socket-outlet. The connections to the socket-outlet should be such that when the earth (E) socket is at the top the L socket should be on the right (when viewed from the front of the socket-outlet), with the N socket on the left, as in Fig. 1. The red cable should be connected to the L terminal and the black cable to the N terminal. It is advisable to check that the connections are correct, however.

In order to do this a lampholder with a mains-voltage lamp may be fitted with flexible leads A and B as in Fig. 1. One lead A should then be connected to a reliable earthing point, such as a main cold water pipe, the other lead B being applied in turn to the two circuit sockets. The lamp should then light when the lead B is applied to the L socket. If the socket-outlet is of the three-pin type and the third socket E is earthed, the lamp should light when connected between L and E. If the lamp lights when connected as in Fig. 1, but does not light when connected between L and E this indicates that the E socket is not connected to earth. If the connections are not as indicated the other socket-outlets should be similarly tested, and the connections of the cables to the L and N terminals changed over if necessary.

In the case of a lighting circuit additional wiring must also be connected to L and N terminals. If three-terminal ceiling roses are employed the L and N terminals will be available at each ceiling rose, as indicated in Fig. 2(a). To identify these terminals remove the lamp from its holder and place the lamp switch in the off position. Then

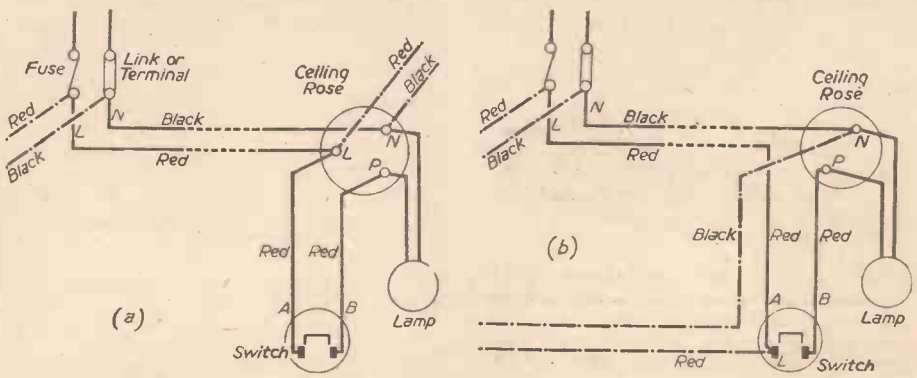


Fig. 2.—Lamp circuit connections.

connect the test lamp between an earthing point and each of the three ceiling rose terminals in turn. The lamp should light when connected to the L terminal. Then connect the test lamp between the L terminal and each of the other two ceiling rose terminals in turn. The lamp will then light when connected between L and N. If the ceiling roses have only two terminals, as in Fig. 2(b), an additional circuit may be fed from the L terminal at the switch and the N terminal at the ceiling rose. The L terminal at the switch can be identified by connecting the test lamp between an earthing point and each of the two switch terminals in turn with the controlled lamp removed from its holder; it will light when connected to L. Then connect the test lamp between the L terminal at the switch and each of the ceiling rose terminals in turn. It will then light when connected between L at the switch and N at the ceiling rose. A new circuit may also be fed from L and N at the fuses. The chain dotted lines in Figs. 2(a) and 2(b) indicate possible connections for an additional circuit.

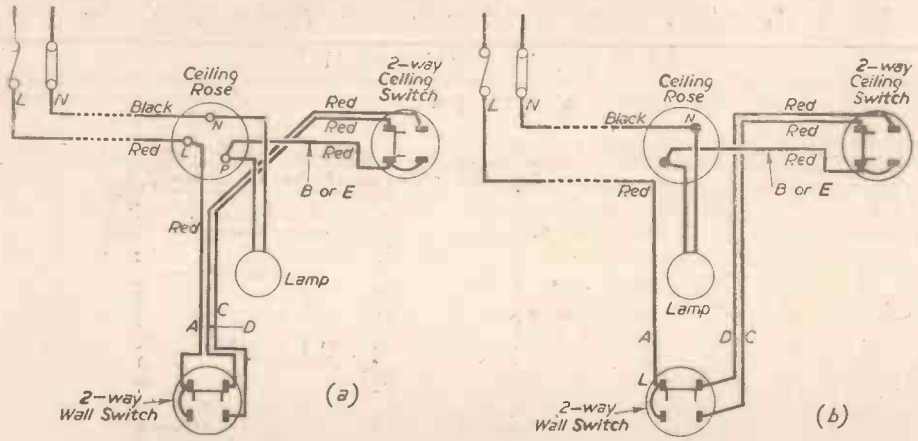


Fig. 3.—Connections for two-way switching with ceiling switch.

Wiring

Having established which are the L and N terminals, the new circuit may be connected with the leads X and Y connected to the back of the L and N sockets of a socket outlet, as in Fig. 1; or to the L and N terminals of the lighting circuits shown in Fig. 2. The red-coloured conductor should be connected in the live (L) pole, with the black conductor in the neutral pole. The switch should be connected in the live (L) pole.

The most suitable cables for the average householder to use for interior wiring are probably tough-rubber sheathed cables or P.V.C. sheathed cables, together with lampholders and switches of all-insulated construction; 1/0.044 cable may be used for 5 amps., 3/0.029 for 10 amps., or 3/0.036 cable for 15 amps. Connections in conductors should be made at fuses, switches, ceiling roses, socket-outlets, junction boxes, porcelain shrouded brass connectors, or should be well soldered, dry-twisted joints not being permissible. Tough-rubber sheathed cables or P.V.C. sheathed cables may be embedded in plaster or concrete, but if liable to mechanical damage, such as might occur due to nails being driven into plaster, the cables should be protected by running them in conduit or metal casing or similar means. The cables should be supported by means of suitable clips at horizontal distances not exceeding 9in., or vertical distances not exceeding 15in. Where cables pass through floors, walls, partitions or ceilings the hole must be made good with cement or fire-resisting material to the full thickness of the floor, wall, etc., and the cable must be kept clear of gas and water pipes.

Uses of Cord-operated Ceiling Switches

The ordinary cord-operated ceiling switch, which is obtainable as a single-pole single-way (on and off) switch, or as a single-pole two-way switch, has many uses. The single-way switch, of the insulated pattern, is quite safe to use in a bathroom when it is mounted on the ceiling and is controlled by means of an insulated cord. It has also been used quite satisfactorily to control a light from various positions. With many staircases serving two or more floors it is often quite practicable to control one or more staircase lights from a switch mounted on the ceiling which is operated by means of a cord hanging down the staircase.

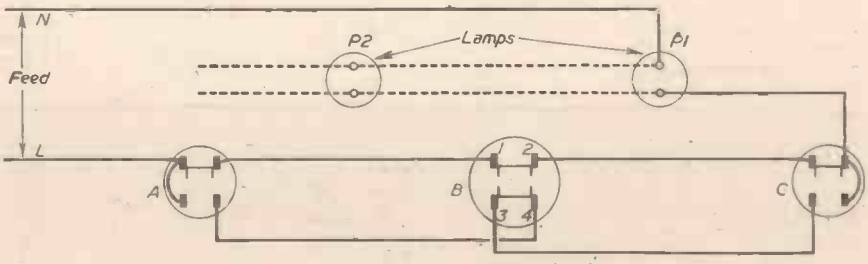


Fig. 4.—Three-way switching circuit.

A hand lamp (of the Board of Trade insulated pattern) may be hung from the garage roof over a car, but quite often one has to squeeze back round the car to switch it on. This can be avoided by using a single-pole single-way cord operated switch to control the socket-outlet into which the hand lamp is plugged. The switch may be fitted on a rafter with the switch base vertical, the control cord being passed round the walls of the garage through smooth hooks or small pulleys. In this way the lamp can be switched on or off from any point in the garage.

A single-pole two-way cord-operated switch is also very useful when it is required to provide an additional switching point. Too many builders seem to lack imagination on some points so that one finds that on entering, say, the back door in the dark, one has to fumble one's way across the kitchen to find the switch placed inside the door leading to the hall. In order to convert to two-way switching one may then have to employ unsightly surface wiring to a new switch near the back door, or spoil the decorations by cutting a chase in the wall.

The cord-operated switch, however, provides a third alternative. Such a switch can be fitted on the ceiling just inside the back door, so that all the new wiring can be accommodated under the bedroom floor. Fig. 3 shows the two-way circuits which may be compared with the single-way circuits shown in Fig. 2. Fig 3(a) refers to a lighting circuit having three-terminal ceiling roses, whilst Fig. 3(b) refers to a lighting circuit having two-terminal ceiling roses. Considering the former circuit, having located the L and N terminals by the methods described previously, switch off at the main switch, mark the end of the lead A at the lamp switch and remove this switch. If a single-core wiring is used, the next step is easy. Secure the switch end of the lead B to the two ends of two new leads C and D. Draw the other end of the lead B into the space above the ceiling, bringing with it the new leads C and D. The ends of the three leads B C D may then be connected to the ceiling switch as shown. The other ends of the leads C and D may then be connected together with the lead A, to the new single-pole two-way wall switch as shown. A similar method may be employed with a circuit having a two-terminal ceiling rose, as in Fig. 3(b). If twin-lead-sheathed cable is used it will be necessary to run two new cables, C and D, between the two switches, cutting out the lead B to the wall switch and running a new lead E from the ceiling rose to the ceiling switch. A new lead E may also be required if B is not long enough.

Three-way Switching and Two-lamp Switching

Where a house has more than two floors or has long passages, and also in the case of a room which has three doors in different walls, it is often an advantage to be able to control the light from any one of three points, in such a way that it can be switched on or off at any of these points irrespective of the point at which it was previously switched. This can be effected by using two single-pole two-way switches A and C, as in Fig. 4, together with an intermediate switch B. This switch is arranged so that in one position terminal 1 is connected to 2, and terminal 3 is connected to 4; in the other position terminal 1 is connected to 3 and terminal 2 to 4. A double-pole two-way switch may be used in place of B if required.

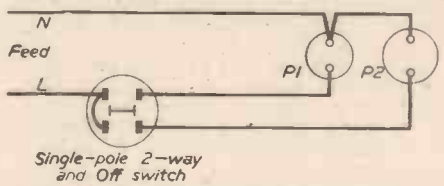


Fig. 5.—Circuit for two-stage illumination.

A single-pole two-way switch with off position may be used to give two values of illumination as in Fig. 5. The switch can control two lampholders for use in a nursery or similar place; one lampholder may contain a neon lamp whilst the other lampholder contains a lamp of normal wattage.

A Photographic Safe-Light & Printer

An Extremely Useful Combined Accessory for Making Contact Prints

By J. A. LOGUE

Fig. 1.—The completed safe-light and printer.

A PHOTOGRAPHIC printing frame can be readily converted into a combined photographic printer and safe-light cabinet. A feature of the design is the hinged safe-light panel, which hinges down over the light bulb and provides a safe light for positioning the photographic negative and printing paper in the frame. It can be mounted at a convenient working height on the dark room wall by means of mirror plates or used on a bench or table top. The photograph, Fig. 1, shows the general arrangement of the completed printer/safe-light cabinet.

The dimensions shown in Fig. 2 are for a printing frame 7½in. × 5¼in. outside measurements, but these can be modified to suit other sizes. Wood ⅜in. thick is used throughout except for the base which is ½in. thick.

The Hinged Panel

Wood strip ¾in. × ⅜in., rebated ¼in. deep and of a width to suit the safelight glass, is used for making the safelight panel frame. The corners are mitred and the frame assembled, glued and tacked around the glass. A piece of ruby safelight glass can be purchased, cut to size.

Assembly

The sides, back and base are assembled, glued and tacked together before the front is fitted. A batten type lampholder is next screwed to the centre of the base and a ¼in. dia. hole is drilled in one side to take the electric flex. The front is drilled and an off/on push button is fitted. The hinged panel is now attached to the front with two 1in. × ⅜in. brass hinges and a strip of cloth is glued along this edge covering the hinges as shown in the sectional view (Fig. 2). The sides of the hinged panel are sanded or planed to allow it to swing freely between the sides of the cabinet, before finally gluing and tacking the front in place. A ½in. × No. 6 round head woodscrew is screwed centrally into the top edge of the hinged panel, its head registering with a ¼in. Terry spring clip fitted to the top as shown. The printing frame is now fitted into the top and is screwed in place. A small screw-in knob is fitted as shown in section AA in Fig. 2 and this also shows the swing of the safelight panel dotted. A small recess is cut inside in the back to take the screw head to allow the edge to lie along the back when in the down position. A length of light flex, sufficient to reach a convenient plug socket or lighting point, is threaded through the side hole and the lampholder is wired with the switch in circuit.

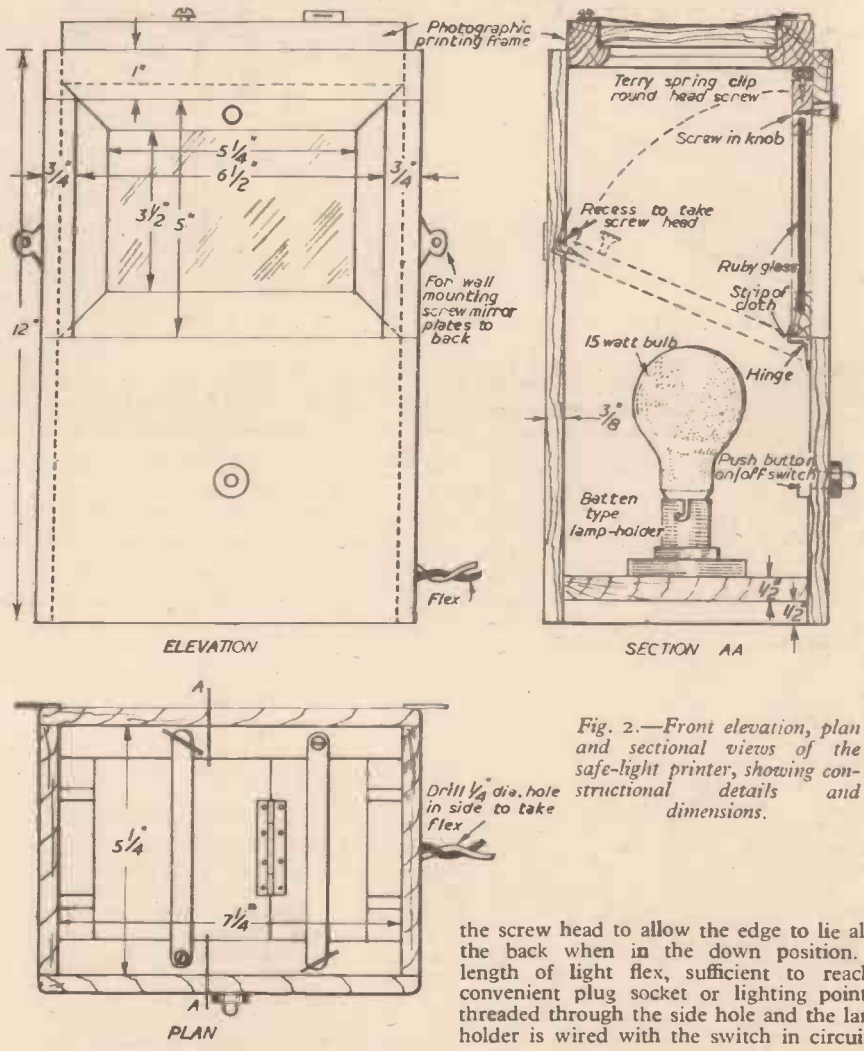


Fig. 2.—Front elevation, plan and sectional views of the safe-light printer, showing constructional details and dimensions.

A Model S
Railw

THIS model of a 4ft. long × 16in. wide × 16in. high figure-of-eight scenic railway is constructed in sections which must be made according to instructions and plans for each section, completing one section before commencing another. The completed model is shown in Figs. 1 and 6.

The motive power is supplied by a well-known construction kit 20 v. A.C. electric motor, driven from the mains through a transformer. It is coupled to pulley wheels driving an endless felt band. The track is composed of oo Wrenn flexible 2 rail track mounted on Wrenn ballast strip for silent running. The car or cars (3-seater) are made of ⅛in. balsa or other light wood and

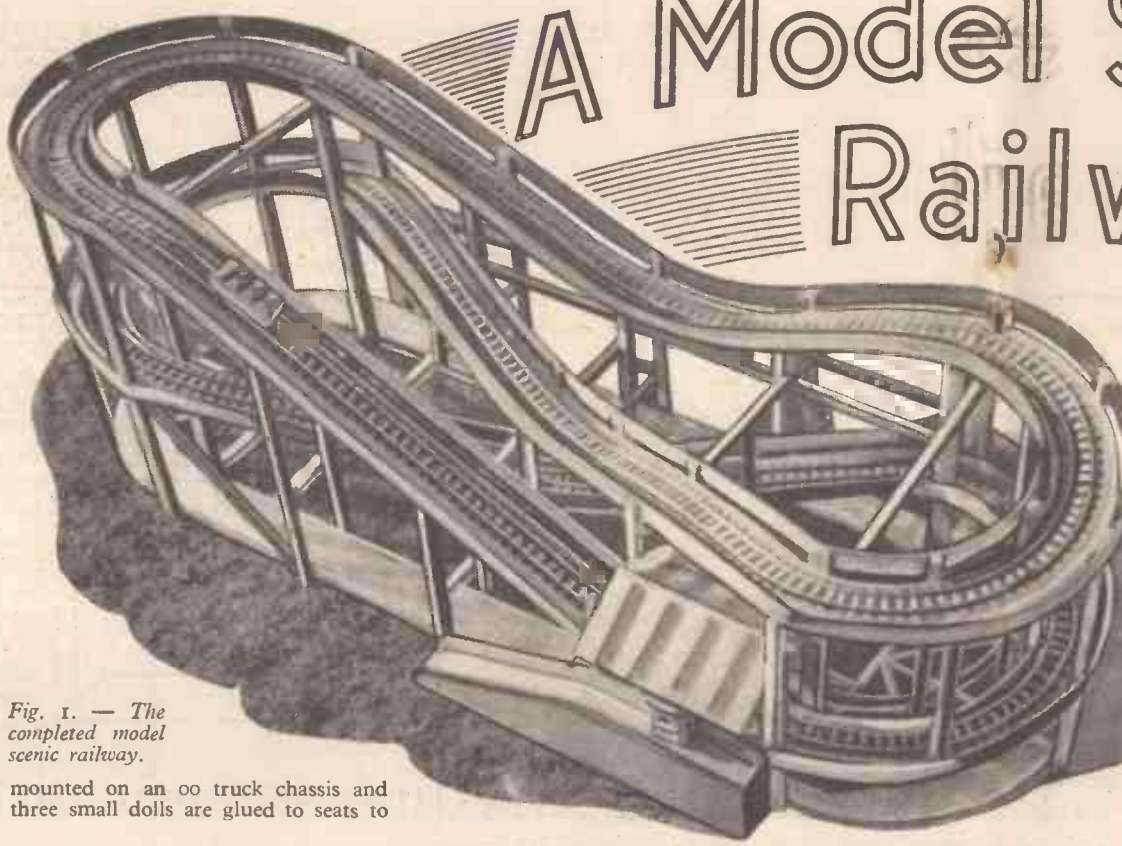


Fig. 1. — The completed model scenic railway.

mounted on an oo truck chassis and three small dolls are glued to seats to

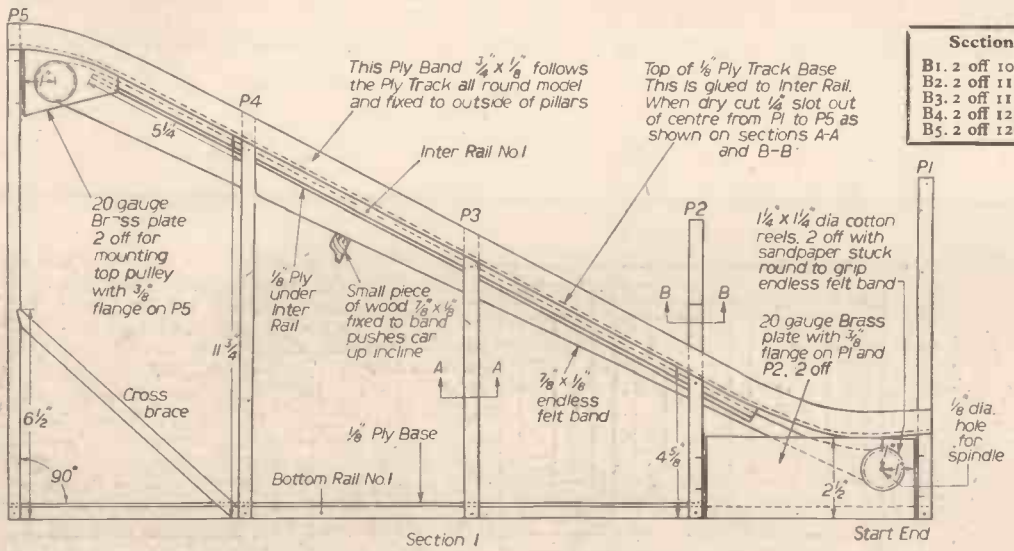
Details of Parts in Fig. 2.

P1. 2 off 10⅜in. × ⅜in. × ⅛in. deal.
P2. 1 off 9⅜in. × ⅜in. × ⅛in. „
P2. 1 off 7in. × ⅜in. × ⅛in. „
P3. 2 off 9⅛in. × ⅜in. × ⅛in. „
P4. 2 off 12⅜in. × ⅜in. × ⅛in. „
P5. 2 off 15⅛in. × ⅜in. × ⅛in. „
No. 1 inter rail, 23⅛in. × ⅜in. × ⅛in.
No. 1 bottom rail, 29in. × ⅜in. × ⅛in.
Diagonal struts 2 off 9⅛in. × ⅜in. × ⅛in.
1 piece 34in. × 2½in. × ¼in. ply track base.
1 piece 23⅛in. × 2½in. × ¼in. ply under inter rail.
1 piece 29in. × 2½in. × ¼in. ply base.

Details of Parts in Fig. 3.

P1A. 2 off 12⅛in. × ⅜in. × ⅛in. deal
P2A. 2 off 10in. × ⅜in. × ⅛in. „
P3A. 2 off 8⅛in. × ⅜in. × ⅛in. „
P4A. 2 off 11⅛in. × ⅜in. × ⅛in. „
P5A. 2 off 14in. × ⅜in. × ⅛in. „
No. 1 inter rail, 2 off 29in. × ⅜in. × ⅛in.
No. 1A bottom rail, 2 off 29in. × ⅜in. × ⅛in.
A, B and C rails, 2½in. × ⅜in. × ⅛in.
(See section D-D).
Diagonal struts, 4 off 10⅛in. × ⅜in. × ⅛in.
1 piece 33in. × 2½in. × ¼in. ply. Track base.
1 piece 29in. × 2½in. × ¼in. ply base
2 pieces ¼in. ply band cut to contour of track.

Sections of Start End	Sections of High End
B1. 2 off 10⅜in. × ⅜in. × ⅛in. deal.	C1. 2 off 15⅛in. × ⅜in. × ⅛in. deal
B2. 2 off 11⅛in. × ⅜in. × ⅛in. „	C2. 2 off 15⅛in. × ⅜in. × ⅛in. „
B3. 2 off 11⅛in. × ⅜in. × ⅛in. „	C3. 2 off 14⅛in. × ⅜in. × ⅛in. „
B4. 2 off 12⅛in. × ⅜in. × ⅛in. „	C4. 2 off 14⅜in. × ⅜in. × ⅛in. „
B5. 2 off 12⅜in. × ⅜in. × ⅛in. „	C5. 2 off 14 in. × ⅜in. × ⅛in. „



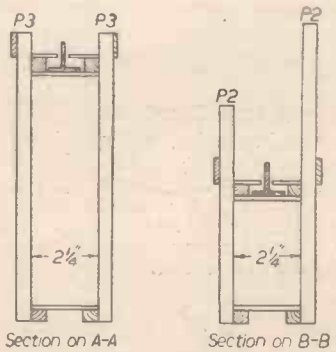
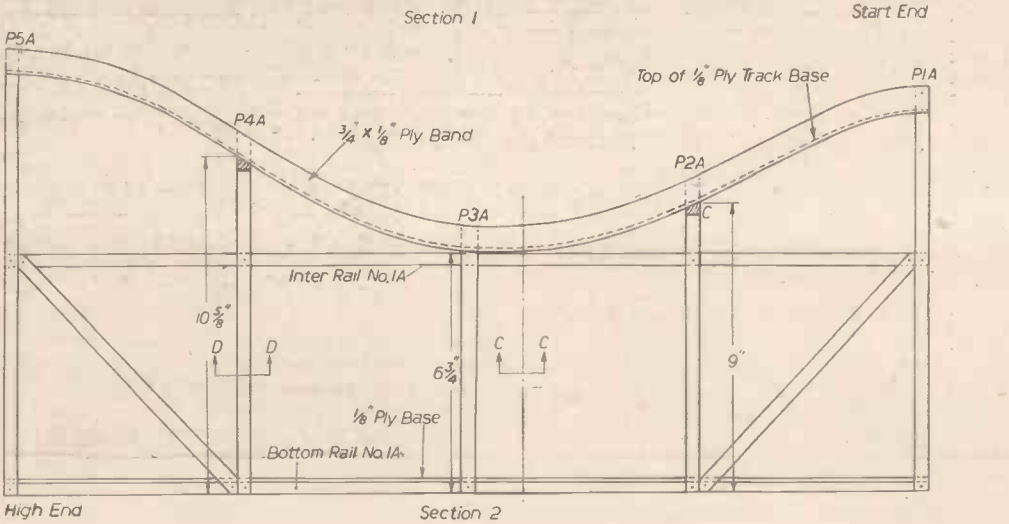


Fig. 2 (Left).— Details of Section 1.



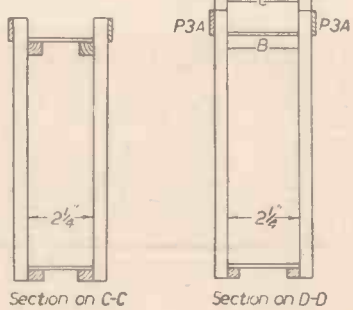


Fig. 3 (Left).— Details of Section 2.

Fig. 4 (Right).— Sections of the high end and start end.

Scenic Way

Drawings and Notes on the Construction of a Unique Working Model

By A. V. MOORE

give realistic effect. The main construction is of $\frac{3}{8}$in. × $\frac{3}{8}$in. deal and $\frac{1}{8}$in. plywood.

Section 1

Bottom rail No. 1 and inter rail No. 1 are placed on table or bench and pillars P1, P2, P3, P4 and P5 are screwed to these at the heights shown in Fig. 2 and squared up by inserting cross-braces. A pair of these are made, the only difference being that P2 is longer on the inside section as shown on section B-B. Two 20G. brass plates are now fixed between P1 and P2 and two other 20G. brass plates fixed at top of incline to P5 and inter rail No. 1. These plates are drilled with a $\frac{1}{8}$in. dia. hole where shown to take pulley spindles. This section is then laid by for time being.

Section 2

This section, shown in Fig. 3, is constructed in exactly the same way as Fig. 2 with the exception of cross rails A, B and C which are inserted between the pairs of pillars P2A, P3A and P4A as shown on section D-D. When construction has been completed this is left for time being.

Fig. 4 shows sections of the start end and high end. These ends are made up according to the measurements shown and assembled one at a time. The start end, after sections have been made, is joined together by cross rails half-lapped into both B1's and both B5's. Three pieces of $\frac{1}{8}$in. plywood are now cut to sizes and radius shown in Fig. 5. The whole of these five sections are now joined together by inserting the plywood base and the plywood track bases into these sections as shown on Fig. 5. The high end shown in Fig. 7 is constructed in exactly the same way.

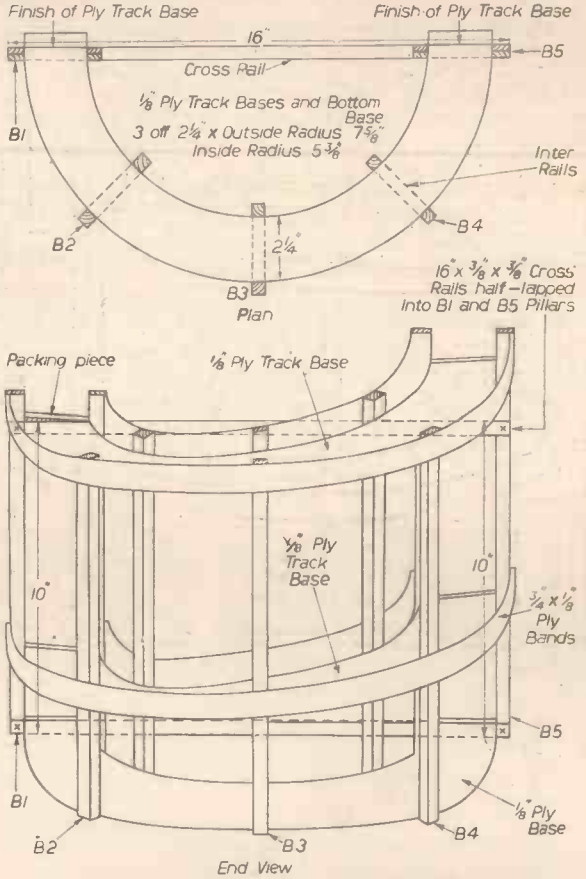


Fig. 5.—End view of the start end.

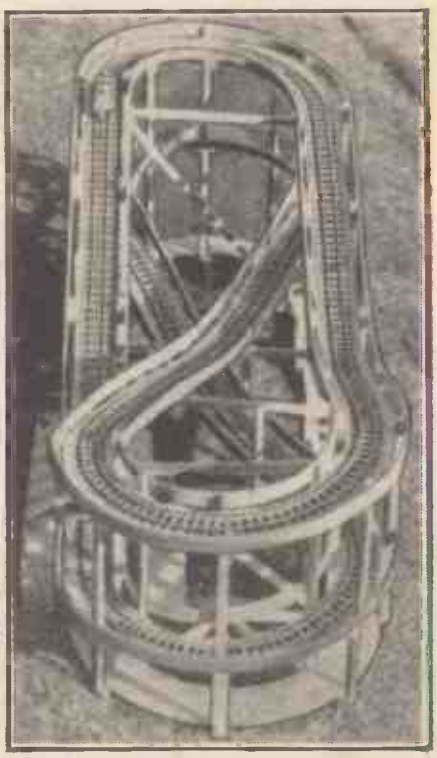
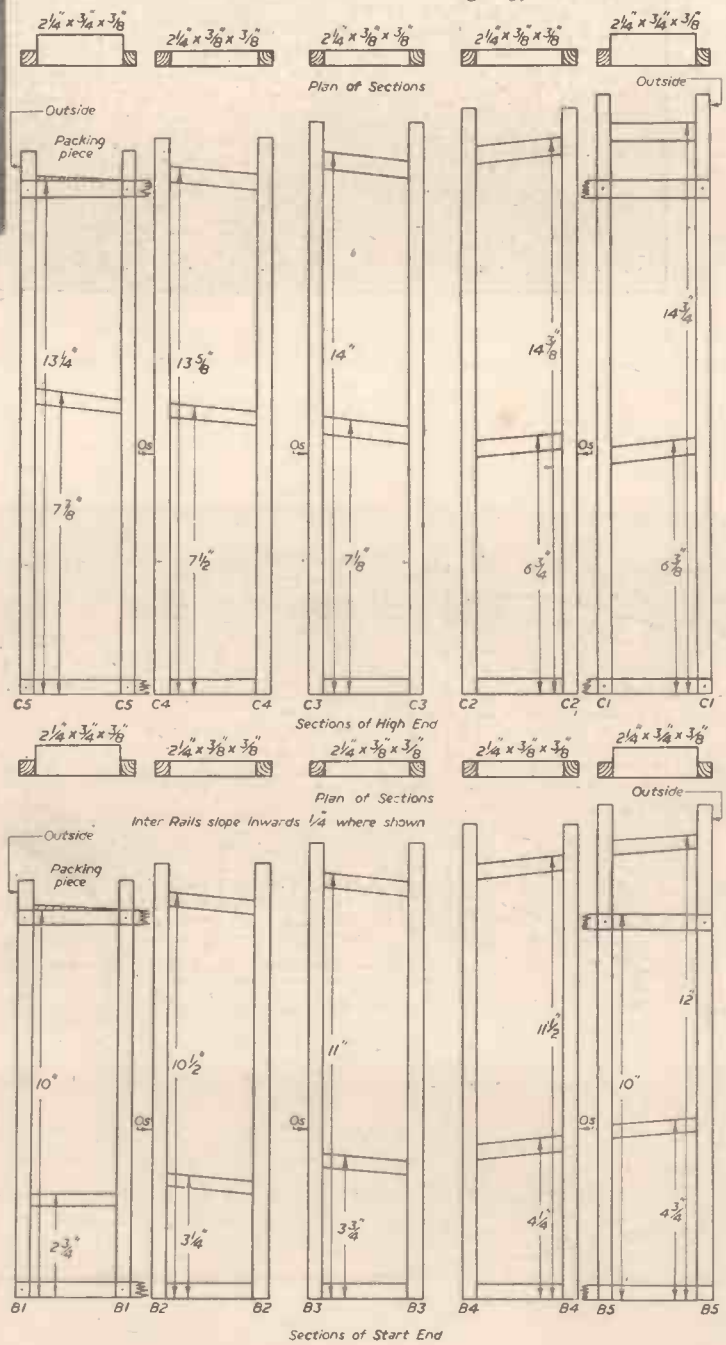


Fig. 6.—A further view of the completed model.



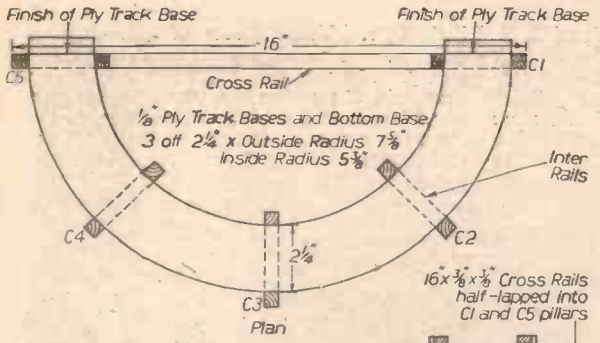
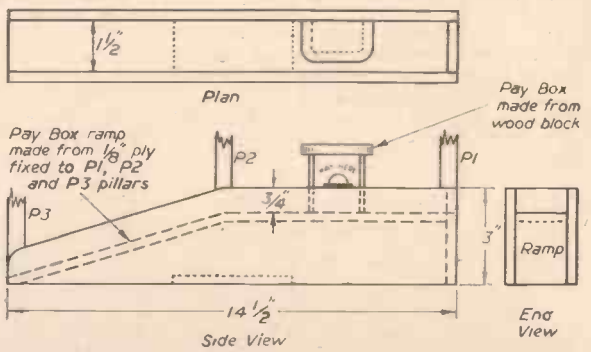
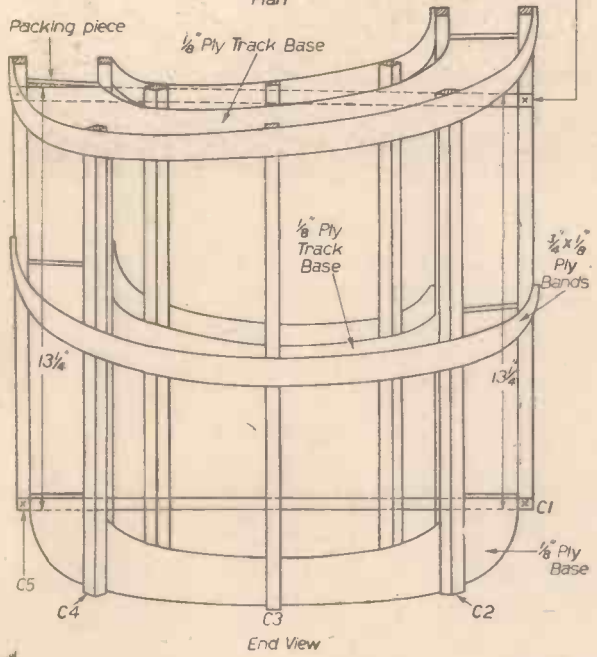


Fig. 7. (Left).—A view of the high end.



Figl 9 (Right).—The pay box and entrance ramp.



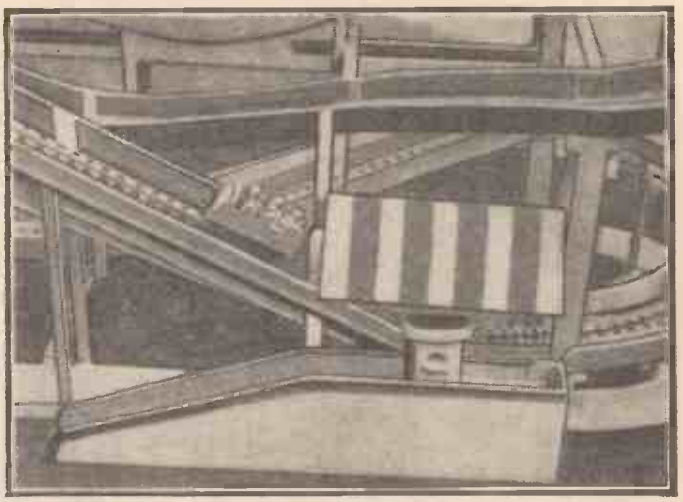
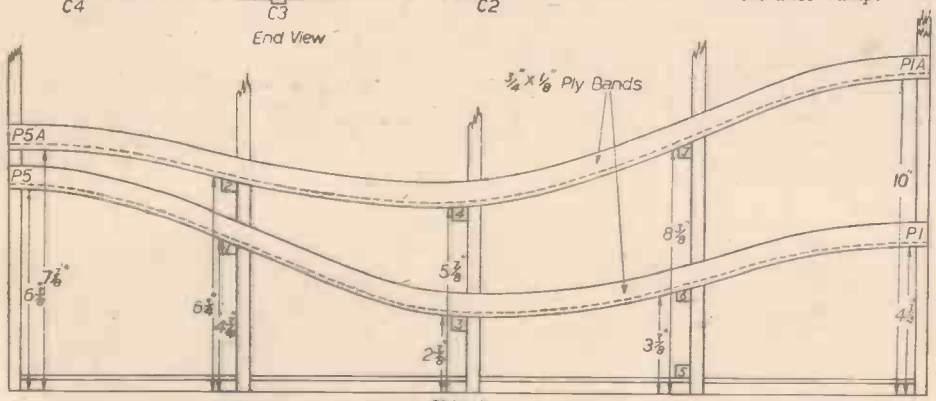
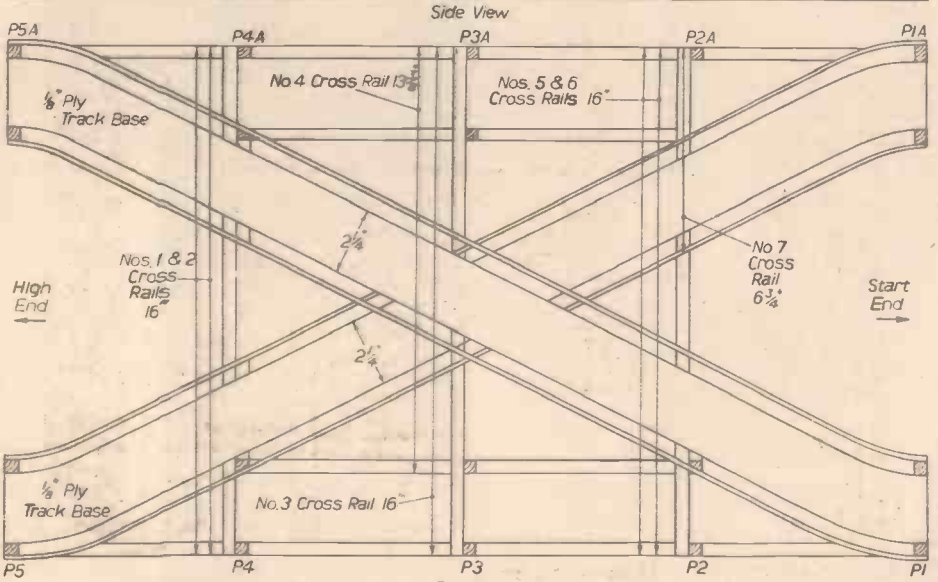


Fig. 10.—A view of the completed pay box and entrance ramp.





The assembling of section 1 and section 2 to the start end and high end is carried out by screwing these completed end sections to P1.P1, both P1's and both P1A's, P1A.P1A start end and both P5's and both P5A's, high end.

When this has been completed and squared up the cross rails 1-2-3-4-5-6 and 7 as shown in Fig. 8 are inserted between side sections in the positions shown in Fig. 8 (side view) to take cross-over track.

The next stage is the insertion of the ⅛in.

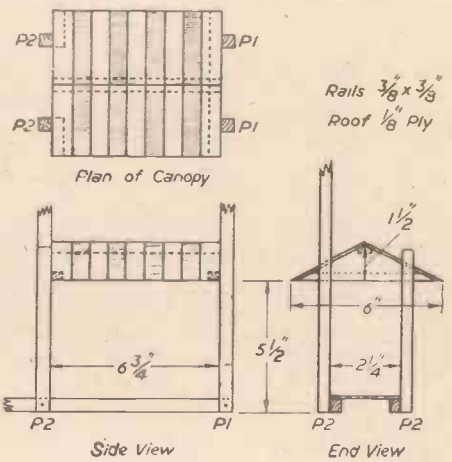


Fig. 11.—The canopy and pay box.

Fig. 8 (Left).—Plan of centre cross-over track and framing.

plywood track base. This is 2¼in. wide and follows the contours of cross rails as shown in side view of Fig. 8.

When the model is completed to this stage the ply. track base of the first incline in Fig. 2 is fitted in. This is 2¼in. × ⅛in. plywood *glued* to inter rail No. 1 and when dry a ⅛in. slot is cut right through the whole length of the centre from P1 to P5. This is to allow the passage of the small piece of wood fixed to the endless band to push car up this

incline. The plywood track base, 2¼in. × ⅛in., can also be inserted following contour as shown in Fig. 3. The ¾in. × ⅛in. plywood band can now be fitted to the outside of pillars and this follows the contour of the track from start to finish as shown on various sections.

Pay Box and Entrance Ramp

The pay box and entrance ramp are constructed of ⅛in. plywood to sizes shown in Fig. 9 and are fixed to and levelled with the bottom of P1, P2 and P3.

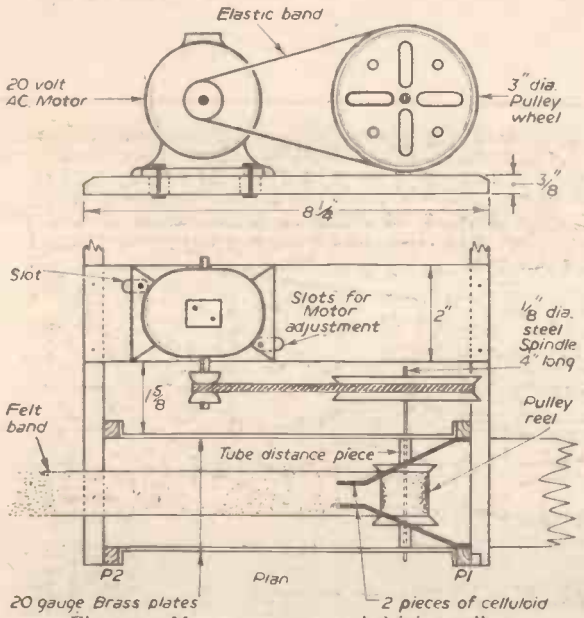
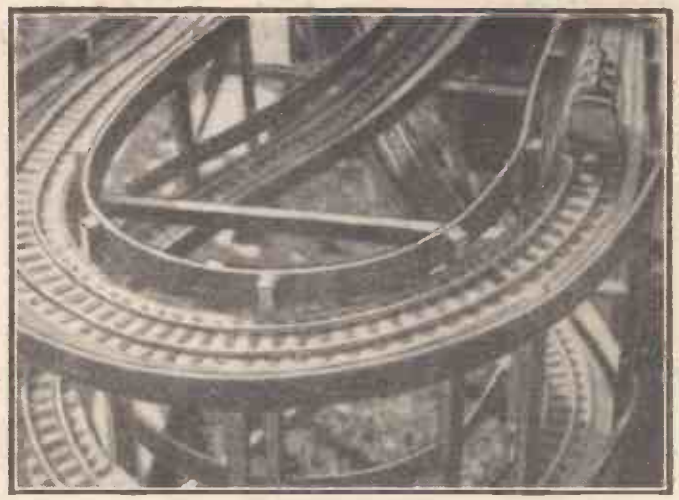


Fig. 12.—Motor mounting and driving pulleys.

Canopy and Pay Box

These are constructed according to measurements shown in Fig. 11 of ⅛in. × ⅛in. rails and ⅛in. plywood fixed between P1 and P2. The completed pay box and entrance ramp are shown in Fig. 10.

Fig. 13 (Right). —A close-up view of the track and the car.



Motor Mounting and Driving Pulleys

Details of engine mounting and driving pulleys are given in Fig. 12. The base board is slotted where the motor fixing bolts pass through, to allow for any adjustment to the rubber driving band.

The ⅛in. diameter spindles are fixed to the pulley reels by two 1½in. × 16G steel panel pins. The two pieces of celluloid shown in Fig. 12 are fixed to P1 and P1 to clear running rails. They measure 3in. × ½in. and hold the car in position while waiting to be carried up the incline.

The Car

Details of the car are given in Fig. 14 The small tinplate angle piece at rear of car is to engage with the wooden carrier piece on the felt band. The car can be seen running in Fig. 13.

Painting

Paint the model in contrasting colours of mushroom and light blue; mushroom throughout except for horizontal lines which are picked out in light blue. The canopy awning is in blue and mushroom stripes.

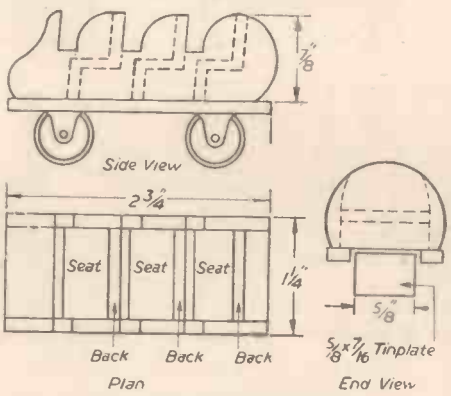


Fig. 14.—Details of the car.

A HANDY CLOTHES HORSE

A Household Item You Can Make Yourself

By K. W. Burton

THIS is an easily made clothes horse consisting of two three-barred wings hinged together as can be seen in Fig 1. Any fairly straight-grained wood can be used. It is a help if the wood is bought ready planed.

Materials Required

Four lengths 36in. x 1½in. x ¾in. for the uprights, six lengths 36in. x 1½in. x ¾in. for the horizontal bars, three 2in. brass hinges, and 36 ½in. brass wood screws.

Construction

First cut the cross-bar receiving slots in the uprights, with hinge recesses in two of the uprights only, as shown in Fig. 2. Then cut the notches on the ends of the cross-bars as also shown in Fig. 2.

When slots, etc., are complete assemble each wing as in Fig. 1, glueing and screwing the joints. Finally hinge the wings together.

The clothes horse can be left in plain wood or given a coat of enamel.

If a larger horse is required, an extra wing can be made in the same way and hinged to fold in the opposite direction.

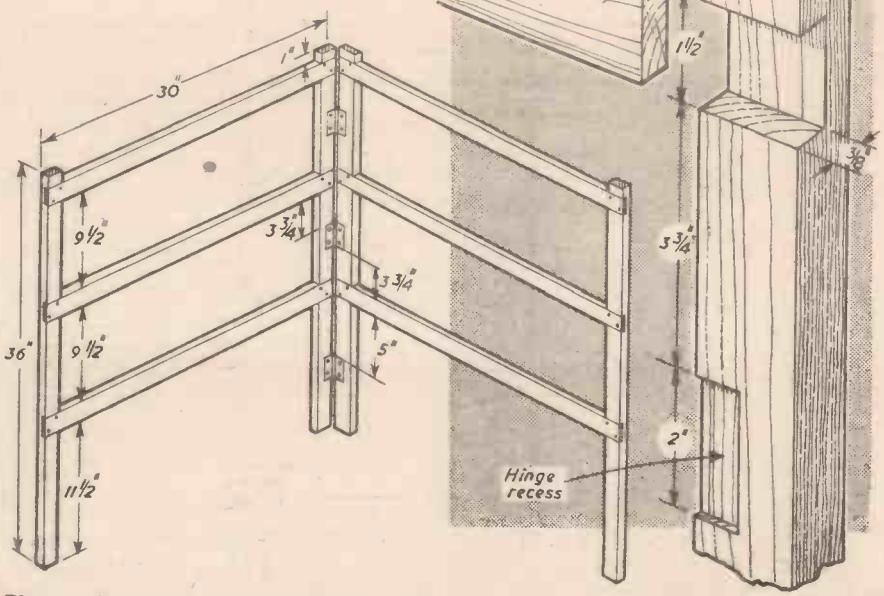


Fig. 1.—A perspective view of the clothes horse, giving some dimensions.

Fig. 2.—Details of the joints.

AN UNUSUAL TABLE LAMP

A Simply-made and Attractive Lamp for the Modern Home

By E. FEASEY

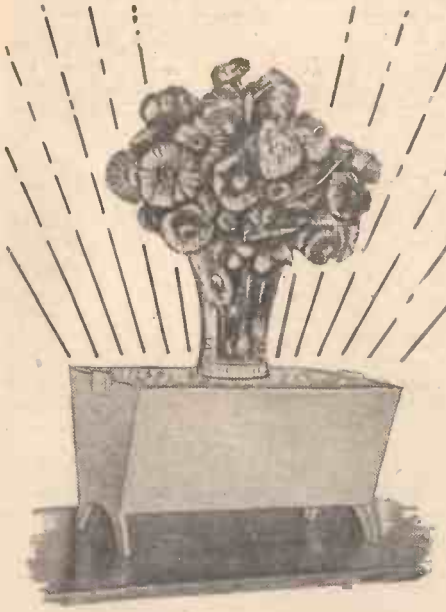


Fig. 1.—The completed table lamp.

THIS little table lamp was designed primarily for use as a television lamp, but it looks so attractive when working that it is now in constant use to set off a cut glass vase of flowers, the light from the 40-watt bulb shining up through the frosted glass top of the lamp and making the vase look as though it is illuminated internally. The heading photograph, Fig. 1, shows the lamp.

Materials

To make it you need the following:

Two pieces 5¾in. × 12in. ¼in. plywood.
One piece 4in. × 11½in. ¼in. plywood.
Two pieces 7in. × 8in. ¼in. plywood.
One piece 8½in. × 12in. frosted glass.

Also needed are a short length of beading with a "lip," a 40-watt bulb, holder and flex with plug, and a few short panel pins.

Construction

First of all mark out the ends, using a pair of compasses to draw in the curved legs. Cut the curves with a fretsaw and the angled sides with a tenon. The only other cutting involved is the ventilation holes in the base. They are necessary because even quite a small lamp creates appreciable heat in a confined space. Fig. 2 shows holes of 1½in. diameter, but these can be smaller, of course, in which case they may be made by drilling holes through the ply.

To assemble the case, place the sides flat on a firm surface and drive about six of the panel pins through each end, spacing them at equal intervals along a line ⅜in. from the end and making sure that the points only just protrude from the underside of the ply.

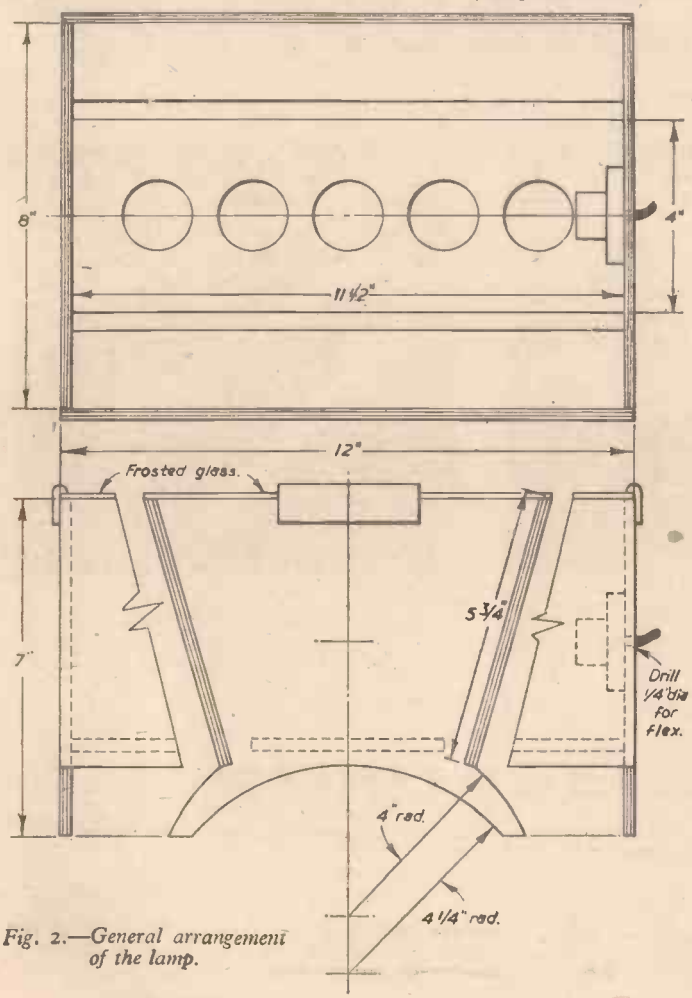


Fig. 2.—General arrangement of the lamp.

Next place one of the sides in position against an end, and drive the panel pins home. Place the other end in position and secure, then add the other side in a similar way.

Secure the perforated bottom with panel pins driven through the end-pieces. It will be noted that the bottom does not fit flush to the sides but is slightly narrower, leaving two further strips through which air circulates and light from the lamp shines.

The main structure of the lamp is now completed, and if the dimensions are correct, the frosted glass top should rest on the top of the case without overlapping. Place it in position and add the two short lengths of beading so that the lip of each holds the glass in place. Secure them with panel pins.

Lamp and Holder

Drill a ¼in. hole through one end to take the flex for the lamp. Place the holder in position so that it is centred over the hole, and drill the screw holes, but before the holder is screwed into place the inside of the case must be given one or two coats of flat white paint. Give the outside a coat of gloss paint to match the colour scheme of your room, and the job is complete.

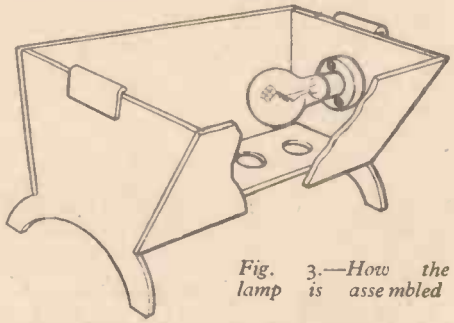


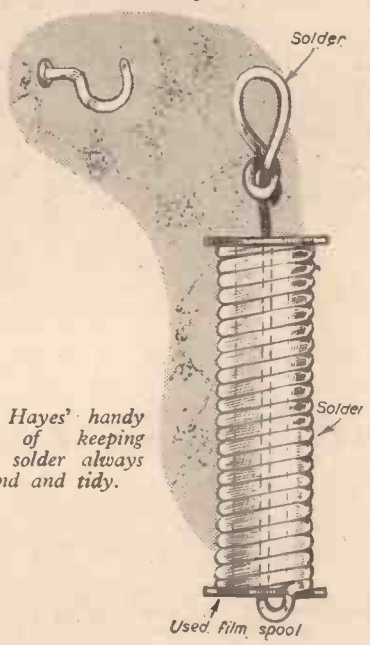
Fig. 3.—How the lamp is assembled

There is no lamp switch included in this arrangement as I have not found one necessary, but it is not a difficult matter to break the flex and add a torpedo switch.

Storing Solder

By J. HAYES

SOLDERS of the "wire" type are often left lying around the workshop to become tangled with tools, dropped on the floor or lost in other ways. The method shown in the sketch keeps the solder tidy and always to hand. An old film spool is wound with the solder and as shown the end of the solder taken up through the centre hole and a loop formed at the top. A hook in the workshop wall on which to hang the spool is all that is then required.



Mr. J. Hayes' handy method of keeping "wire" solder always to hand and tidy.

Solving the Problems of Tropical Fishkeeping

Some Useful Hints for the Home Aquarist

By I. W. BRASSINGTON

PROVIDING a few basic rules are followed, fish are probably the easiest of pets to keep, but from time to time fish die for no readily apparent reason, plants fail to grow, etc., and one has to delve

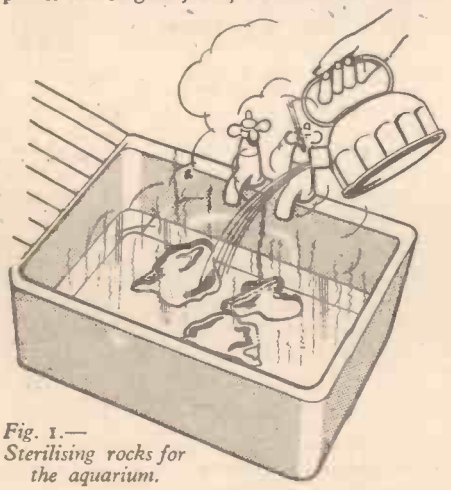


Fig. 1.—Sterilising rocks for the aquarium.

a little deeper than usual to find out why. Some of the less obvious reasons for possible failure are included in this article.

Death of Fish

One hears fairly regularly of the unexplained death of fish, when the aquarium water appears perfectly clear, the plants growing well, and no other evidence of trouble can be seen, and in cases like this there are quite a number of things which should be checked.

First, try to remember what new additions, if any, have been made recently. New fish and plants will certainly be remembered, but it is easy to overlook the addition of a new piece of rock, an ornament, or even a handful of gravel to fill in a depression. Each of these may have contained some substance which has proved toxic to the fish. New rocks, etc., should always be sterilised (see Fig. 1)

How many aquarists remember to wash their hands before splashing about in the tank after decayed leaves? This may appear to be a small point, yet oil, grease, nicotine, etc., will certainly not improve the fishes' environment.

Also check the iron frame of the aquarium for the possibility of water condensing and dripping off newly-painted parts into the water, also from rusted parts of the lighting shade.

If the death in question is an isolated one, consider the possibility of plain old age. The life-span of most tropical fishes is only two or three years, for they breed often, live in warmer water and move about more rapidly than cold-water fish, each factor tending to shorten their life. For this reason also, always buy young fish.

Fish quite often die when they are transferred to new tanks, or if the aquarium water is completely changed. Old water in an aquarium is said to "mature." Living organisms occur, especially of plant life which give the water a greenish tinge and give rise to the term "green water," which are most beneficial to the fish, and a sudden change to sterile water may prove fatal, especially if temperatures are not carefully watched. When setting up a new tank some "green water" from an established tank should be used whenever possible, and the water should never be *completely* changed.

Failure of Plants

Sometimes, although the fish appear healthy, the plants just will not grow. Often this is due to insufficient light. The average 24in. tank needs 75w.-100w. for about seven hours each day, but local conditions may make a considerable difference

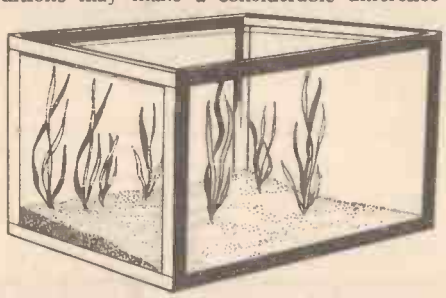


Fig. 2.—Plant heavily with Vallisneria to combat Brown Algae.

to this figure, e.g., the availability of natural light must be taken into account, as well as the aspect of a tank, if it is in or near a window. The type of plant used is another factor of importance, for such plants as Sagittaria and Cryptocoryne are shade lovers, while the more usual Vallisneria and Myriophyllum like a really bright light.

Plants from local ponds will very frequently die off in an established aquarium, even though they may be of a species normally used in tanks. Sometimes this is due to the fact that they are collected at the wrong time of the year, that is, during the winter months when most plants are resting anyway, so that new root systems cannot be induced to form. But more often than not it is, as with the fish, due to the sudden change of environment—both the chemical content and the temperature of the water being new to them. Plants which are bought, however, even if they belong to the same species, are from a strain whose ancestors have become used to the more artificial surroundings of the aquarium.

pH Value

Aquarists often ask about the pH value of the water, a question which, under normal conditions, they should never need to investigate. For all practical purposes, the pH (meaning percentage Hydrogen) scale is a measure of the acidity or otherwise of the water. The scale reads from 0 to 14. Seven being neutral, above 7 the water is increasingly alkaline and below 7 it is acid. Simple apparatus is available with which to make tests, but it should be made clear that over-acid or over-alkaline water is only an effect and that the cause of either lies somewhere else, and will be almost certainly shown by other symptoms.

For instance, choice of rocks for decoration purposes may have a bearing on this question. Rock of a chalky nature, such as marble and limestone, may make the water much more alkaline, which in turn will encourage the growth of a soft green algæ. (This would be a symptom.) The rocks to use, then, are either insoluble or contain no soluble particles which will have a harmful effect. The best for the purpose are granite, flint, coal or Westmorland stone.

Algæ

The soft green algæ mentioned above, being a symptom of alkalinity, should be cleaned off the sides of the tank and some of the aquarium water may be strained through sterilised peat several times to increase its acid content. Brown algæ is often caused by hard water and looks very unsightly, but it will not normally compete

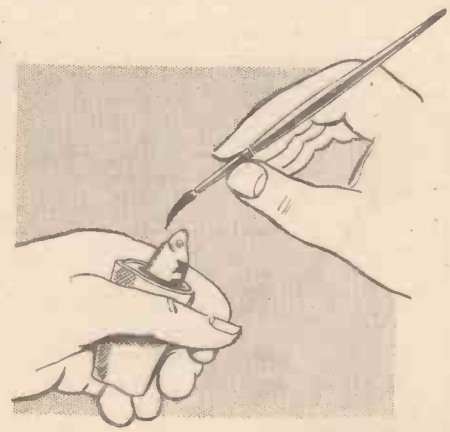


Fig. 3.—Painting an ulcer with iodine.

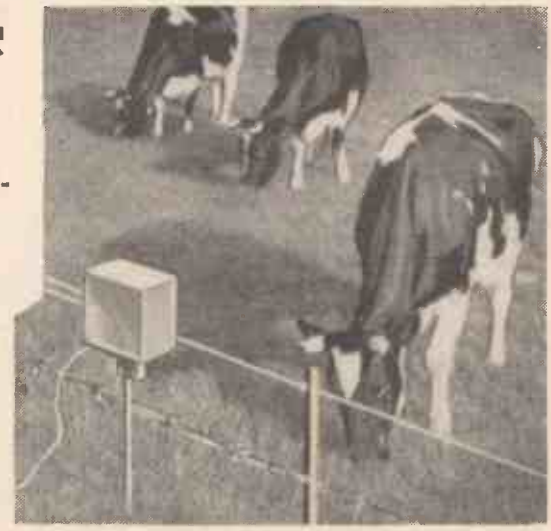
with other plants, so clean out as much as possible and plant very heavily with Vallisneria around the back and sides of the tank (see Fig. 2).

Two types of illness which are sometimes encountered are dropsy and ulcers. The former is often fatal and it is kinder to kill the patient immediately it is confirmed. The symptoms are a bloated look about the body and later the scales appear to stand on end, making the fish look very rough.

If a fish develops an ulcer it should be held gently but firmly in a soft, wet rag, while the affected part is painted with iodine several times as shown in Fig. 3.

A Touch-operated Electric Fence Control Circuit

Adaptable to a Wide Variety of Contact-operated Devices



COLD cathode trigger tubes combine a high input resistance with negligible standby loss. They are therefore ideal for standby "touch" control applications in which a relay is required to operate when the resistance between two points changes from the normal insulation value. The relay may actuate an alarm, energise a circuit, or perform some other function. The principle is applicable also to some applications in which no relay is used, such as purely electronic switching.

The introduction of primed trigger tubes, such as the Mullard Z803U, with close tolerance breakdown characteristics and high stability, makes possible the design of circuits with very good discrimination against stray or leakage resistance. An example of such a circuit, designed to provide high voltage impulses to a fence when it is touched, is described in this article.

Electric Fences

The need to retain animals within a certain area, or within a sequence of areas, makes necessary a form of fencing which is both cheap and easily movable, and is at the same time not liable to be pushed through and is not harmful to man or beast. These varied requirements are not completely met by any single conventional fence.

The electric fence, on the other hand, meets them all. It repels effectively, and therefore does not need to withstand pushing. Its structure can therefore be very light (a single plain wire on widely spaced supports is sufficient for most animals) rendering it both cheap and easily movable. If its electrical control circuit is properly designed it is not a source of danger and damage. It compares well with barbed wire.

Earlier circuits for electric fence controllers have normally in Britain been of the battery-operated inductive discharge type, in which the input voltage is chopped by a magnetically actuated mechanical "oscillator" with a period of about one second, or by a simple relaxation oscillator using a gas-filled diode. The chopped voltage is fed to the primary of a step-up transformer, and the high voltage output pulses are delivered to the fence terminal. These controllers operate continuously.

Description of the Proposed Circuit

The system described in the present article has been developed in the Mullard Applications Research Laboratory from a controller designed by N. V. Philips' Gloeilampenfabrieken of Eindhoven. It makes use of an RC circuit which is discharged into the transformer primary by means of a cold cathode trigger tube. A further very important difference between this circuit (and its prototype) and earlier controllers is that energisation of the fence takes place only while an animal is in contact with the wire; thus the battery drain is minimised. If the fence is touched its lowered earth resistance causes the trigger tube to fire. A relay then operates, and a high impedence high voltage pulse is injected into the fence. If the contact persists, the pulse is repeated at a frequency of about 1 c/s. When the contact ceases, the circuit immediately returns to its standby condition.

Although this development of the basic system can provide repetitive action, adaptation for "one shot" applications such as liquid level control and batch counting by touch is possible.

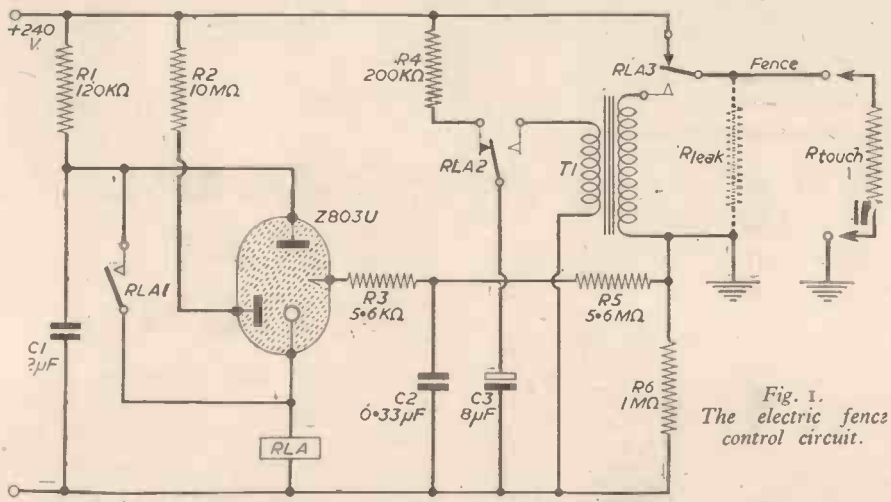


Fig. 1. The electric fence control circuit.

Operation

The fence control circuit is shown in Fig. 1, which illustrates the standby condition. The capacitor C1, charged through R1, maintains a steady voltage between the cathode and anode of the trigger tube. A small priming discharge of 10μA maintained in the tube via R2, ensures that the tube will operate at a closely controlled trigger voltage and without delay. The trigger standby voltage across C2, which is below the critical value for firing, is determined by the potential divider formed by R6, and the leakage resistance of the fence ^{R}leak. A steady voltage is maintained across the capacitor C3, which is charged through R4.

When an animal makes contact with the fence, its body resistance ^{R}touch is in parallel with ^{R}leak. The potential divider values are thus altered, and C2 will charge to a higher voltage which is above the critical value for firing.

As soon as the tube has fired, the relay RLA (which is pulled in by the partial discharge of C1 through the tube) connects the fence to the secondary by means of contact RLA3 and connects C3 across the primary of the step-up transformer T1 by means of RLA2. The capacitor discharges through the transformer and delivers a high voltage pulse to the fence. The remaining relay contact, RLA1, short-circuits the trigger tube and ensures that the anode-cathode discharge is extinguished. The discharge of C1 continues via RLA1, until it is no longer sufficient to hold in the relay. The current now flowing through R1 and RLA1 is also not sufficient to hold in the relay, and all three contacts return to their original states. The trigger circuit is self-extinguishing. The capacitors C1 and C3 recharge, and the circuit is ready to operate again either when ^{R}touch is next applied to the fence, or (if ^{R}touch has not been removed) after a short interval determined by the time constants of the trigger circuit.

Practical Values

In the circuit shown:
R1 = 120kΩ.
R2 = 10MΩ.
R3 = 5.6kΩ.
R4 = 200kΩ.
R5 = 5.6MΩ.
R6 = 1.0MΩ.
C1 = 2.0μF.
C2 = 0.33μF.
C3 = 8.0μF.

These values are based on an assumed fence leakage resistance of about 1MΩ. The circuit can, however, be designed to cover a whole range of conditions. The practice of providing alternative outputs for "dry" and "wet" conditions could readily be followed.

The low pre-ignition current of the Z803U (3×10^{-8}A) allows its use in similar applications where the leakage and contact resistances are very high (for example, > 100MΩ).

Transformer

An existing transformer was used. If suitably redesigned it could be taken via R4 to the 240v. line rather than to a 120v. tap. Redesign of the transformer is essential in any practical controller based on this experimental circuit. The present arrangement allows the possibility of moving the 120v. tap to a much higher position on the battery, with, as a consequence, a prohibitively high output delivered to the fence.

The details of the existing transformer (for use at primary voltages not exceeding 135v.) are as follows:—

Laminations, 0.5 mm. Stalloy E + I.
Window area, 8.0cm².
Stack, 20 × 25 mm.
Primary, 600 turns of 0.35 mm. (28 s.w.g.) tested to 2kV.
Secondary, 9,000 turns of 0.08 mm (44 s.w.g.) tested to 10kV.

Relay

Contact RLA2 should preferably operate later than RLA3.

Safety

The circuit is battery-operated, in accordance with normal British practice. It is generally considered that mains operation, with its possibility of great available power under certain fault conditions, is inherently rather less safe than battery operation. And, of course, the need for a mains connection reduces movability. It is significant that the safety recommendations for mains units are very exacting.

Standard specifications or (occasionally) regulations, have been drawn up in many countries. The British specifications are neither legally compelling nor legally protecting; they are guides to what has appeared to be good practice.

A thorough study of American practice, with particular reference to safety, can be found in "Agricultural Engineering"—which is the journal of the American Society of Agricultural Engineers. The gradual development of safety regulations, from the original code instituted in Oregon in 1936 to the present code of the American Underwriters Laboratories, is discussed, and the performances of four main types of controller are critically examined:—

(i) Inductive discharge: usually battery-operated, with a mechanical interruptor and an induction coil. (This is the type normally used in Great Britain.)

(ii) Capacitive discharge: similar to (i) but with capacitor output.

(iii) Intermittent a.c.: a current-limiting transformer and an oscillating motor or positive make-and-break mechanism—usually in the primary.

(iv) Continuous a.c.: continuous high voltage from a transformer secondary.

The general conclusion to be drawn from this American work is very much in line with the views implied by the British Standard specifications: namely, that the most advisable system is one which provides a strictly limited and closely controlled impulse to the fence, and is preferably battery-operated.

A Pan and Tilt Head

An Accessory for Use with Your Tripod

By D. G. JONES

Fig. 1.—The pan and tilt head in position on the tripod.

THIS device was mainly designed to facilitate tilting rather than panning. The base was made first and consists of a circular piece of ¼in. thick plywood 3½in. in diameter. A square hole was sunk three-quarters of the way into the centre of the base, and the centre of this drilled to take a ¼in. bolt. A metal strip 1in. long and ½in. wide was then screwed down on top of the bolt. If this is left protruding a little, the strip when screwed down will hold it really firm.

Four small right angle brackets are required next, 1in. × ½in. thick. If they cannot be obtained from the local hardware shop, they can be made easily.

The Camera Platform

This was designed to take a Rolleicord and measured 4in. long × 3in. wide. The platform was faced with a piece of an old cork table mat and black Sellotape used to make a border around it. A hole to take a ¼in. bolt was made 1¾in. from the front of the platform. The bolt is of the type used to retain the camera in its case and has, therefore, the same thread as the tripod bush.

The brackets were drilled next with two ¼in. holes in each angle for screwing to the base and the platform. A nut and bolt were used on the left hand side and a bolt and wing nut on the right.

The Arm

A 6in. nail was used for the arm and it was drilled with two holes for screwing to the platform and a rubber knob fixed to the end. This was purchased from a cycle store for 6d. It should be possible to build the complete pan and tilt head for less than 5s.

The system for panning is to release the retaining screw on the tripod, thus allowing the head to pan.

The device was designed to suit the author's own camera and tripod, but can easily be adapted to meet individual requirements.

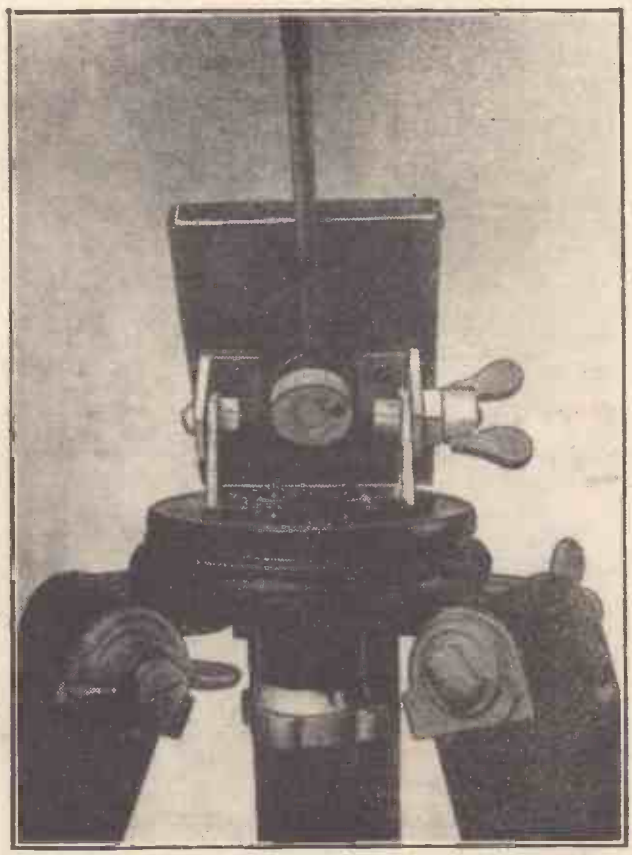


Fig. 2.—A close-up view giving details of construction.

BOOKS Received

The Fascination of Numbers. By W. J. Reichmann. 175 pages. 15s. net. Published by Methuen and Co., Ltd.

BESIDES containing a great deal for the expert in mathematics, this book will also be of interest to the student and to the general public. It is not by any means a textbook, but contains much of serious interest to the student as well as recreational interest to the seriously minded reader. The book sets out to show the ways in which numbers or groups of numbers are related to each other; how they may be expressed in terms of each other; and the general nature of number behaviour in varying circumstances. To understand the greater part of this book, little more than elementary mathematical knowledge is necessary. Chapters on magic squares, number peculiarities, pseudo-telepathy and mathematical recreations form the book's lighter side. A short index is included.

Perspective Drawing for Technical Illustrators and Draughtsmen. By Peter Manktelow. 120 pages. 30s. net. Published by George Newnes, Ltd.

AS the title indicates, this is a book for the art student, technical illustrator and draughtsman. It deals with one-point, two-point and three-point perspective and the preparation of complex subjects with the aid of the grid or perspective underlay. Its purpose is to enable the principles of these various methods to be understood by explaining them in the form of a series of progressive steps.

Included in the contents are chapters entitled Projection Classified; Effects of Perspective; The Cube in Perspective; The Grid or Perspective Underlay; The Perspective Circle; Examples of Finished Work; Perspectives of Inclined Objects and Applying Orthographic Drawings to the Perspective Grid. The volume is competently and extensively illustrated and an index is included.

OUR JUNIOR SECTION

A Catapult Gun

A Device for Firing Arrows at a Target

THIS instrument is simple to make and use, and will provide endless amusement when aimed at a target. The materials required are:—

Some pieces of strong, tough wood, scrap pieces of 1/16in. and ⅛in. thick sheet iron or brass, a few ½in. thick bamboo sticks, hen's feathers, screw eyes, a small spiral spring, thin cord, aeroplane elastic, screws and nails, ⅛in. thick wire nail, glue, paint and oil.

Construction

Obtain two lengths of strong wood—28in. long x ⅛in. thick x 1in. and 1⅝in. broad respectively. Join these with glue and nails along their length to form the barrel. A slot should now be cut at one end to receive the trigger. (See Figs. 1 and 2.)

Cut the trigger from ⅛in. sheet iron or brass to the shape and dimensions shown. Cut with chisel or hack-saw, drill holes for pin, spring and finger, and smooth off with a file (Fig. 3).

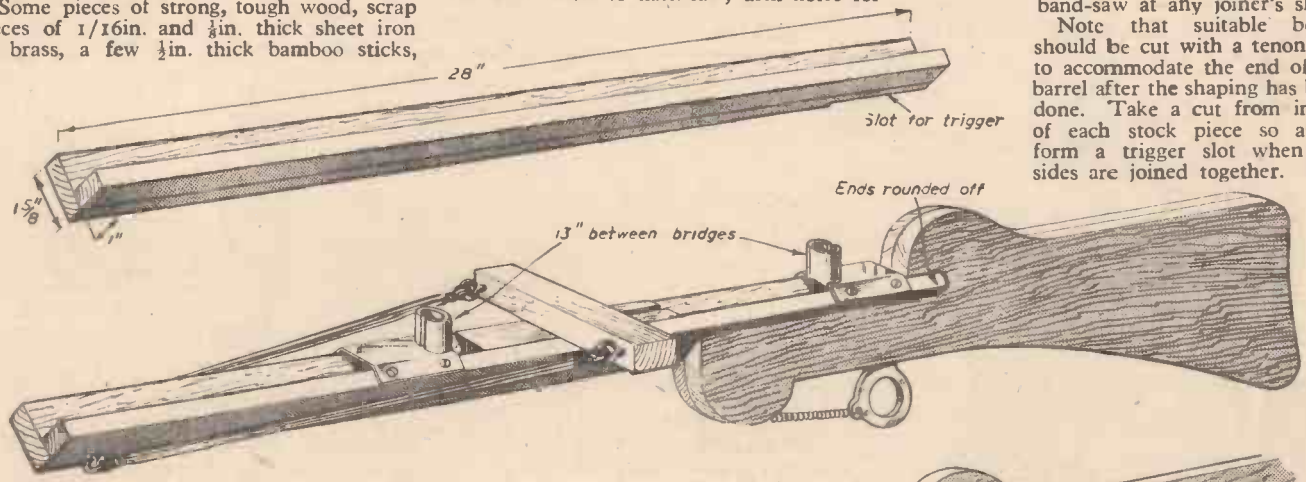
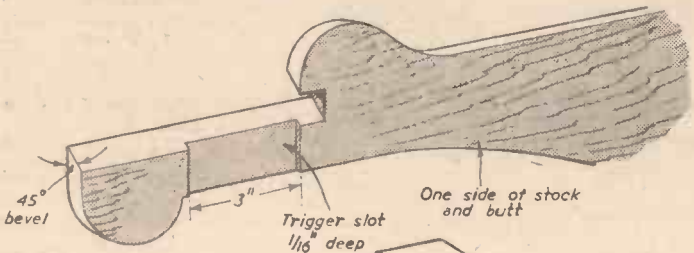


Fig. 1. — The completed gun and details of the trigger slot and barrel.



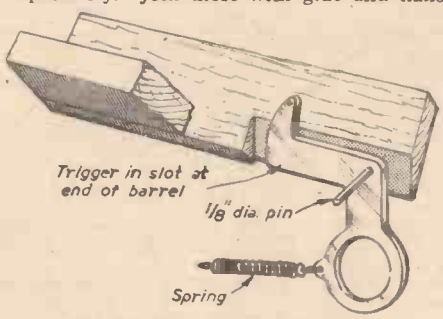


Fig. 2.—The trigger in position.

Fix the trigger in the barrel slot, using a piece of ⅛in. wire nail as a pin. The pin should be an easy fit through the trigger hole, but a tight driving fit in the sides of the barrel. See that the trigger is not fitted too high nor too low. The top of the trigger should be positioned in the slot as shown in Fig. 2.

The stock and butt are made together. Obtain two good pieces of strong wood ⅝in. thick, having the grain running lengthways. Cut out the two separate sides of the stock and butt to the shape and dimensions shown in Fig. 3. This can be done with a fret- or bow-saw, or with a band-saw at any joiner's shop.

Note that suitable bevels should be cut with a tenon-saw to accommodate the end of the barrel after the shaping has been done. Take a cut from inside of each stock piece so as to form a trigger slot when the sides are joined together. (See Figs. 2 and 3.) The two sides of stock and barrel may now be joined by glue and short screws after which any inequalities round the edge of the shape can be smoothed down with a rasp file. The barrel should now fit snugly into the bevels of the stock, and should be

(*Concluded on page 43*)

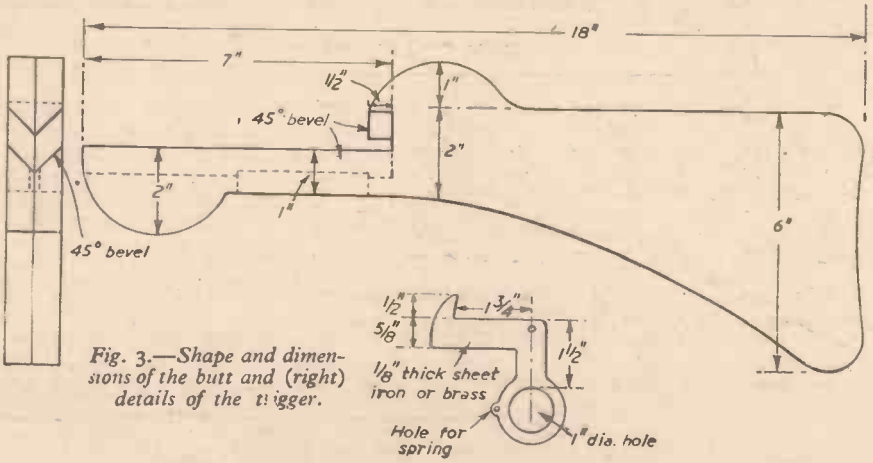
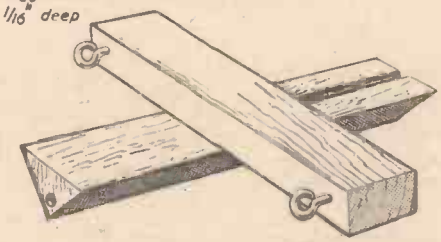


Fig. 3.—Shape and dimensions of the butt and (right) details of the trigger.



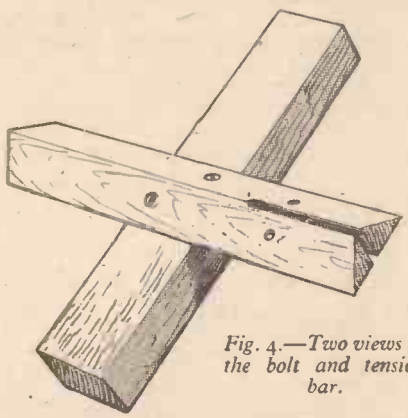


Fig. 4.—Two views of the bolt and tension bar.

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glued and screwed in place. See that the two slots register.

The trigger is tensioned by a spiral spring, obtainable from any cycle dealer, one end through a small hole in the trigger, the other end made fast to the bottom of the stock by means of a screw. (See Fig. 1.)

Fig. 4 shows the complete bolt and tension bar. The bolt is a piece of hardwood 6¼in. long, and of right-angle triangle section. A slot 3/16in. wide should be cut along a distance of 2½in. from one end of the bolt and a suitable length of ¼in. wire nail driven into a drilled hole ½in. from the head of the slot.

The tension bar is a piece of plain tough wood 7¼in. long, glued and screwed to the middle of the bolt. Two screw eyes receive the elastic.

Try the bolt in the barrel and make sure that the trigger, etc., is so fitted that the bolt will be securely held against the tension of the elastic when completed. Two bridge pieces should now be cut from ⅛in. thick sheet iron or brass. Cut and slit these with hack-saw and bend to shape as shown in Fig. 5. Drill four holes in each and fix securely to the top edges of the barrel with stout screws in the positions shown in Fig. 1. The bolt should slip under these bridges as far as the tension bar.

Put two strong screw eyes in the barrel, one either side, about 1in. from the muzzle.

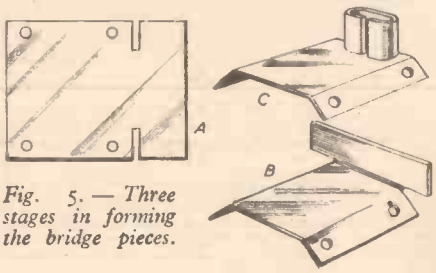
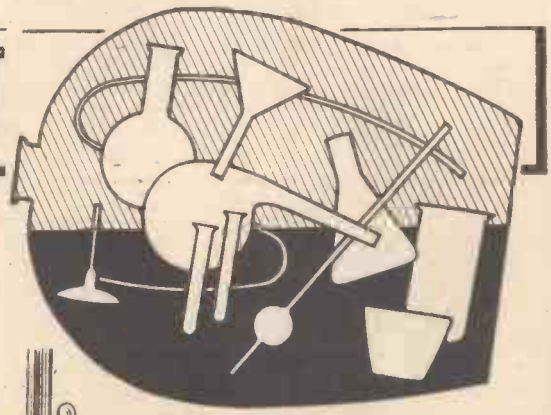


Fig. 5. — Three stages in forming the bridge pieces.

Obtain 3 yds. of ⅛in. broad model aeroplane elastic and cut to two equal lengths of 1½ yds. Thread a piece three times through the screw eyes in the barrel and tension bar and join the ends by a secure knot. This will give strength equal to six single lengths of elastic and will drive the arrows a considerable distance. Thread the other side in the same way. Oil the pins of the trigger and bolt, and the gun is finished. The "catapult gun" is designed to fire 12in. bamboo arrows, but small stones of a size that will go under the bridge piece may also be used.

Warning must be given regarding the danger of accident which may result from the misuse of this gun. Do not fall into the error of pointing the gun at anyone loaded or unloaded. The gun should not even be poised in the direction where any person happens to be. It is not intended to be used in mimic warfare, but only in target practice.

THE JUNIOR CHEMIST



Elementary Chemical Analysis

(Concluded from September issue.)

THIS decomposition can be hastened by introducing a lighted match into the test tube. Notice the brown colour of the nitrogen peroxide, and smell it gently.

Now heat some potassium nitrate strongly in a test tube, for a few minutes, holding the test tube with a piece of folded paper, as shown in Fig. 3. Allow the test tube to become cold before placing it in the test tube stand. Next, add dilute sulphuric acid to

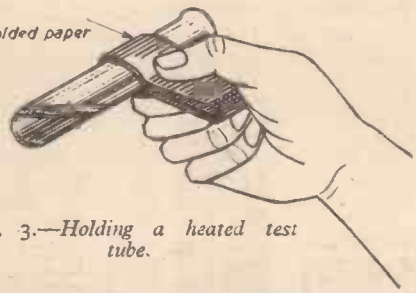


Fig. 3.—Holding a heated test tube.

the solid in the test tube; nitrogen peroxide should be evolved.

When potassium nitrate is heated, potassium nitrite is formed. Potassium nitrate gives no nitrogen peroxide with dilute sulphuric acid, but potassium nitrite does.

Table 2.

Gas	Colour	Smell	Confirmatory test
Carbon dioxide	—	Very slightly acid.	Turns lime water milky.
Sulphur dioxide	—	Burning sulphur	Chromate paper becomes green*.
Hydrochloric acid	Colourless, but fumes in air.	Acid	Forms white fumes with ammonia gas. A solution of the gas gives a dense white precipitate with silver nitrate solution.
Nitrogen peroxide.	Brown or brownish yellow.	Acid.	—

** Hydrochloric acid gas also turns a chromate paper green, but only after a long time.*

Detection of Gases

When testing gases, notice the following properties:

1. Colour.
2. Smell (carefully).

The colour and smell usually suggest a certain gas, and then a suitable experiment may be performed to prove if you have judged correctly. Table 2 will help.

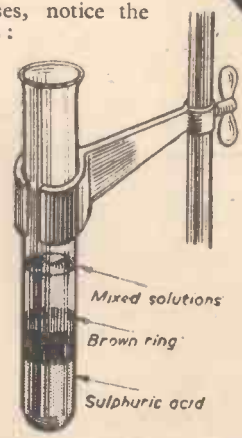


Fig. 4.—A brown ring at the junction of solutions confirms nitrate.

Examination for Acid Radical

When testing for an acid radical, use the table given below. It is important that the tests should be carried out in the order stated.

Always take a small quantity of the substance to be analysed, and if a gas is liberated upon treating it with acid, smell it very carefully.

A nitrate cannot be tested for when nitric acid is present, nor a chloride when hydrochloric acid is present, nor a sulphate when sulphuric acid is present.

This article is the final one in the present series, which was designed especially for our junior readers.

Table 3.

Experiment	Observation	Inference
Warm the substance with dilute sulphuric acid.	Carbon dioxide evolved.	Carbonate or bicarbonate. Note.—A strong solution of a bicarbonate gives carbon dioxide upon heating, but a carbonate does not.
—	Nitrogen peroxide evolved.	Nitrite.
—	Sulphur dioxide evolved, and a precipitate of sulphur.	Thosulphate.
Warm the substance with strong sulphuric acid.	—	Same as with dilute acid.
—	Hydrochloric acid evolved.	Chloride.*
—	Nitrogen peroxide evolved.	Nitrate.†
Add barium chloride solution and dilute nitric acid	Dense white precipitate (insoluble).‡	Sulphate or bisulphate. Note —A bisulphate is acid to litmus, but a sulphate is very slightly acid.

* Confirm by making a solution of the substance in distilled water, and adding silver nitrate solution and dilute nitric acid. A dense white precipitate insoluble in the nitric acid indicates chloride. A small quantity of the white precipitate is merely an impurity.

† Prepare a solution of the substance in cold, distilled water, and then a solution of ferrous sulphate, by dissolving two or three crystals in about ½in. of cold, distilled water in a test tube. Now mix these two solutions in a test tube, and carefully pour a little strong sulphuric acid down the side of the tube, which should not be shaken.

A brown ring formed at the junction of the solutions confirms a nitrate (see Fig. 4).

‡ A small amount of the precipitate denotes an impurity.

A NOVEL BAROMETER

Details of a Cellophane Actuated Weather Indicator

Fig. 1.—The completed "barometer."

A PIECE of Cellophane 9in. long in the dry state will reach a length of 9⅝in. when it is saturated with water: it is this property that is used here. Variation of the atmosphere will give only ¼in. movement, but the completed hygrometer in Fig. 1 magnifies this movement. The Cellophane strip is held between two clamps, to the lower of which is attached a length of silk. The other end of the silk is wrapped round a drum mounted on a spindle, with a pointer attached. A slight rotary movement of the drum makes a comparatively large movement of the tip of the pointer.

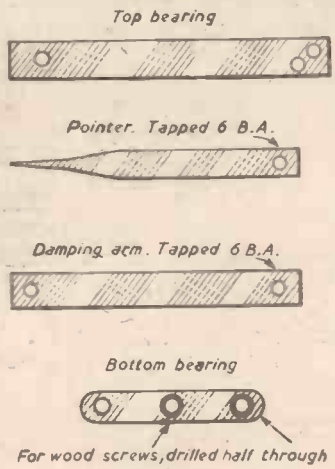


Fig. 2.—Details of the bearings and pointer.

The Base

The base on which the working parts are mounted is a wood batten 2in. × ⅝in., and 16in. long. Polished mahogany will give an attractive and workmanlike finish to the instrument. The pointer and drum are mounted on a 6B.A. threaded rod as a spindle. The ends of the rod are turned off to a point, and the bearings are made by drilling halfway through two brass strips (Fig. 2). The drum is the mainspring barrel from an old watch. This should be about ½in. in diameter. If it is very much less, the magnification of the movement will be so great that the pointer will run off the scale. In line with the pointer at the opposite end of the spindle is fixed another strip of brass with a small hole drilled in the outer end. A little lead weight is hung on here to steady the pointer.

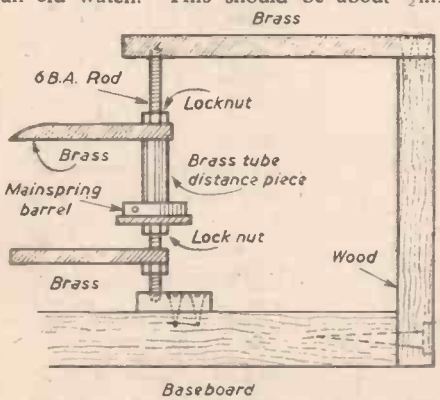


Fig. 3.—The assembly of the movement.

Set up the spindle in its bearings truly perpendicular to the baseboard (Fig. 3) and see that it turns quite freely and without undue shake in the bearings. The silk thread is passed through a hole in the periphery of the drum and secured by a knot inside. The free end is passed once round the drum anti-clockwise and fixed to the lower brass clamp. The faces of the clamps which come into contact with the Cellophane must be true and smooth (Fig. 4). The lower half of the bottom clamp has a small hole drilled near its edge for attaching the silk while a nick is cut with a small round file in the top half to clear this hole. The top clamp is so mounted that it provides for adjustment of the setting of the pointer. The adjusting rod is threaded 2B.A., and is equipped with a knurled ebonite knob. Rotation of the knob moves the clamp in the desired direction to raise or lower the pointer. Shape the guides for the clamp with care, so that the clamp runs easily with the least possible sideplay. A piece of 4B.A. rod is screwed into the underside of the clamp and secured with a nut behind the baseboard.

The Guides

To cut the slots in the guides, mark out with dividers, drill holes (4B.A. clearance) at each end of the slots, then more holes close together along their length

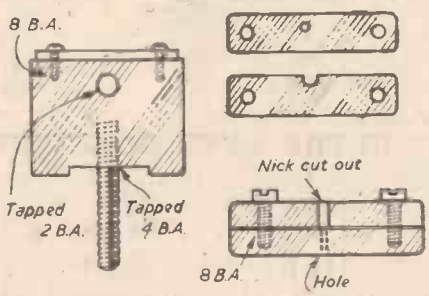


Fig. 4 (Left).—The top clamp. (Right) The bottom clamp.

(Fig. 5). Chip out the webs with a chisel and finish to the scribed lines with a file. Now fix the top guide on the baseboard with two screws. Drill right through the baseboard at each end of the slot and clear out the slot with a sharp chisel. This will give the correct location for the brass guide underneath. The assembly of the top clamp and adjustment is shown in Fig. 6.

The scale is drawn on paper and glued to a wooden platform fixed between the drum and the pointer, close underneath the latter. A piece is cut away to clear the spindle. Lines at every ten degrees will be ample for all practical purposes. The instrument is intended to work in a vertical position, so you will need to fix a brass hanger at the top of the baseboard.

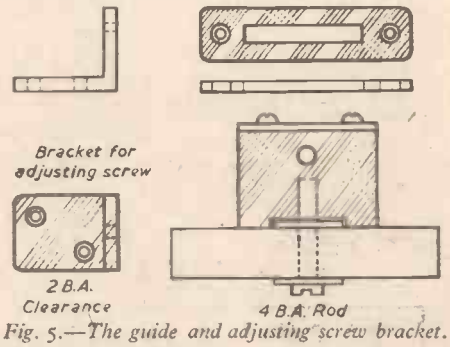


Fig. 5.—The guide and adjusting screw bracket.

The Cellophane

Standard Cellophane, thickness 600in., is used and make sure it is not "moisture-proof" Cellophane. Hold the sheet up to the light and fairly well defined lines will be seen running in one direction across it. Cut a strip ½in. wide off the edge at right angles to these lines; this direction of cutting takes off a strip with the greater expansion. Use a razor blade or a very sharp knife, and cut with one sweep of the blade. Do not handle the strip more than necessary.

Set the top clamp midway in the guide slot, fix the ends of the Cellophane strip in the clamps, leave 1in. projecting through the top clamp for subsequent adjustments and cut off the remainder. There should be about 9in. of Cellophane between the clamps. Now hang up the instrument and make sure that the silk is wound round the drum. Adjust the top clamp till the pointer is horizontal Slight vibration of the Cellophane makes the pointer wobble up and down. To counteract this tendency, hang a small blob of lead on the damping arm by means of a wire hook. Vibration and draughts will then not affect the pointer so seriously.

To test the hygrometer hold it above a gas burner. Keep it at least 2ft. above the flame, since scorching of the Cellophane destroys its properties. The pointer rapidly rises as the Cellophane dries. Play the steam from a kettle on it and it will fall as rapidly.

Remove all the brass fittings from the baseboard and stain and polish the latter and then reassemble.

Adjusting For Use

Dry over the gas as before until the pointer will go no higher, indicating that the Cellophane has fully contracted. Adjust the top clamp till the pointer coincides with one of the scale divisions near the top and mark this "very dry." If it happens to be a wet day, you will be able to mark the "rain" position, following this with "fair," "stormy," etc.

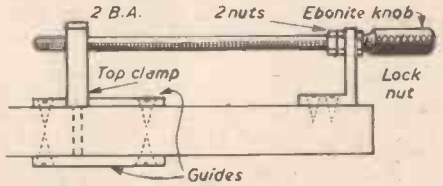


Fig. 6.—Assembly of the top clamp.

Letters to the Editor

Address letters to The Editor, "Practical Mechanics," Tower House, Southampton Street, London, W.C.2.

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

Chemical Distiller

SIR,—Mr. R. E. Rayner (Information Sought, August) is obviously thinking of an Ion Exchange Resin such as are supplied by the Permutit Co. Ltd., Gunnersbury Avenue, London, W.4, and Messrs. Joseph Crosfield & Sons Ltd., Bank Quay, Warrington, although for small quantities he would probably have to go to suppliers like British Drug Houses Ltd., Graham St., N.1., or Messsrs. Hopkin & Williams Ltd., 14, St. Cross Street, E.C.1.

Several firms of laboratory suppliers, however, supply wash-bottles and appliances for dispensing small quantities of "distilled" water.—J. C. WILLIAMS (Edgware).

Flattening Perspex

SIR,—With reference to your answer to the query in the August issue on "Flattening Perspex," I should like to mention a very simple method of doing such a job as your correspondent requires. I had a quantity of off-cuts of corrugated Perspex, which is used in factories to allow more light through a roof. It is about ⅛in. thick.

I placed the corrugated Perspex on a perfectly flat metal plate and heated it in an oven maintained at a temperature of about 260° F.

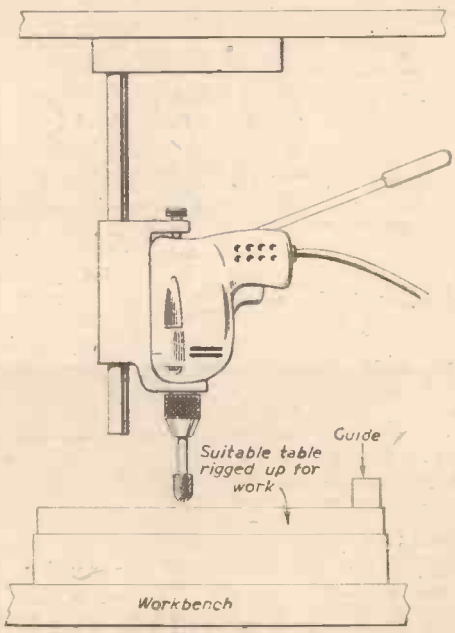
After some 20 minutes the Perspex softened and collapsed on the plate, becoming as flat as the plate, The Perspex was rapidly removed at this stage from the oven, and put between two pieces of wood (the thicker the better) with a weight on top. The object of the latter operation was to allow the Perspex to cool slowly. The result, when cold, was a dead-flat piece of Perspex.

The temperature of the oven will vary with the type of Perspex used. It must not be too high as bubbles are likely to appear on the surface.

The oven I used was electric and thermostatically controlled, but I see no reason why an ordinary domestic gas oven should not prove equally successful.—M. J. MAIZELS (N.20).

Drill Stand Modification

SIR,—In the article in February issue of PRACTICAL MECHANICS entitled "Using a Vertical Bench Drill as a Wood Miller," the writer states that limitations are imposed by the restricted distance between the centre line of the drill table and the pillar. In the case of the Black and Decker drill stand this restriction can be overcome by removing the drill clamp from the pillar and then screwing the base of the pillar to a suitable batten or plate *above* the workbench so that the pillar is hanging down (see sketch). Replace the drill clamp on the pillar and a suitable table can be rigged up with a guide; the workbench itself can of course be used provided it is smooth and will not scratch the face of the wood being worked.



Mr. L. J. Edwards' drill stand modification.

Large sheets of plywood, such as are for cabinet making, can be worked without any hindrance by the pillar. With this method there is no need for modifying the drill pillar as suggested by the author.—L. J. EDWARDS (Cornwall).

Electric Vehicle Transmission

SIR,—I have read with interest Mr. Dowsett's comments on my letter on electric vehicle transmission in the August issue.

My only personal experience with "Nife" batteries was when they were fitted to some motor cycles, where they didn't last long, mainly due to vibration. But I have a suspicion too that it was partly due to people not being careful enough to see that no acid got near, testing gravity with a hydrometer that had been used on an acid battery, or using a hydrometer to top up with distilled water, etc.

The objections Mr. Dowsett put forward seem rather minor details, which if true would just be found and overcome during the making of the vehicle, though it might not work as it is drawn.

I would remind Mr. Dowsett that experts were "proving conclusively" in 1896 that heavier-than-air machines could never fly, and at about the same time that the human body could not withstand a speed of 100. m.p.h., that motion pictures would never come to much, and that wireless would never work. In about 1927 they said talking pictures would never oust silent, in 1930 that television would never be more than a scientific toy, and right down to last year, when the BBC said they could never get a successful "live" TV broadcast from Scarborough for various reasons—but I.T.V have done it!—W. R. BROOKS (Scarborough).

TRADE NOTES

A Review of New Tools, Equipment, etc.

The Elge Radio Pen

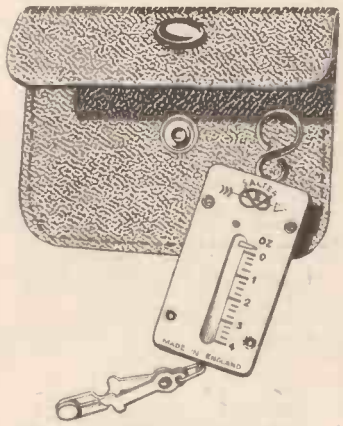
AS can be seen from the photograph, this pocket-sized fault finder does indeed resemble a pen. It is used for voltage testing, signal tracing, spark plug testing, valve and component testing and mains and polarity indications. Its chief field of use will, therefore, be for the quick location of faults in TV, radio and electronic equipment generally. The pen is constructed so that the test prod can be inserted into either end, according to the nature of the test, while the banana plug on a fly-lead can be plugged into the opposite socket.

The distributors are Mercia Enterprises Limited, Coventry, and the price of the Radio Pen is £1 4s.

The Elge Radio Pen.

Pocket Spring Balance

FROM Messrs. George Salter & Co., Ltd., West Bromwich, Staffs., comes news of the "Weightlet," a newly introduced small pocket spring balance designed specially for checking the weight of letters. As can be seen in the sketch, it has a white Ivorine dial with black figures and a spring clip for holding the corner of the letter to be weighed. When not in use it fits neatly into a 3in. x 2in. snap fastening leather pouch. It is obtainable from stationers, ironmongers and gift shops and costs 8s. 9d.



The "Weightlet" spring balance.

Electrician's Kit

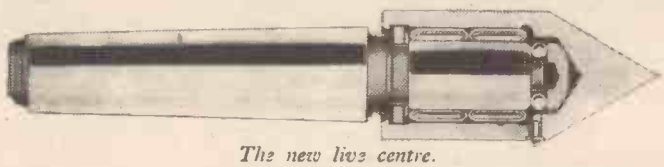
THE Stead Electrician's Kit No. 4 consists of an attractive plastic wallet containing a fully insulated mains tester, a pair of 6in. pliers, electrician's 4in. sleeved Screwmaster, a pair of 6½in. diagonal nippers and a utility screwdriver. The kit is made by J. Stead & Co. Ltd., Manor Works, Cricket Inn Road, Sheffield, 2, and costs 23s. The appearance of the kit may be seen in the photograph below.

Stead Electrician's Kit No. 4.

New Live Centre

A NEW, practical live centre has been introduced by A. A. Jones & Shipman Ltd., Leicester, which enables turning jobs to be carried out much faster and more easily than with standard dead centres.

This neatly designed "J. & S.-Centrex" live centre (see photograph) has a small diameter head, revolving on three bearings which will take all the thrust and radial load that would burn out an ordinary dead centre. The point has a short overhang from the shank so that chatter is avoided. All parts are hardened and ground. A lubricator is provided for greasing the bearings and a felt seal keeps out dirt and suds.



The new live centre.

"J. & S.-Centrex" live centre is manufactured in three sizes—No. 1, No. 2 and No. 3 morse taper—and is stocked by all J. & S." small tool distributing agents. Further information may be obtained from A. A. Jones & Shipman, Ltd., Narborough Road South, Leicester.

RODENE COUNTING RELAY

INTENDED for use as a selector, counting or memory relay in such applications as the automatic control of apparatus and production processes, this unit has a rotary switch with heavy stud-type fine silver stationary contacts and silver-graphite moving contacts. It can be either 21-way single pole or 10-way double pole, and is stepped forward one position every time a pulse is fed to the coil shown in the front of the photograph.

A momentary impulse to a second coil lifts a pawl and allows a spring to reset the switch to the zero position. This is assured by a latch which holds the pawl out until the next forward pulse. The relay can also be supplied without the switch-bank for use as a "pecker-motor" or "rotary solenoid."

Important features are that the unit can be operated direct from A.C., and that the consumption is only 45 VA on A.C., or 15 watts on D.C. The size is 3in. x 3in. x 2½in.; the maximum speed is 40 steps per second, and the price with standard coils is £3 18s. nett.

Further details of this relay and of a wide range of others are available from D. Robinson & Company, 58, Oaks Avenue, Worcester Park, Surrey.

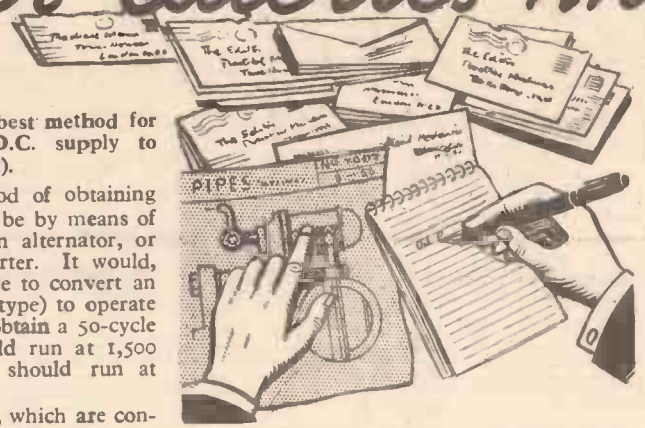
The Rodene counting relay.

BABY ALARM OR INTERCOM UNIT

(*Concluded from page 16*)

the microphone should be in the form of a small loudspeaker as it will be required to act as such when the unit is switched to send. When the unit has been tested as described, the microphone should be connected up to the amplifier and preferably taken into another room. The volume control should then be increased until the microphone pick-up is adequate. If a loud howl results when the volume control is advanced it is due to the microphone picking up the sounds from the loudspeaker, and it will therefore be necessary to provide some form of screening between them.

Your Queries Answered



Converting D.C. to A.C.

COULD you tell me the best method for converting my 230 D.C. supply to A.C. ?—A. Fraser (Bradford).

THE most practical method of obtaining the A.C. supply would be by means of a D.C. motor coupled to an alternator, or by means of a rotary converter. It would, however, be quite practicable to convert an ordinary D.C. motor (shunt type) to operate as a converter. In order to obtain a 50-cycle supply a 4-pole motor should run at 1,500 r.p.m., or a 2-pole motor should run at 3,000 r.p.m.

Points on the commutator, which are connected to armature conductors which are one-pole pitch apart, should be connected to two slip rings on the shaft, the A.C. output being obtained from brushes on these slip rings. If a 4-pole motor is used with a lap-wound armature, points on the commutator which are diametrically opposite each other could be connected to one slip ring, the two commutator segments midway between these being connected to the other slip ring.

A 2- to 3-h.p. motor is suggested. With 230 volts D.C. input the output of the converter will be about 160 volts ; thus the output side should be used in conjunction with a step-up transformer, preferably having tapped secondary windings. We could supply constructional details for a suitable transformer, if required, on receipt of a note of the current rating or h.p. of the motor and the A.C. voltage(s) required.

Alternatively, you could probably buy a suitable rotary converter from one of the following firms:—Croydon Engineering Co. Ltd., Commerce Way, Croydon. Electro-Dynamic Construction Co. Ltd., St. Mary's Cray, Kent. General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2. Newton Bros. (Derby) Ltd., Alfreton Road, Derby. Small Power Dynamo & Motor Co. Ltd., Gordon St., Hyde, Cheshire.

Ceramic Paints

I AM interested in pottery painting and design, etc., but cannot get any information about the materials used in the manufacture of the paints.

I use the colours in powder form, each one mixed separately on a pallette, a small quantity mixed with oil with a pallette knife and picked up with a touch of oil of turpentine on a small painting brush.

What are the powders composed of ? What is the oil ?—M. J. B. (Yorks).

THE colours used for the painting of ceramic wares comprise various coloured oxides. The oil used for moistening them is usually a high-grade raw linseed oil to which, as you say, a little genuine turpentine is sometimes added. These colours may be obtained in powder form from Wengers, Ltd., Etruria, Staffs. You may possibly be able to obtain them in very small amounts from a firm of handicraft material dealers such as Dryad Ltd., St. Nicholas Street, Leicester.

Renewing Bronze Finish

I HAVE a heavy wrought-iron curb which originally had a bronze finish. This has quite disappeared and I would like to know how it could be renewed.

The curb is in use before a fire and something heat resisting would be necessary.—J. S. Barton (Yorks).

FIRST of all, thoroughly clean your wrought-iron curb, making it as bright as possible with emery paper or similar abrasive treatment. Then make up the following solution:—Caustic soda, 20oz.; saltpetre, 12.5oz.; water, ¼ gallon approx. (About ½oz. of urea added to the above solution improves the colour of the bronzing.)

Heat the solution to 150 deg. C. and brush it repeatedly on to the warm fender for about half an hour, or until the desired depth of bronzing has been obtained.

Another method is to make a thin paste of turpentine and flowers of sulphur. This is brushed on the fender and then set alight. As it burns, the fender is given a black coloration, which is deepened and made more uniform with each repetition of the process.

In the case of the former treatment, the fender must be well rinsed with water and, in both cases, it should be eventually rubbed over with an oily cloth in order to add depth and lustre. The coloration thus produced is quite heat proof.

Washing Bleach

COULD you give me details of a washing bleach and method of manufacture, if it does not involve the use of very expensive equipment.—S. Higson (Bolton).

THE following is a formula for a good, effective, useful and cheap household bleacher:

Bleaching powder (chloride of lime), 1lb.; washing soda, 1lb.; common salt, 1lb.; water, 1 gallon.

The soda and salt should be dissolved in the water, the latter being either hot or cold. This done, the resulting solution must be allowed to get dead cold after which the bleaching powder should be made into a thick paste with a portion of the cold solution. This paste is then thinned out with the remaining solution so that a milky fluid is obtained. The fluid is next strained through several folds of fine cloth or fabric. It is then filled into clean wine bottles, the bottles being filled up to the necks and then tightly corked in this condition, and stored away from light. The solution will remain in good order for five or six weeks but seldom for a longer period. When the bottles are opened, and the solution is exposed to air, it will not remain good for more than ten days, the solution rapidly losing its bleaching power and becoming acidic in nature.

Photographic Trick

I HAVE a photo of three race horses apparently hidden underneath the glossy surface of the print ; a special piece of tissue paper is moistened well and the glossy side is well rubbed with it till the complete photo appears. Could you tell me what it is ?—F. Westoby (Doncaster).

YOUR photograph is based on a photographic "trick" which is at least ninety years old. These so-called "magic photographs" can be produced in the following way. Take an ordinary photograph (preferably one on printing-out or self-toning paper) and immerse it in a strong solution of mercuric chloride (poison) until the image has completely disappeared. Then wash the paper and dry it. Take a sheet of tissue paper, immerse it for a moment or two in a strong solution of sodium thiosulphate ("hypo") and, without rinsing, allow the tissue to dry. Place the tissue thus treated in contact with the bleached surface of the print, moisten the tissue and rub it down well. Then strip it away from the print surface. The original photograph will immediately reappear after contact with

QUERY SERVICE RULES

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

the moistened tissue. If this reconstituted photograph is again bleached in mercuric chloride solution the process can be repeated

Colouring Conservatory Glass

I WISH to colour the glass roof of my conservatory to a semi-transparent green in order to cut down the light. Is there any stain or varnish I could apply which would give this appearance ?

The conservatory is heated, and during the winter months there is considerable condensation on the glass.—C. L. Jackson (Essex).

OBTAIN from Vinyl Products, Ltd, Butter Hill, Carshalton, Surrey, a quantity of a toluene solution of poly-methyl methacrylate. This is a clear varnish or lacquer of quick-drying character. You can dye it any colour by dissolving in it a small amount of an oil soluble dye, such as Oil Green, Waxoline Green (I.C.I.) or Anthraquinone Green G. These oil-soluble colours can sometimes be obtained from large paint stores and also from laboratory dealers, such as Messrs. Griffin & Tatlock, Ltd., Kemble Street, Kingsway, London, W.C.2.

An alternative procedure is to obtain from a local paint shop a can of clear cellulose varnish or lacquer and to dissolve in it a small amount of a spirit-soluble dye, such as Brilliant Green or Malachite Green.

Oil-soluble dyes dissolved in a light pale oil varnish will give satisfactory results when brushed on to the inner side of the glass.

All the above preparations should, of course, be applied to the inner side of the glass and not to the external side. You cannot expect the colour to remain for two or three years without fading, for none of these dyes can withstand the influence of strong sunshine. The colours obtained, however, will be perfectly transparent.

H.T. Line Carrying Poles

WHAT is the safe working life of a pole carrying overhead H.T. lines, 11KV., lines being .1in. in size? What method of testing these poles is used and approved by regulations that govern them? How often should they be tested for rot? What measures are to be taken against rot whilst poles are in use?—J. Anderson (Neath).

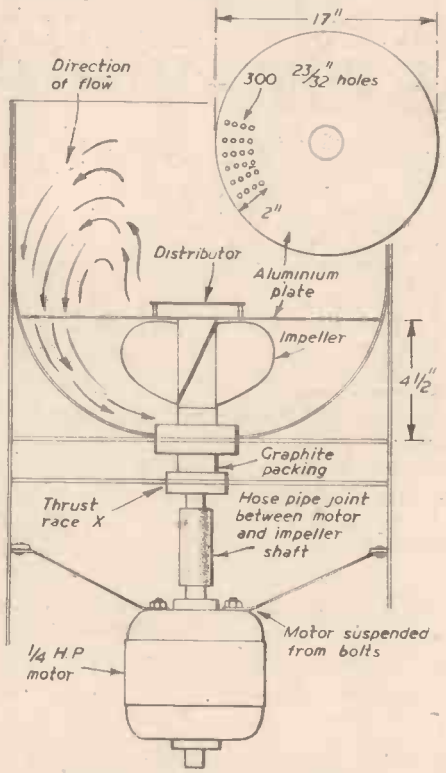
WE do not know of any regulations which specify in detail the inspection and testing of wooden poles used for overhead lines. The Overhead Lines Regulations governing the construction and installation of such lines are obtainable from H.M. Stationery Office.

These regulations require that all wooden supports, other than oak or hard wood cross arms shall, unless otherwise approved by the Electricity Commissioners, be of red fir impregnated with creosote. The factor of safety of a wooden pole support must be 3.5, calculated on the assumption that all line conductors are at a temperature of 22 deg. F. and have a covering of ice (57lb. per cubic foot) of radial thickness of ¾in., and are simultaneously subjected to a wind of 50 m.p.h. at right angles to the line ; this wind being taken as exerting a pressure equivalent to 8lb. per square foot calculated on the whole of the projected area of the ice-covered lines. These regulations require that every overhead line, including its supports and structural parts, shall be regularly inspected and efficiently maintained.

The poles should be impregnated with creosote, preferably by the vacuum-pressure process. The butt of the pole should be tarred to well above ground level. We suggest that the depth of the pole in the ground should not be less than 4ft. for a 24ft. pole, 5ft. for a 36ft. pole, and 6ft. for a 48ft. pole, and preferably greater, especially in made-up ground. The safe life of a new pole which has been properly installed and treated may be about 10 to 15 years. We suggest that each new pole be tested annually for rotting for the first three years, and afterwards tested about three times a year ; the poles could be tested by pressing a thin-pointed steel rod into the pole around and below ground level.

Electric Washing Machine

I AM making an electric washer as sketch below. The motor is suspended from its bolts by stays to frame of washer. The motor shaft is connected to impeller shaft by hosepipe (for flexibility). The impeller is to have three 4in. blades with 1½in. core, 3in. long.



Suggested washing machine design.

Is this impeller large enough? The motor speed is 1,400 r.p.m. What is correct pitch ? Will 300 holes as shown be sufficient ?

Is it correct to run a motor in a vertical position ?

Is ¾in. brass shaft suitable for the impeller ?

Would you advise thrust bearing at x to lift the impeller (it will of course be pressing down when in action).?—T. Johnson (Hull).

WE consider that the impeller will be large enough if it has a pitch of about 45 deg.; the area of the holes should also be sufficient.

If a motor is to be run in a vertical position it should have at least one ball bearing or else have a special thrust bearing. It is also advisable that the top end shield should be of a type which will not allow any dripping water or condensate to enter the motor.

We consider that the diameter of the shaft should be at least ¾in., and that it should be provided with a thrust bearing. We suggest that stainless steel might be suitable for the flat surfaces.

Parking Lights Arrangement

COULD you give me any information as to how I could build a transformer or any other simple device for cutting down the voltage of a 6 volt, 12 amp. motor cycle battery to feed three 2.5 volt torch bulbs. I wish to make a set of parking lights for my motor cycle combination and so save on the battery. I thought of wiring the bulbs in series to equalise the load, but if one bulb were to fail the remaining two would also fail. What do you suggest ?—J. W. Warwick (Middx).

A TRANSFORMER will only function on alternating current or fluctuating direct current, and would thus be useless for your purpose. The simplest and most economical method of using the three 2.5-volt lamps on a 6-volt circuit would be for you to wire them in series as you suggest. We think the risk of one lamp burning out unexpectedly would be rather remote if you renewed the bulbs periodically. Such bulbs are generally used on 3 volts, whilst you would be using them on 2 volts only. Bulbs which are used in series must have the same current and voltage rating. You could safeguard yourself by using two separate sets of three 2.5 bulbs in series across the 6-volt supply, in which case the failure of one bulb would only extinguish one bulb in each lamp.

If you prefer to use one 2.5-volt bulb in each lamp circuit with a series resistance the ohmic value of the series resistance should be equal to 3.5 divided by the current rating of the bulb. For currents up to 0.5 amp. you could use 34 s.w.g. Eureka resistance wire or 34 s.w.g. nickel-chrome wire. The Eureka wire has a resistance of approximately 10 ohms per yard, whilst nickel-chrome wire has a resistance of approximately 22 ohms per yard. Thus for a lamp having a current of 0.3 amp. a resistance of approximately 12 ohms, so that 0.54 yards (19in.) of 34 s.w.g. nickel-chrome wire could be used. The wire could be wound into a coil of small diameter

It should be noted, however, that with three such lamps, each with a series resistance, the total current taken from the battery would be approximately three times the current of each lamp due to losses in the resistances. We suggest that you would find it simpler and better to use three separate 6-volt lamps of low current rating, such as those used with a cycle dynamo set.

Information Sought

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

Beeswax candles

I WISH to make some beeswax candles. Can you give me any information or recommend any books on this subject ? What gauge of wick to thickness of wax is required for equal burning ? What is the dipping process ?—H. PILKINGTON (Stroud).

Dies for Embossing

I WISH to make some dies for an embossing press for notepaper. The steel die presents little difficulty, but I should be grateful for some help with the copper counterpart.—J. PHILLIPS (Ringwood).

3-D Photographs

I HAVE a 3-D photograph, to view which I have to use the red and green glasses. Can you give me any information as to how it is made ?—J. PAYNE (Dublin).

BATTERY CHARGERS

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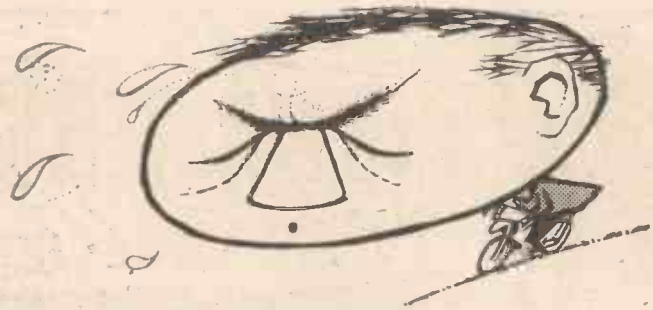

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THE Cyclist
Editor : F. J. CAMM

VOL. XXVI OCTOBER, 1957 No. 423

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

Phone : Temple Bar 4363
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WHAT I THINK By F. J. C.

Control of Dogs on Roads

THAT menace to cyclists' safety, the wandering dog, is to come under control and persons who allow dogs off leads in certain roads will be liable to a fine of up to £5 under two Orders made by the Barnes Borough Council and the Eastwood Urban District Council. These Orders have been confirmed by the M.O.T. The Eastwood Order, now in force, is the first to be made under the powers granted to local authorities in Section 15 of the Road Traffic Act, 1956, which makes it an offence for any person to permit a dog to be on any designated road without being held on a lead. It does not apply to dogs kept for driving or tending sheep or cattle in the course of trade or business. The Order made by the Barnes Borough Council comes into force on October 1.

I hope that other borough councils rapidly follow suit. At the same time it should be remembered that anyone suffering injury caused by a dog can sue the owner of the dog for damages. With motor cars, a motorist may not plead that he caused an accident as a result of swerving to miss a dog. Presumably, in those circumstances, the motorist must run over the dog. A cyclist is unable to do so. The dog which chases cyclists and quite often brings them down, causing damage to rider and machine, is a public menace, and owners should be made to shoulder their responsibilities.

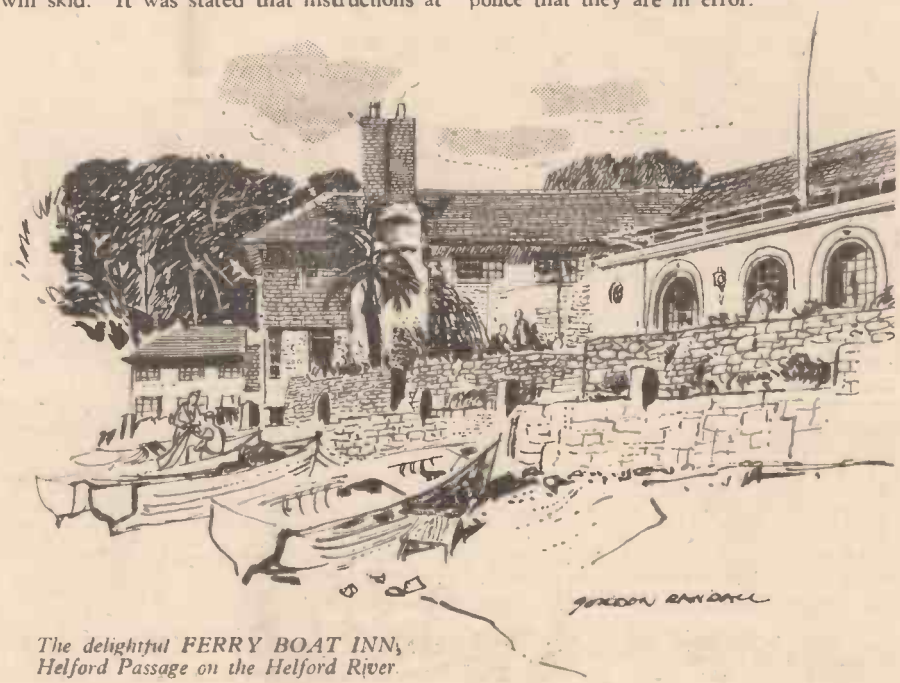
Those Stand-by Lamps

I OBSERVE that the Standing Joint Committee on Cycling has urged the Minister of Transport to suspend the Road Vehicles Lighting (Stationary Cycles) Order 1957, because it would necessitate bicycles fitted with dynamos being fitted with stand-by batteries which would take over the lighting when the cycle is temporarily at a standstill. Under the 1945 Order, it was permissible for a cyclist not to have the lamp alight when stopped. An unlighted cycle may still be wheeled close to the kerb and this will still be permitted if the new order comes into force. The argument advanced against the stand-by battery is that the battery rapidly deteriorates and that it sulphates and damages the lamp case. If the lamp is properly constructed and the right materials are used, this cannot take place, and we have no doubt that the Minister of Transport will draw attention to this. It is also possible to design a battery which does not sulphate. The defects are rather due to poor design than to a fundamental defect.

When the committee argues that there is an absence of evidence of accidents being caused as the result of a dynamo-operated lamp going out at a traffic stop, they are on sounder ground. In any case, cyclists have rear reflectors and we can see no purpose in making the Order on those grounds alone. A motorist who cannot see a cyclist when his bicycle is fitted with a reflector should not drive at night at all.

About Brakes

THERE is a new school of thought on bicycle braking. The tendency now is to advise people to use the front brake in preference to the rear, and driving instructors are teaching drivers of scooters and motor cycles to rely mainly on the front brake. I take leave to question this practice. On a wet road, application of the front brakes tends to promote a skid, and it is well known that it is practically impossible to correct a front wheel skid and comparatively easy to rectify a rear wheel skid. In my view, front wheel braking only is dangerous, almost suicidal. For one thing, there is less load on the front wheel, secondly there quite often is judder, when the head bearings are not properly adjusted and thirdly, it is generally agreed that braking pressure using both brakes, should be distributed in the ratio of one-third to the front wheel and two-thirds to the rear wheel. The maximum tyre adhesion is with the rear wheel. I learn that the police at the Hendon Driving School advocate the use of the front brake. I think this is wrong and unwise. The chief engineer of the Automobile Association was recently defending a test case relating to inefficient brakes on a scooter. It was stated that the police method of testing brakes was unfair. The constable giving evidence said he could pull the scooter along the road with two fingers with the rider sitting astride and the front brake applied, but surely the rider should have been asked to apply both brakes. The A.A. chief engineer said: "That method is quite unsatisfactory. On these scooters, the brake is not intended to lock the front wheel. It is only intended to supplement the foot brake. If the front wheel is locked the rider would go over the handlebars." One should never use such braking power that the wheel is locked. Maximum braking efficiency occurs just before the wheel is locked. If the pressure does lock the wheel, it merely means that the wheel will skid. It was stated that instructions at the Hendon Police College are that 60 per cent. of the total braking force should be on the front wheel. Engineers question the wisdom of that figure and I think it is time that the Hendon Police College took the advice of some qualified engineers on the subject and ceased from inviting motor cyclists to commit suicide. It is a most dangerous practice to suggest that the maximum braking pressure should be on the front wheel. The scooter in question had standard brakes as fitted by the makers. They were in good order and correctly adjusted, but the defendant was fined £1. This means that thousands of motor cyclists using standard braking equipment in good order are likely to be prosecuted, and it also means that every motor cyclist so fined will be able to sue his manufacturer for breach of implied warranty. We think this is a matter which the police should have taken up direct with the manufacturers concerned. The magistrate was also remiss in accepting evidence from the Hendon Police College without asking for independent evidence from qualified engineers. I do not accept the opinions of the Hendon Police College as the ultimate and beyond question, and I invite them to give further consideration to the matter. According to the D.S.I.R. report, during 1955 the percentage of accidents on wet roads which involved skidding was found to have increased to 26 per cent., an increase of 3 per cent. over the figures for the previous year. Perhaps it is because of this new fangled practice having police support that the accidents have increased. This is a serious matter and I hope the manufacturers, in view of the decision in the case I have quoted, will vigorously take up the matter with the object of convincing the police that they are in error.



The delightful FERRY BOAT INN, Helford Passage on the Helford River

THE HUB DYNAMO

Description : Wiring : Dismantling : Reassembly

AN excellent example of this type of lighting is the unit made by Sturmey Archer, which gives an output of 6v., .34 amp. at normal speed. The set consists of a generator hub (see Fig. 1) headlamp and rearlamp. A dry battery unit can also be included to provide light when the cycle stops.

Description

The hub dynamo is a slow speed generator in which no gears are employed. Bearings and brushes are not used and the extra effort required to drive it is almost negligible. The hub shell contains the magnet and this revolves around the armature which is fixed to the hub spindle and remains stationary. The voltage control incorporated is very efficient.

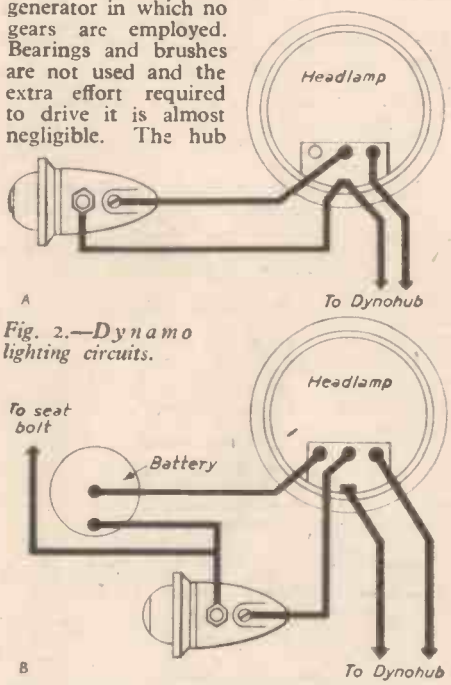


Fig. 2.—Dynamo lighting circuits.

Wiring

This is simply done and if the Sturmey Archer headlamp is used, the circuit will be as A in Fig. 2. If the generator is used in conjunction with other lighting equipment, it should not be difficult to adapt the wiring to suit. The circuit to include the dry battery unit is shown at B in Fig. 2.

The Dry Battery Unit

Fitted to the seat tube of the cycle, this is essentially a container enclosing three 1½-volt dry batteries. The purpose of the unit is to provide a standby light when the cycle is stationary at traffic lights or parked. Connection is made to the two terminals at the top of the unit and it is closed by means of a rubber cap, locked by means of a washer and nut. There is little that can go wrong with this unit, but it is well to remember that the spring in the base provides the earth contact and should thus be kept clean and preferably greased with petroleum jelly.

The use of this unit is entirely optional, and if batteries are not replaced the dynamo lighting will function, without, of course, the parking light. The unit is shown in Fig. 3.

Fault Finding

The failure of the lamps to light or a reduced beam only can often be attributed to the same causes as in wheel driven dynamos. Provided that the wiring is correct and the bulbs used of the correct rating, possible reasons for failure could include loose or corroded connections, and bulbs which are failing. The frequent burning out of bulbs is almost always due to loose contacts or to wrongly rated bulbs. In the hub unit itself, a fault in the armature would almost certainly cause a complete failure of the lighting. Dim lights might also be due to a magnet which is not up to strength. To test for a faulty armature, connect a bulb across the armature terminals and spin the wheel, failure to light indicates an armature which is probably faulty. Rewinding the armature oneself is rather outside the scope of the amateur and the remedy is to return it to the makers for repair: this applies too to remagnetising a magnet, and remember when sending it to enclose the armature also, or a keeper will have to be supplied.

Fig. 3.—The Sturmey Archer dry battery unit.

The correct bulbs to use with a hub dynamo are for the headlamp a 6v. .25 amp. and for the rear lamp a 6v. .04 amp. It is most important that the correct bulbs be used.

Dismantling

Reference should be made to Fig. 4, which shows all the parts of the Sturmey Archer GH6 hub dynamo; this hub was chosen for description as it is not incorporated with the hub three-speed and therefore description is simplified.

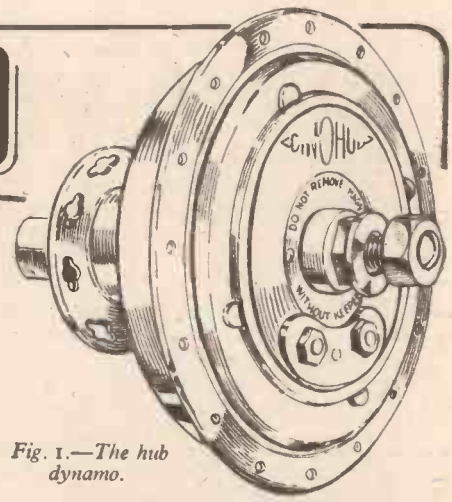


Fig. 1.—The hub dynamo.

Remove first the dynamo side locknut and washers and then the four magnet fixing screws and nuts. The dynamo unit is next removed complete by laying the wheel on a bench and tapping the wheel spindle at the other end, causing the dynamo to drop out. Lift the magnet spacing ring from the hub drum.

The armature acts as a keeper to the magnet and the two should therefore never be parted, unless it is absolutely necessary, in which case a keeper should be provided. Magnetism is lost immediately the magnet is separated from the keeper ring.

If the armature is separated, it may be tested for continuity either by means of a test meter or by connecting a battery and bulb in series between the two armature terminals. As a further test, one of the leads may be disconnected and touched on to the outside of the armature. If the bulb lights a short circuit is indicated.

To continue dismantling the hub, unscrew the right hand cone and locknut, prise out the dustcap with a screwdriver and remove the ball cage. The spindle can be removed together with the left hand cone and then the other ball race removed. Checking ball races, cones, etc., for wear follows normal procedure.

Reassembly

Fit the ball cage into the smaller end of the hub shell and follow this with the dustcap. If it has been removed, refit the dynamo side cone on to the spindle, screwing it right up to the shoulder. Fit the dynamo-side ball cage and insert the spindle from the dynamo side. Fit the right hand cone and locking nut and adjust the bearing for free running with only slight play on the wheel rim. Replace the card disc inside the cover plate and then fit the cover plate over the magnet, making sure that the holes in the cover plate are in line with the notches in the card and magnet. Fit the metal spacing ring into the hub shell and the shim washer over the cone. Replace the complete dynamo unit in the hub shell, lining up the holes correctly and then fit the fixing screws through the magnet. Replace dynamo side cone, locknut, washers, etc.

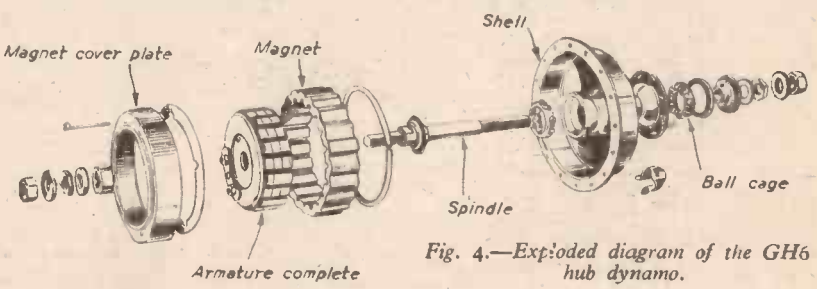


Fig. 4.—Exploded diagram of the GH6 hub dynamo.

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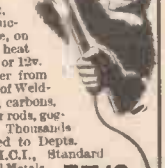

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