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NEWNES

PRACTICAL MECHANICS

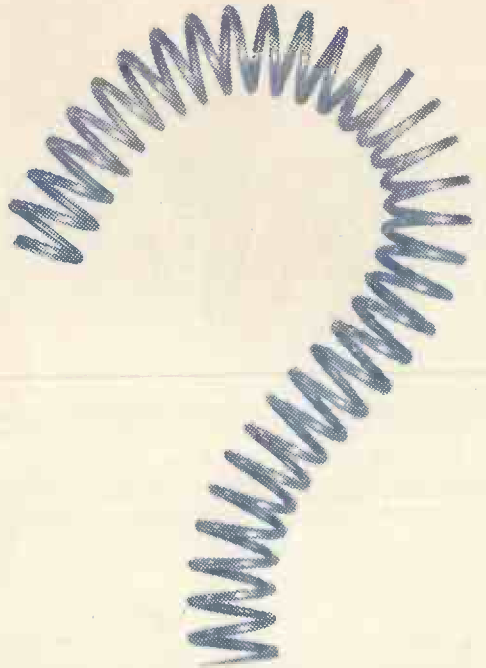
1'3

50p

EDITOR : F. J. CAMM

DECEMBER, 1957

Contents



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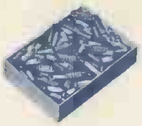

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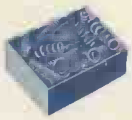

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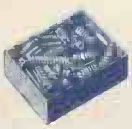

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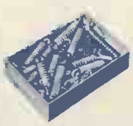

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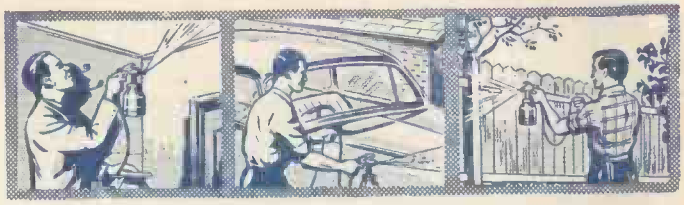

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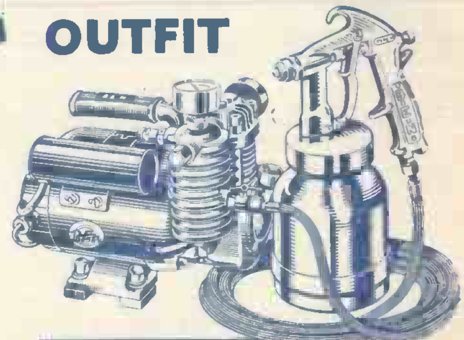

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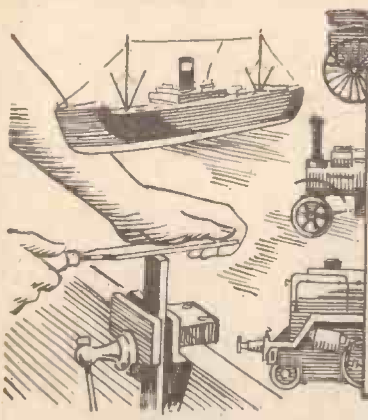

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CONTRIBUTIONS

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

THE RUSSIAN SATELLITES

THE most important events up to the present in this geophysical year have been the launching by the Russians of their artificial satellites—scientific achievements of the first importance which are certain to have far-reaching repercussions. Every credit must be given to the Russian scientists who have thus stolen a march on the rest of the world and have demonstrated in a practical form the astronautical theory first evolved in this country by our own Interplanetary Society. When this society, small in numbers then but now considerably greater in membership and prestige, first drew attention to the possibilities of space life, it suffered the same fate of all pioneers—it was derided.

This journal was the first to see the possibilities and, in fact, we published a lengthy series of articles on the subject a few years ago, and we have since regularly kept our readers informed of current trends. The Interplanetary Society must be given the credit of having awakened the scientific interest of all countries in space travel. Experiments have been actively going on in most countries, but particularly in Great Britain and America. It is regrettable that for economic reasons this country did not find it possible to give practical effect to its plans. The designs are in existence and, but for lack of funds, we could have been months ahead of the Russians and Americans.

WHAT IS PRACTICAL TRAINING ?

SIR WALTER PUCKEY recently addressed the Institute of Production Engineers on the subject of practical training. Practical men who have had a proper training are in short supply, partly accounted for by the fact that each year sees a smaller intake of apprentices to the various trades. Youth to-day prefers to take a more highly-paid but blind-alley occupation upon leaving school, only to find when it is too late that the higher salaries paid were but a temporary advantage, since they did not increase as the years went by.

An apprentice is naturally paid a lower wage, but his payment is not only in cash. It is also in experience which must be paid for. The apprentice, in the long run, must always be better off, since he has a craft skill which cannot be taken away from him. The old Latin tag *Scientia est Potentia* (Knowledge is power) is truer to-day than ever, and the opportunities for trained men are immeasurably greater to-day, with better chances of promotion to executive positions. Sir Walter Puckey, however, in propounding this, did not provide an adequate answer. He admitted that one of the problems not yet fully understood was that of practical training. He admitted that facilities for technical education in this country are good, but that the facilities for training a greater number of young men who will one day become executive managers of industry are not so good. One method adopted by the National Council for Technological Awards was to devise an award which would have a national status and be equivalent in most respects to a high university degree, but would be operated through the technical colleges. The Council decided to issue the "Diploma in Technology" and for engineers, the "Diploma in Technology (Eng.)." The standing of these two awards broadly corresponds to honours degree standard in universities. These awards mean that many technical colleges will have to increase their standards of teaching and facilities, and broaden their outlook.

"PRACTICAL HOME MONEY MAKER"

I HOPE that all those readers wishing to augment their income have ordered a copy of my new companion monthly journal, *Practical Home Money Maker*, which costs 1s. 3d. every month, and is in the same style and same size as PRACTICAL MECHANICS. It deals with every home craft on the basis of money-making at home.—F. J. C.

Build Your Own Clubhouse

A Project That Members Can Undertake Themselves

By J. JOHNSTON

BEFORE any building work can be commenced the permission of the local authority must be obtained. A plan with a site plan in duplicate or triplicate will require to be lodged with the local authority and there are also planning permission and byelaw forms to be completed. Before carrying out these preliminaries contact should be made with the building inspector at the council offices, taking a copy of this article with you. He will assist you with the filling in of the forms and advise you on the procedure for lodging the plans with the council.

It is quite easy for anyone with a little knowledge of draughtsmanship to prepare a plan by simply copying Figs. 1, 2, 3 and 4 to a scale of $\frac{1}{8}$in. or $\frac{1}{4}$in. to a foot, as these drawings contain all the information necessary. A tracing of the site plan can usually be obtained at the council offices.

IT is the desire of most athletic clubs to possess a clubhouse but, usually, owing to lack of funds the erection of such a building by a contractor is beyond their means. Members, however, could easily undertake the erection of a small clubhouse themselves.

The clubhouse shown in Fig. 1 is a strong, well-built structure with a long life if properly looked after. It is suitable for football, cricket or tennis clubs and is designed for a site where a water supply and drainage are not obtainable. It is, however, equally suitable for a site where these services are available if proper sanitary fittings and drainage are provided.

In the case of football and cricket clubs one W.C. might be sufficient but for a tennis club it is better to provide two.

A water supply at a clubhouse is always a convenience and a tank is provided to collect the rain water. A sink, which can be drained to a soakaway is indicated on the plan.

Front and end elevations are shown in

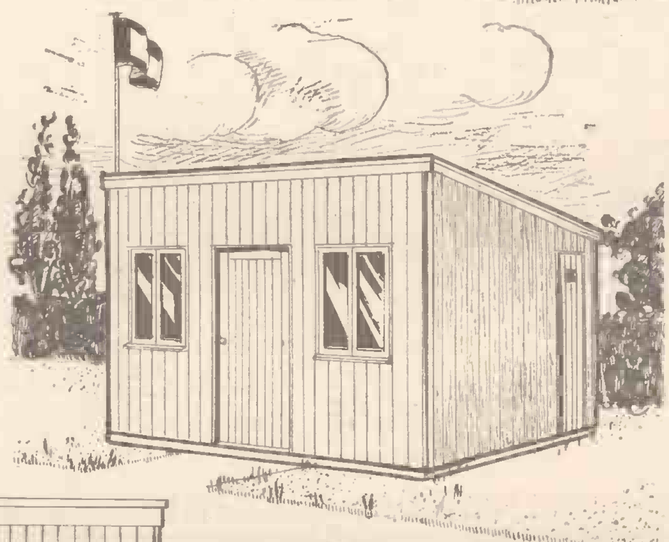


Fig. 1.—An impression of the completed club house.

Fig. 2 (Left).—Front elevation.

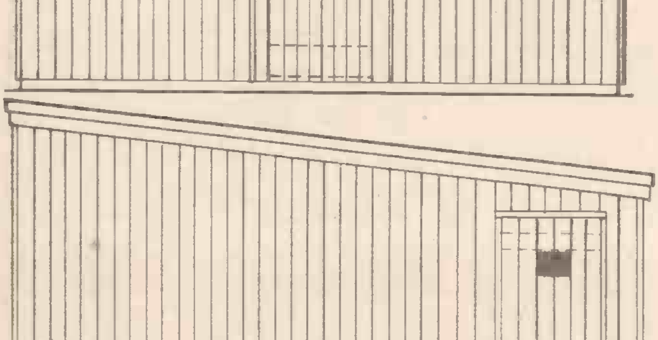


Fig. 3.—Side elevation.

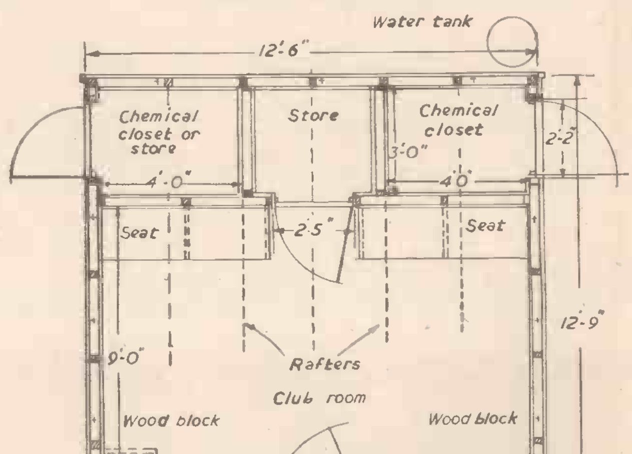


Fig. 4.—A plan view.

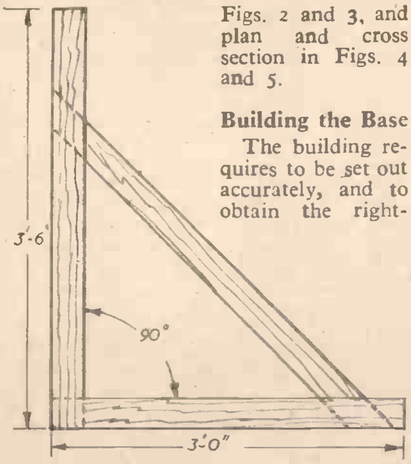


Fig. 6.—Details of the square used for obtaining right angles.

Figs. 2 and 3, and plan and cross section in Figs. 4 and 5.

Building the Base

The building requires to be set out accurately, and to obtain the right-angles at the corners make a square out of odd pieces of timber as shown at Fig. 6. Then proceed to set out the building, measuring a length 12ft. 9in. and with the square at B set off another line at right angles 12ft. 6in. long. Carry out the same procedure at the other three corners and as a check, measure the diagonals which should both be the same length, see Fig. 7.

The Concrete

To prepare the foundations, remove the top soil and form a rectangle 12ft. 9in. × 12ft. 6in. with boards held in position by pegs driven into the ground. With these as a guide fill in the area with a layer of hardcore and concrete 4in. thick, composed of four parts broken bricks or stone to pass a 2in. ring, two parts sand and one part cement. A box should be used to measure the materials to the proportions stated. When filling in the concrete, insert 11 hardwood plugs each 1½in. square and 2½in. long; to these plugs are spiked the bottom rails of the framing, see Fig 8. An alternative method is to bed ⅝in. dia. rag bolts in the concrete. When the structure is roofed the floor should be rendered ¾in. thick.

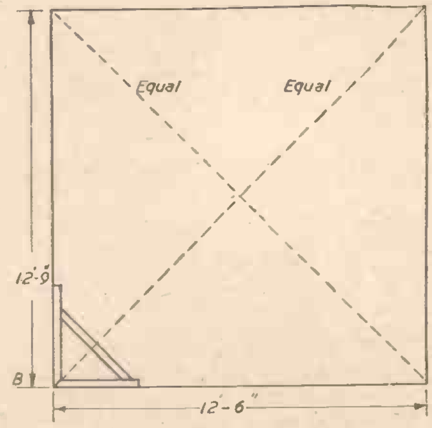


Fig. 7.—Checking the base.

(*To be concluded*)

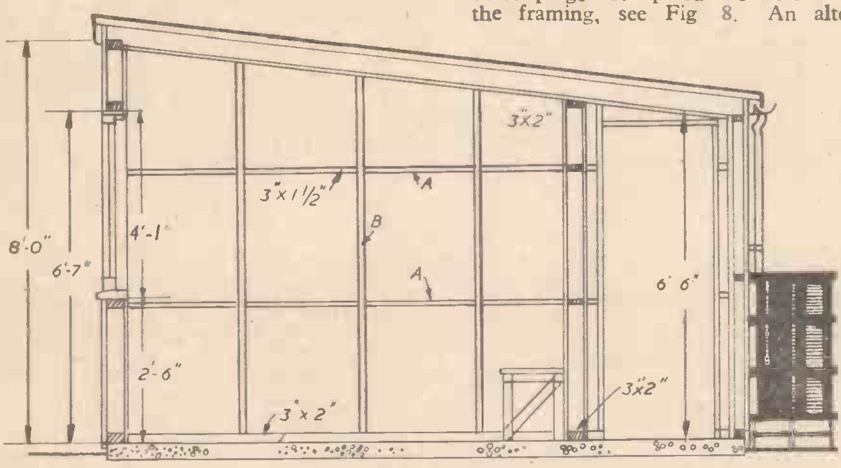


Fig. 5.—Cross-sectional view.

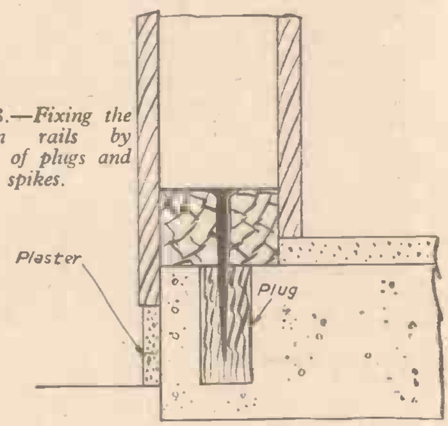


Fig. 8.—Fixing the bottom rails by means of plugs and spikes.

Quantities of Timber Required

2½in. × 1½in. × 1½in. Hardwood Plugs
  11 required
3in. × 3in. Posts
  2 8ft. long
  2 6ft. 6in. long
3in. × 2in. Top and Bottom Rails
  3 12ft. 6in. lengths
  4 4ft. 10in. lengths
  1 12ft. 1in. length
  2 12ft. 9in. lengths
3in. × 1½in. Framing

Front—
  A 1 12ft. 1in. length
  B 2 4ft. 6in. lengths
  C 4 4ft. 1in. lengths
  D 4 10in. lengths
  E 2 2ft. 4½in. lengths
  F 2 1ft. 4in. lengths
  G 2 7ft. 9in. lengths

Back—
  A 1 12ft. 1in. length
  B 5 6ft. 2½in. lengths

Ends—
  A 4 12ft. 4in. lengths
  B 10 8ft. lengths

Centre Partition
  Rail 1 2ft. 5in. length
  Rail 2 4ft. 9in. lengths
  Posts 6 7ft. 1in. lengths

Cross Partitions
  A 2 3ft. 1in. lengths
  B 4 7ft. lengths
  C 6 3ft. lengths
5in. × 2in. Rafters
  7 13ft. long.

⅝in. Roof Boarding
  19 sq. yd.
4in. × ⅝in. Matching
  38 sq. yd.
2in. × ¾in. Fillets
  4 8ft. lengths
4in. × ½in. Matching
  70 sq. yd.
5½in. × ¾in. Fascia Plates
  2 13ft. 3in. long
  2 12ft. 9in. long
4½in. × 1in. Linings
 Entrance—
  2 6ft. 6in. long
  1 3ft. long
 Door to Store—
  2 6ft. 6in. long
  1 2ft. 5in. long
 Door to Toilets—
  4 6ft. 6in. long
  2 2ft. 2in. long
 Windows—
  4 3ft. 10in.
  2 2ft. 8in. long
5½in. × 2½in. Sills
  2 2ft. 8in. long
4½in. × 1¾in. Door Stiles
  2 6ft. 6in. long
4½in. × 1¾in. Door Rail
  1 2ft. 9in. long
8in. × 1in. Rails
  2 2ft. 9in. long
4½in. × 1⅛in. Ledges
  2 2ft. long
  1 2ft. 3in. long
7in. × 1⅛in. Ledges
  4 2 ft long
  2 2ft. 3in. long

⅝in. T. & G. Matching for Doors
  6½ sq. yd.
2in. × 1¾in. Window Stiles
  4 3ft. 10in. long
2in. × 1¾in. Window Rails
  4 1ft. 3in.
2½in. × 1¾in. Bottom Rails
  4 1ft. 3in.
2¾in. × 1¾in. Meeting Stiles
  4 3ft. 10in. long
1½in. × ½in. Door and Window Stops
 Doors—
  8 6ft. 6in. lengths
  1 3ft. 0in. lengths
  1 2ft. 3in. lengths
  2 2ft. 0in. lengths
 Windows—
  4 3ft. 10in. lengths
  2 2ft. 6in. lengths
2½in. × 1½in. Framing for Seats
 Legs—
  8 1ft. 5in. lengths
 Rails—
  4 1ft. 5in. lengths
 Braces—
  4 1ft. 9in. lengths
 Fillets
  2 2in. × 1½in. × 1ft. 6in.
6in. × 1in. T. & G. Flooring
  6 4ft. 6in. lengths
Roofing Felt
  19 sq. yd.

These quantities are approximate and scantlings will have to be cut in certain instances to suit the requirements of the job.

A Roll-away Projection Screen

A Useful Piece of Equipment for Camera Enthusiasts

By J. C. LOWDEN

THE tremendous increase in colour photography, especially in transparency work, has brought about a demand for a light, efficient and easily stored and carried screen. While a makeshift rigid screen will suffice for a few showings, it will generally present its own problems of storage and cleanliness. The screen described here was made entirely from scrap materials. It is shown in Fig. 1.

The Screen

The projection surface was made from a simple spring-roller blind, of the type familiar to most householders, purchased from a secondhand shop. The actual fabric of the blind measured 6ft. 6in. long × 32in. wide. The spindle, with its fixed spring-loaded mechanism measured 35in. long.

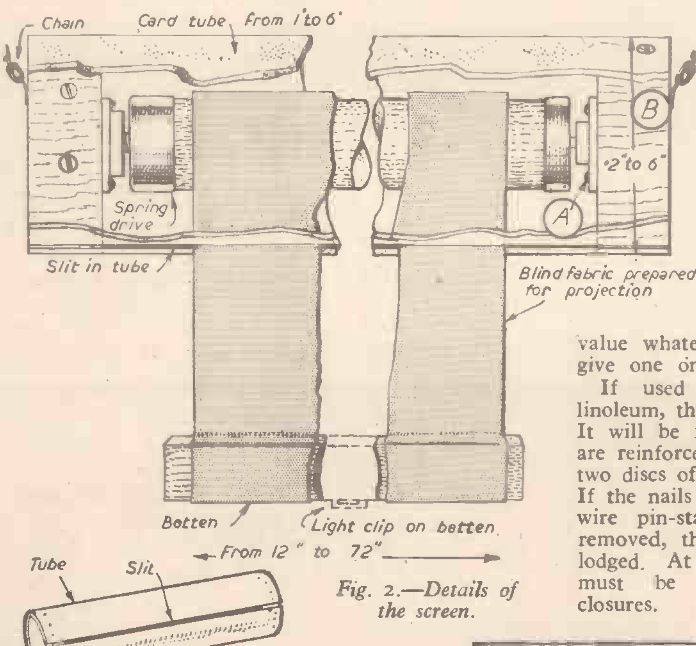


Fig. 2.—Details of the screen.

The fabric of the blind, being rather tattered at its lower end, was reduced to 4ft. long. The lower end was re-hemmed, and a rather heavier batten of 1in. × ¾in. oak was substituted for the rather flimsy lath originally fitted.

As the original colour was green (by now badly faded), the fabric was painted over with aluminium paint. This restored the material to perfect opacity, and gave a very good projection surface.

Those who prefer a white projection surface to a silver will find that a coat of "Screenwhite" or similar screen dressing over the aluminium will give a first-class white finish. The finish will be in no way impaired by rolling, since these materials are made for this type of work.

The end fittings for the roller blinds are standard equipment, sold by most household furnishers, and cost 9d. per set complete. It will be found that the bases of these fittings are turned over at right angles to offer two screwing surfaces. It may be found advisable to remove the lower of these with a hacksaw, to prevent fouling with the bore of the casing.

For those who prefer to purchase the blind new these blinds can be made up, any length, in widths up to 6ft., a typical blind for use as a screen, measuring 4ft. 3in. long × 32in. wide, ready to fit, costing under ten shillings.

The Outer Casing

For the protection of the screen and support of the roller blind spindle, a cylindrical casing was made (see Fig. 2). This consisted of a length of cardboard tubing, taken from the centre of a roll of linoleum. Most household furnishers are pleased to be rid of an awkwardly shaped end product, of no salvage value whatever, and will gladly give one on request.

If used for "full width" linoleum, the tubes are 6ft. long. It will be found that the tubes are reinforced inside with one or two discs of wood, lightly nailed. If the nails (in many cases light wire pin-staples) are gently removed, the discs can be dislodged. At least two of the discs must be preserved as end closures.

Fig. 4.—The screen in its collapsed state.

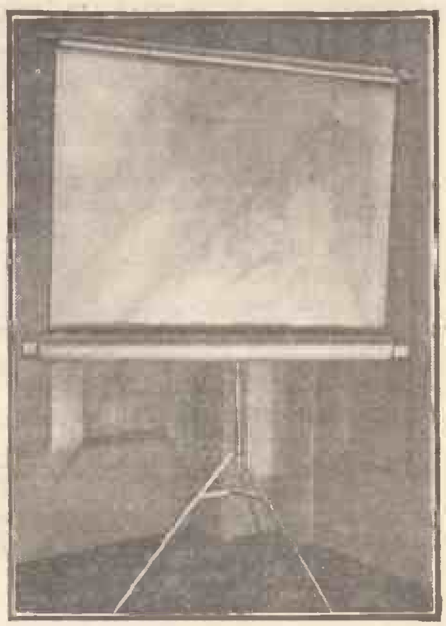


Fig. 1.—The screen on its music stand.

The tube should first be sawn to the length of the roller spindle plus the thickness of the two end closures. After this the tube may be sawn down its length, with a tenon saw (Fig. 2).

The end fittings for the roller blind spindle should be screwed centrally to the end closures. The closure carrying the circular end should be inserted into one end of the tube, and firmly screwed into position, so as to leave a slit about ¼in. wide between the walls of the sawcut. The blind travels through this slit. After the blind is fully wound, it should be introduced into the tube so that the lath lies outside of the slit. The circular end of the spindle should be engaged firmly in the hole in the fitting at the far end of the tube. The rectangular drive spindle should be enclosed in its own fitting, and the end closure screwed into place.

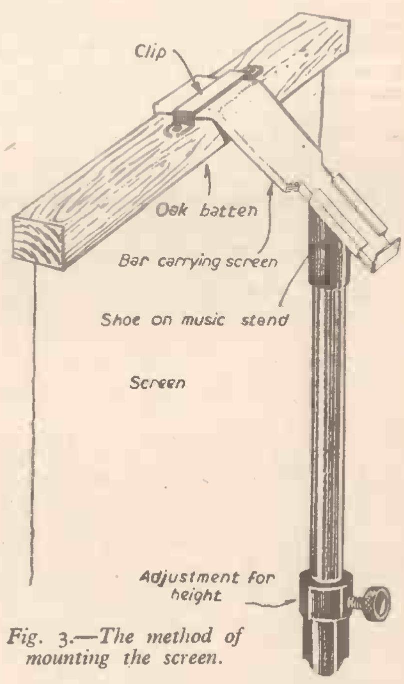


Fig. 3.—The method of mounting the screen.

At this stage the original model was papered over with waterproof packing paper, end caps of the same material being pasted

(Concluded on page 130)

Making Fishing Lures

Include These Home-made Spinners in Your Tackle

By J. C. HINES

SPINNING is rapidly becoming the most popular branch of angling and is widely used to catch many varieties of fish, ranging from salmon to mackerel.

Unfortunately the various lures are fairly expensive—about 4s. for a small and quite ordinary one, and when fishing in a weedy loch or stony river it is only too common for them to catch and be lost. They can, however, be made at home quite successfully and need cost only about 8d. each for an excellent minnow.

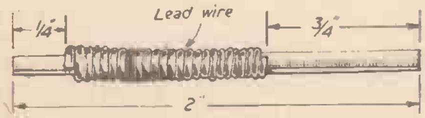


Fig. 1.—Tube and lead wire weighting.

Plastic Wood Type

For this some narrow metal tubing is required, no greater than ⅛in. o/s diameter; some types of ball-pen refill tubes suit quite well.

For a 2in. minnow cut off 2in. of tubing and wrap around about 1in. of its length with lead wire obtained from the local tackle shop; cord solder is ideal if you have it handy (see Fig. 1).

Take a portion of plastic wood and coat the tube and lead with a generous covering. Do not cover the holes in the tube. Now mould a minnow-like shape as shown in Fig. 2, making it plump at the shoulders and pinching out the fins at 45 deg. to the horizontal. They should be fairly large in area but not too thick, and it is most important that they should be drawn out from the body of the minnow and not just little pieces stuck on afterwards.

Leave to dry thoroughly for about 24 hours. Then file and sandpaper the minnow to a torpedo shape and pay particular attention to the fins, making them thinner and making the edges of them fairly sharp.

It is important that the plastic wood used should be in good condition, i.e., very soft and easily worked. If the tin is left exposed to the air, the wood becomes crumbly and useless for this purpose but may be reconstituted by the addition of plastic wood solvent.

Attaching the Hooks

Take a piece of light trace wire, a small swivel and an eyed treble hook; sizes depend on personal taste, but the largest swivel which will pass through the tube is best: A No. 12 treble would be reasonable for a 2in. minnow, although many people like them a lot larger.

Snip off about 6in. of wire, place the swivel half-way along it, double it over and twist the ends together for about $1\frac{3}{4}$in., fit a small bead to act as a bearing for the body, insert the two wires through the eye of the hook, one from each side. With pliers, wrap the wire for 5 or 6 turns around the body of the hook, bind into place with silk or cotton thread and finish off with a coating of acetate cement (see Fig. 3).

Painting

The minnows should then be painted with bright enamels. The usual colours are blue back and silver belly, or brown back and golden belly. Manufacturers usually paint neat eyes on their minnows, but as these are invisible when the minnow is spinning, they are not really necessary.

Unusual painting and markings will be dealt with later

It is always best to make the minnows in pairs, one with a left-hand spin and one with a right; this enables the angler to change his direction of spin at intervals and thereby remove the kinks from his line put in by the previous minnow.

This minnow is very useful, as its size, weight and buoyancy can be arranged in any combination. For example, any size of minnow may be made to fish deep by increasing the turns of lead and decreasing the plastic wood. For fishing near the surface over weed-beds a nice, plump-bodied minnow with little lead gives maximum buoyancy with still enough weight for casting.

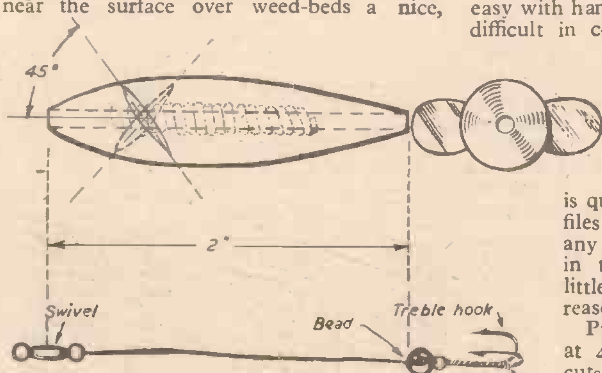


Fig. 2.—The body shape and fins and Fig. 3—the swivel and hook.

It is not always appreciated that fin size has a great effect on fishing depth. Large fins give more drag and the minnow therefore rides higher in the water, with small fins the minnow sinks deeper. This effect can to some extent be modified by the speed of recovery; fast winding makes the minnow ride high and vice versa.

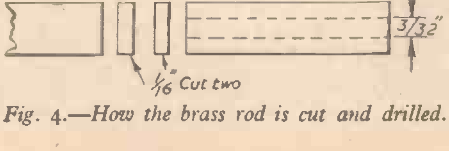


Fig. 4.—How the brass rod is cut and drilled.

A Small, Heavy Lure

The next model is a very neat and efficient lure. It is small, heavy, casts like a bullet and yet, with its rather large fins, rides at a convenient depth.

It is not suitable for large sizes, as it would be too heavy, but from ¾in. to $1\frac{1}{2}$in. it makes an ideal lure for fast spinning with fine tackle in clear water, where other lures would be too obviously artificial.

Start with fairly large ones in this range—about 1in. to $1\frac{1}{2}$in. Take a piece of brass or copper rod about ⅜in. dia. and cut off a piece the length of the required minnow with a hacksaw. Then cut two slices off the same material, each about 1/16in. thick (see Fig. 4). The piece to be used for the body of the minnow should then be drilled along its length with a 3/32in. hole. This is not easy with hand tools in brass and even more difficult in copper. The best plan would probably be to take about a dozen pieces at a time into a local machine shop and have them drilled.

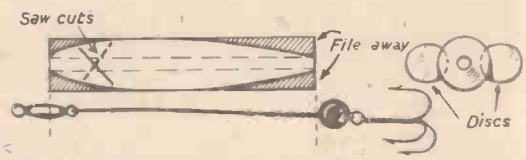


Fig. 5.—Filing to shape and fitting swivel and hook.

This piece of metal can be turned to shape in a lathe, or if this is not possible it is quite light work to shape it with files. It is important not to take any metal off the shoulders except in the very small sizes where a little may be removed to preserve reasonable proportions.

Put two saw-cuts in the shoulders at 45 deg. to the horizontal; the cuts are on opposite sides and at 90 deg. to each other (see Fig. 5).

The two discs of metal must be filed until smooth and then one edge filed until it is thin enough to be inserted into the saw-cuts. Insert the discs and solder into position, making sure that they are not inserted too far so that they block the central hole in the body of the minnow. The edges of the fins may now be filed to a sharp edge, but not sharp enough to cut the line, of course. Make up the hook and swivel as before.

In finishing, the natural colour of the metal can be used by polishing it up and adding a few dabs of brown and then giving it a coat of clear, hard lacquer. For silver minnows the body may be tinned with solder and then the blue back added and clear lacquered. The lacquer prevents tarnishing, although the lures will need repolishing and relacquering at intervals, due to scratching and chipping on sand and rocks.

The Spoon

To give a little variety to your growing minnow-box, the making of the popular spoon will be described.

To make an ordinary spoon, a piece of thin copper sheet is required. Cut a pear shape about 1½in. long.

Using a block of hardwood with a hollow carved in the surface and a ball-pene hammer, the piece of copper should be beaten to shape as in Fig. 6. Try to beat the sides of the pear shape into a deep curve but keep the metal relatively flat along its length.

Drill a small hole at the top and bottom of the spoon. It should be noted that the metal must not be hammered thin where these holes are going to be located or the

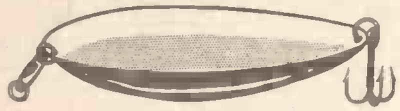


Fig. 6.—The spoon.

metal might tear through under the strain of a large fish.

The fixing of the hook and swivel is simplicity itself. Obtain some split rings from the tackle shop and fix the swivel to the broad end of the spoon by means of one split ring, and the treble to the narrow end by the means of another split ring. Use a good, big swivel as this help to give casting weight.

A favourite colouring is to leave the outside of the spoon polished copper and the inside tinned copper.

The Vibro-spoon

A very popular variation of the spoon is the vibro-spoon. This is a spoon which

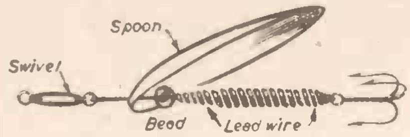


Fig. 7.—The vibro spoon.

rotates around a weighted axis; this has the effect of a slightly wobbling movement and simulates the injured or sick minnow which is such a tempting morsel to the lazier fish who do not feel like a long chase.

These can be made much smaller than the normal spoon if required, as the lead gives casting weight. For a small one empty .22 cartridge cases may be used by splitting them down and flattening them out, then cutting out a pear shape and hammering out the spoon.

Take a piece of heavy trace wire, attach a small swivel, thread on the spoon through a single hole at its broad end with the dished face away from the swivel. A small bead is now threaded on the wire which should be twisted for about 1in. and the small treble fixed in the usual way.

A piece of lead wire should be tightly wrapped around the trace wire between the hook and the bead and the finished article appears as in Fig. 7.

Special Painting Effects

Little thought seems to be given to the painting of fishing lures and the main idea seems to be to make a minnow look attractive to the angler rather than to consider what the appearance of the minnow will be in the water.

With home-made minnows the painted eyes may be dispensed with.

Secondly, when one closely observes a spinning minnow painted blue on the back and silver on the belly it no longer looks anything like the colouring of, for example, a baby trout. The two colours merely blur together and give exactly the same effect as a minnow painted silvery pale blue, which is the colour of no British fish.

An effective colouring which seems to look more natural is shown in Fig. 8. Take a silver painted minnow and paint a fairly board stripe of blue around the minnow in a barber's pole fashion. The stripe should only make a couple of turns as if the turns

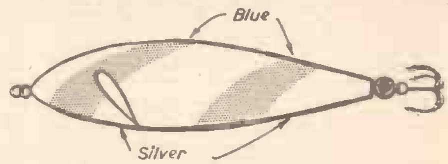


Fig. 8.—Colour scheme.

are close together the old blurred effect occurs.

It is intended that when the minnow revolves the stripe will appear to move along the minnow, giving it a live, undulating appearance.

It is a good idea to use bright red beads on minnows and spoons as this gives a good splash of colour. It is a common practice to put a few dabs of bright red paint on spoons.

MAKING A USEFUL CHRISTMAS PRESENT

A Glove Dryer and Stretcher

By H. A. VINCENT

THE drying frame is 12in. long and 4in. wide and can be made from any suitable ½in. material. Smooth down with fine sandpaper and then draw out the shape shown. Note that the middle finger is the longest, and that the general end-of-finger line is 3½in. from the tip of the second finger. First and third finger are shorter than the second and the little finger only comes level with the first joint of the second finger.

Thumbs are set further back on a hand than might be imagined and in the frame the joint is 6in. in from the extreme finger-tip. The "thumb" is held by a piece of dowel, squared at one end and round at the other. The square end is wedged into a similar hole in the thumb, the round fitting tightly into a circular hole in the frame. The thumb-piece is 3¾in long.

Having marked in the outline hand and the position for the thumb pivot, cut the shape out carefully and drill the hole. Make the thumb and tap home the dowel, first gluing the contacting surfaces.

A good tight fit with the dowel is required in both the thumb and frame and if necessary it is worthwhile to cut several short pieces till a really tight fit is secured. The tightness must not be such as to prevent stiff rotation in the frame, however.

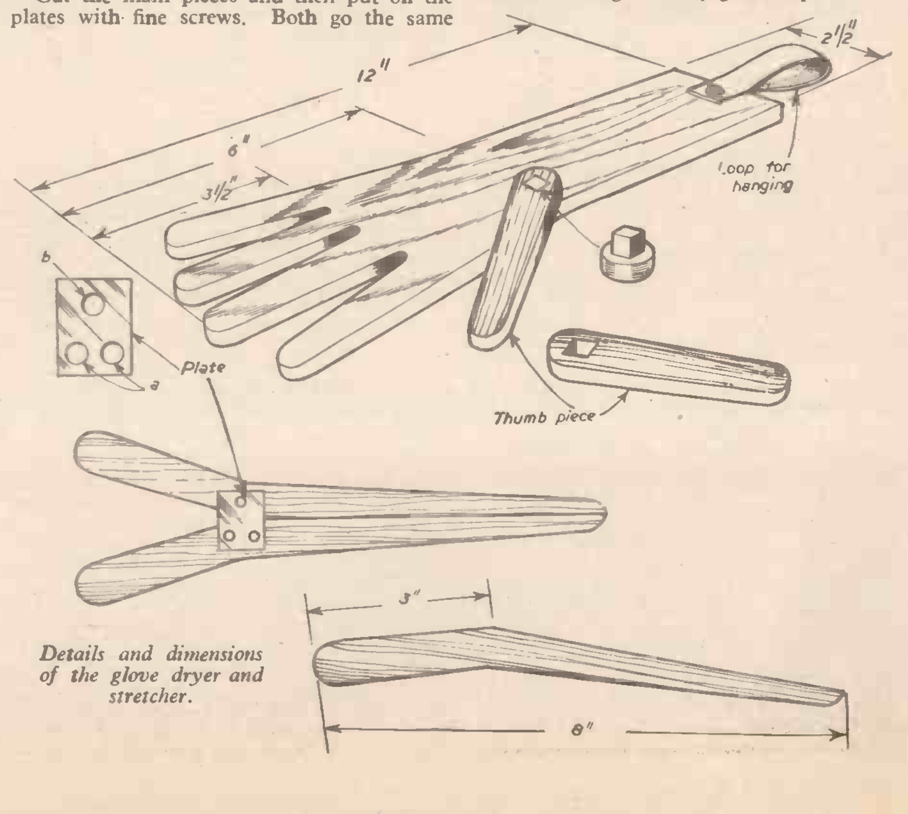
Finally go over everything with fine sandpaper, slightly rounding all the edges and fit a loop of material at the top end for hanging purposes.

The glove stretcher is made up of two pieces of wood, each 8in. long and 5/16in. thick. They are connected in the middle by two plates. These can be obtained in brass from most chain stores. There are two holes (a) at the one side, and a single hole (b) at the other.

Cut the main pieces and then put on the plates with fine screws. Both go the same way, so that the one half of the stretcher will pivot on the single screws.

To complete, round off the top edges of the pieces but leave the inner faces flat.

To give as a present, wrap the two items together in Cellophane and fasten with coloured string or fancy gum strip.



Details and dimensions of the glove dryer and stretcher.

Making Indoor Fireworks

Some Simple and Safe Varieties

THE following experiments are performed with chemicals readily obtainable from any chemist. The resulting fireworks are quite harmless.

How to Make Nitre Paper

Probably most amateurs are familiar with nitre or touch paper, but for the benefit of those who have not yet made its acquaintance, we will describe the preparation. A strong solution of saltpetre (potassium nitrate) is made, and in it are immersed several sheets of thin absorbent paper.

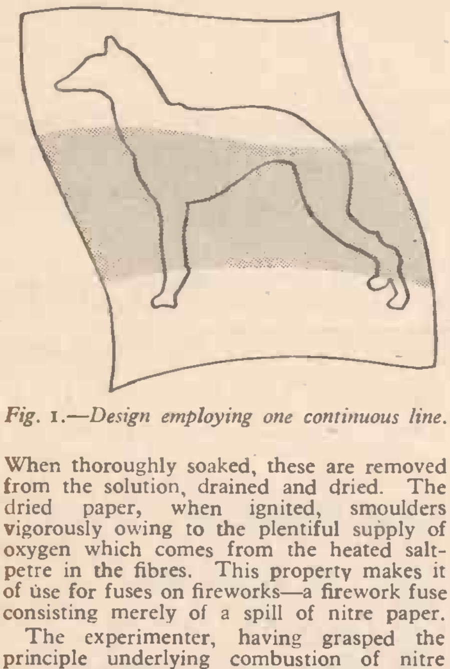


Fig. 1.—Design employing one continuous line.

When thoroughly soaked, these are removed from the solution, drained and dried. The dried paper, when ignited, smoulders vigorously owing to the plentiful supply of oxygen which comes from the heated saltpetre in the fibres. This property makes it of use for fuses on fireworks—a firework fuse consisting merely of a spill of nitre paper.

The experimenter, having grasped the principle underlying combustion of nitre paper, will doubtless devise a few entertaining tricks with it. With a paint brush and a solution of saltpetre, paint on a piece of thin paper some design employing one continuous line (see Fig. 1). Make a pencil mark at the commencement of the design, and, when the paper is dry, apply a red-hot needle to the pencil mark. The pattern will smoulder itself into visibility.

A Bombardment

Draw on a piece of paper a picture, showing in the foreground a cannon, and in the distance a castle (see Fig. 2). In the centre of the castle fix a match-head by sticking over it a fragment of stamp edging. Now, with a brush, paint a line of saltpetre solution from the mouth of the cannon to the match-head.

When the paper is dry place it on a tray and apply a red-hot needle to the mouth of the cannon. The "shot" will be seen to travel to the castle which will explode with a crack and burst into flame.

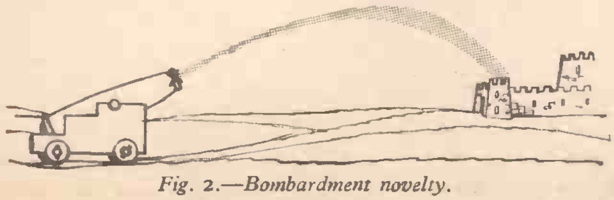


Fig. 2.—Bombardment novelty.

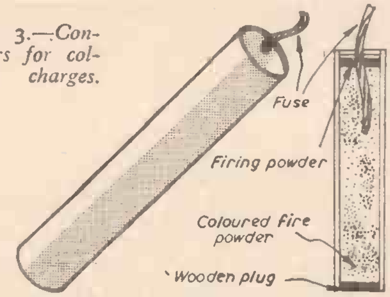
How to Make Coloured Fires

It is characteristic of certain elements that they impart to a flame a definite colour. This flame-colouring property of substances is utilised in the production of coloured fires.

Coloured fires consist of a paper cartridge packed with a powder which consists of:

1. A substance rich in oxygen which it will readily liberate under the influence of heat. This promotes fierce and rapid combustion.
2. A substance which will burn under the influence of "1."
3. A salt of a metal, imparting to the flame the desired colour. Oxygen-containing substance used is potassium nitrate. The combustible is usually flowers of sulphur. It

Fig. 3.—Containers for coloured charges.



is unwise to use potassium chlorate unless considerable care is to be exercised in the production of these coloured fires. Chlorate is liable to explode violently with friction. When mixed with sulphur, the explosive nature is considerably increased, and the mixture becomes highly unstable, detonating violently with slight friction or on being struck. The cautious amateur is, therefore, warned to use only saltpetre.

The Containers for the Coloured Charges

Cut a sheet of brown paper, 3in. × 12in., and having well anointed it with a starch paste, form it into a cylinder by rolling it round a 1in. broomstick. When the paste has set, remove the paper tube, and block one end with a tight-fitting wooden plug, as shown in Fig. 3. The powder, moistened with methylated spirit, is rammed into the paper cylinder until it lies within ½in. of the open end, and into this mass of powder is forced a length of touch paper. A layer of firing powder one-eighth of an inch deep is poured over the coloured fire powder. The touch-paper fuse is thus surrounded by firing powder. Finish off the cartridge by closing it with a disc of cardboard, punched with a hole for the fuse. When the fuse is ignited it smoulders down to the layer of firing powder; this takes fire immediately, and gives off sufficient heat to fire the colour powder; make the fuses from touch paper as already described. The firing powder is an approximate gunpowder composed of a rough mixture of powdered charcoal, powdered saltpetre, and flowers of sulphur.

Coloured Fire Powders

Blue Fire: Saltpetre 8 parts, sulphur 2 parts, copper sulphate 4 parts.

Green Fire: Saltpetre 24 parts, sulphur 16 parts, barium nitrate 40 parts, lampblack 1 part.

Red Fire: Strontium nitrate, 25 parts, saltpetre 15 parts, sulphur 13 parts, antimony sulphide 4 parts, mastic 1 part.

Pink Fire: Potassium chlorate (use with care) 12 parts, saltpetre 5 parts, milk sugar 4 parts, lycopodium 1 part, strontium oxalate 1 part.

Yellow Fire: Potassium nitrate 4 parts, antimony sulphide 2 parts, sulphur 2 parts, sodium oxalate 1 part.

In making the above powder the procedure in each case is the same. Powder the ingredients separately, and mix them thoroughly.

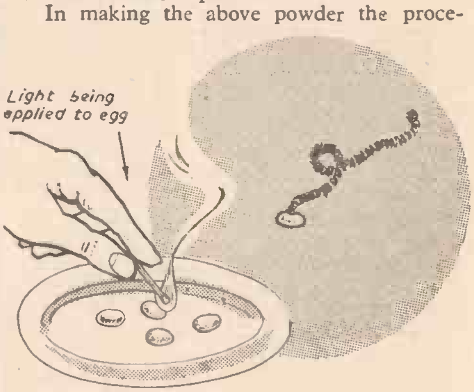


Fig. 4.—Serpents' eggs or Pharaoh's serpents.

Making Serpents' Eggs or Pharaoh's Serpents

There are several ways of making the chemical "eggs" generally known as

Pharaoh's serpents, but the disadvantage is that both they, and the ash that results from them, are very poisonous, in addition to giving off an unpleasant smell.

By making them in the following way, however, both these drawbacks are avoided, and the "eggs" when lit, are just as effective. Only three chemicals are required: 1 part of saltpetre, 2 parts of bichromate of potash, and 3 of white sugar are the proper proportions to use. Pound each of these separately very finely, then well mix together in the dry state and moisten with just enough of balsam of Peru to enable the chemicals to be kneaded into a stiff paste, that can be rolled into little balls and allowed to become thoroughly dry. Each egg may then be rolled in a small piece of tissue paper and storage should be effected in a tightly-corked bottle until wanted for use. Having manufactured the "eggs," put one into the centre of a plate or other non-inflammable place, strike a light, and apply to any part of the egg. A small spurt of flame, and then a tiny "head" peeps up, quickly followed by a long, writhing body, turning and wriggling in the most life-like manner until the entire egg has been consumed.

The Noisy Floor

Obtain a little iodine (not tincture), and with a knife gently rub into a fine powder. Transfer to a dish as much of this powder as will cover sixpence, and pour over it a little strong ammonia. Allow to stand aside for half an hour, then pour the entire contents of the dish on to a piece of blotting paper, and leave for a few hours to drain and dry. When the drying operation is completed a small amount of brown powder will remain on the paper. This powder must be handled carefully, as it is very sensitive to friction and, with rough handling, may "go off" before it is desired. Gently pick up the paper and sprinkle the powder on the floor. When anyone walks over this part of the floor they will be much alarmed at the tiny explosions which accompany every step they make, much to the amusement of the observer.

A Christmas Present for You to Make

NOVEL BOOKENDS

By V. R. BENNETT

FIRST required is a section from the bough of a tree, having an offshoot on either side. The section should be 5in. in diameter and about 5in. tall. Close grained wood is best for the purpose and, of course, it must be free from all faults (Fig. 1).

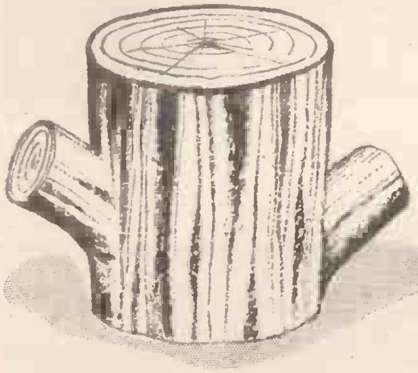


Fig. 1.—The original section of bough.

If the section found has been lying about for a time it will be probably well dried out; if not it should be dried in some slow heat.

While still in one piece, clean and polish the end which will be the top, the other does not matter, and also the extremities of the offshoot branches. Polishing is done with beeswax dissolved in turpentine to the consistency of soft butter. Shred the wax into a jar, cover with turpentine and heat by placing the jar in hot water. Do not use a naked flame. The solution is ready when cold.

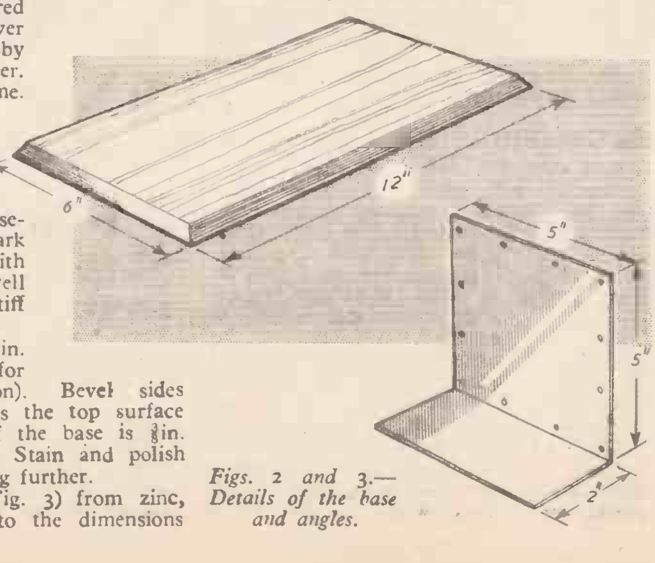
This preparation, rubbed in and polished off, will bring out all the grain and give it a close-knit appearance. The bark of the section is treated with clear varnish after being well cleaned with a fairly stiff brush.

The base (Fig. 2) is 12in. long and 6in. wide (for a 5in. diameter section). Bevel sides and end for ½in. towards the top surface as shown. Thickness of the base is ⅜in. or ½in., but no more. Stain and polish the piece before proceeding further.

Prepare the angles (Fig. 3) from zinc, which is easily worked to the dimensions shown. Drill so that there are four screw holes on each side of the upright. These pieces will be screwed to the backs of bookends, as shown in Fig. 4, where they make the base still firmer while the foot goes under the first book of the row, giving steadiness to the collection.

The parts ready, fix the log in the middle of the base with several long screws (either side of the centre line). Apply hot glue to the contacting surfaces before finally assembling.

Now carefully cut the log and the underlying base in two as in Fig. 4. Use a fine saw and mark out where the cut is to come before starting and then closely follow the line. To make sure there will be no splintering on the top surface cut the line here first with a sharp knife run along a steel edge. This breaks cleanly through the outer surface and gives the saw a start.



Figs. 2 and 3.—Details of the base and angles.

Finally, the angles are attached to the inner faces of the ends with fine screws (flat-headed and, if possible, countersunk), and a rectangle of baize is glued under the halves and the bookends are complete.

The degree of artistic effect achieved in the final appearance of the bookends depends a great deal on the log chosen in the first instance. Selection should be made with an eye to attractively formed bark, and if at all possible the log should be one that is already fully seasoned. It is not absolutely necessary for the two bookends to be equally balanced as to size, projections, etc.

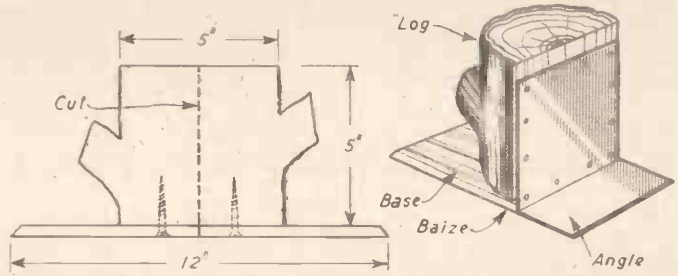


Fig. 4.—Cutting the log and fixing the angles.

Fig. 5.—The completed bookends.

A TRANSISTORISED GEIGER COUNTER—OMISSION

WE regret that the list of components was omitted from the article "A Transistorised Geiger Counter," which appeared in the November issue. The list is now given below.

LIST OF COMPONENTS

Transistor—Mullard OC72.
G-M—20th Century Electronics, Ltd., Type G5H.
Rectifiers—Standard Telephones and Cables, Ltd. K3/10.
Headphones—High impedance type.
C1, C2—.02 μF 500 v. working.
C3—100 pF.
R1—3.3 KΩ ½ watt.
R2—180 Ω ½ watt.
R3—200Ω variable, miniature Colvern.
R4—10 MΩ ½ watt.
S—Single pole single throw toggle.
Transformer—Base winding 35 turns 36 s.w.g.
Collector winding 65 turns 36 s.w.g.
High tension winding 3,000 turns, 44 s.w.g. interleaved .001in. paper.
Core—M.E.A. Type 21 Radiometal ¾in. stack.

A Simple Printing Press

Constructional Details of a Practical Unit Which Will Print Club Magazines, Handbills, Letterheads, etc.

THE apparatus described, although easy and not costly to make, is designed to produce real work, so that printing in this instance may be taken seriously.

Construction of the press, although simple, must be of first-class workmanship, for unless the press is accurately and truly made it will be of little use.

The Bed

The important part of every printing-press is the bed. In this case it consists of a prepared wood base which must be perfectly true and flat. This, added to the solidity and strength of workmanship, are its most essential factors. The entire section is made of oak. Be sure that the wood is well seasoned and dry otherwise it will warp after assembly. Concise details of this section are shown in Fig. 1, and dimensions are also given. The press is designed to print up to 8in. × 6in. size.

First, cut the actual bed-piece from one piece of oak, and see that the grain runs in the direction indicated. This is important. Finish the upper side with sandpaper until it is perfectly smooth and flat. Under this piece at each end is secured an oak runner. These serve two purposes—first, they prevent the bed-piece from warping across the grain, and, secondly, they provide a level for the press. They are fitted by gluing and screwing at each end, the heads of the screws being countersunk. On the upper side of the bed-piece is fitted a framed edge which allows for the chase to be dropped in. This must be true and square, and the simple joinery at each corner is shown in Fig. 1. Finally, down the right and left sides of the frame are fitted two guide-pieces which are glued and pinned in position, and these serve as a guide for the press-plate. This completes the bed.

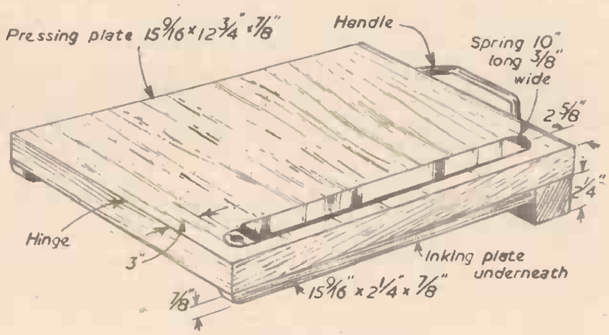


Fig. 2.—The press plate.

The Press-plate

This is hinged to the back edge of the bed, and serves also as an inker. The main piece, which is of substantial oak, is cut to size first. The complete details of this section are shown in Fig. 2. The under side, which is to face the bed, must be finished quite smooth and flat, and the grain should be in the same direction as that of the bed, as shown. The purpose of this is to balance any very minor inaccuracy. The sides of this piece must also be true and smooth and fit between the guide-pieces of the bed truly. At the front edge of the press-plate is fitted a metal handle, which must be strong and firmly secured: any handle will do for this purpose. At each side of the back of the press-plate are fitted side pieces as indicated, and these serve the combined purpose of maintaining the straightness of the plate, allowing the plate to be dropped back level without straining the hinges, and enclosing the inker.

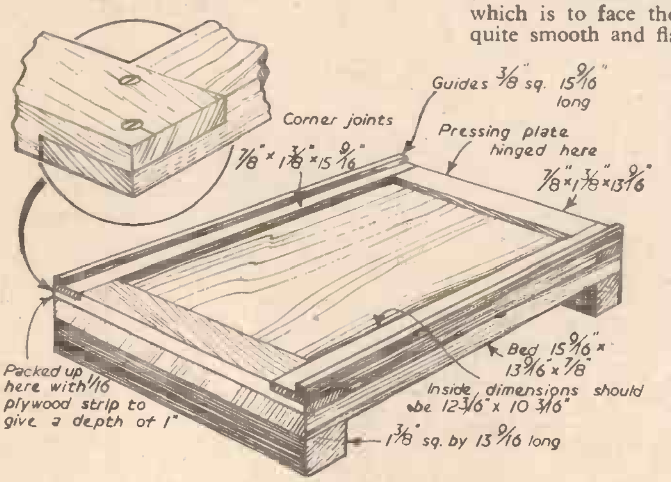


Fig. 1.—Details of the press bed.

The next item required is a strip of springy steel drilled at one end, which is fitted at the right side of the front of the press-plate. This, with the addition of registering pins, is to hold in position the paper to be printed. The back of the plate is fitted with a stout piece of zinc, or, if possible, a steel plate. The press-plate is now hinged to the bed. This part of the work must be done accurately, the hinges being recessed into the wood to give perfectly flat contact between the bed and plate. The only type of hinge which may be used is the long piano hinge, and this should be strong.

The chase, or forme as it is sometimes called, is a frame in which the type is set up. The construction of this must be just as true as the rest of the work, but it consists simply of a wood frame which must be perfectly square and flat. Details are given in Fig. 3, and from the dimensions it will be noticed that this is designed to drop into the bed and that the space for type-setting allows for printing on quarto-size paper. This part is made of oak, and the corner joints if well made, as shown in Fig. 3, and glued in addition to screwing, will ensure a square setting. For all marking out of the wood, use a steel square. The corners of the chase are rounded so that it is easy to drop it into the bed and to lift it out again. The fit should be smooth, not tight.

Type

All type is made to standard size as regards height to paper. The letters themselves take various forms and sizes, and there are a number of styles to choose from. At the moment it is enough to know that there are "caps," that is, capitals, and "lower case," that is, the appropriate small letters. The matter of type can be gone into fully when the art of printing something has been mastered. Type can be obtained from any founder by the pound or by the font, which consists of a given style with all the caps, smalls, numerals, and signs, in appropriate quantities. For use here, to commence, an assortment of discarded type may be obtained and classified. This can usually be had from the local printer.

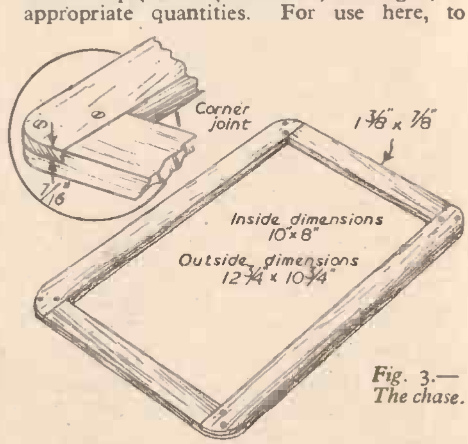


Fig. 3.—The chase.

Setting Up

This refers to setting up the type in the forme or chase. Remember that all the work is done backwards, and start on something simple like an address or visiting-card.

Balance is the first thing to consider. The type must not be all over the place, but lined up at the edges with everything well proportioned. Then the ultimate work will look neat. Before starting some "furniture"

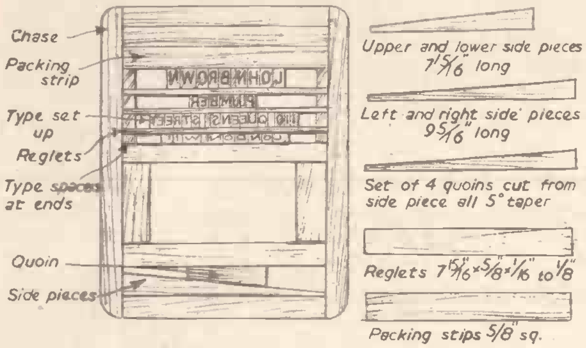


Fig. 4.—How the type is set in the forme.

will be required. This consists of wood packing-pieces of standard size, reglets to use between the lines of type, and side-sticks and quoins. To make all this clear Fig. 4 shows how the type is set, with packing-blocks, reglets, side pieces, and quoins. A stock of these is required, the side-pieces and blocks being of one length to suit the chase. Start at the top with packing-pieces, then set each line of type with blank type

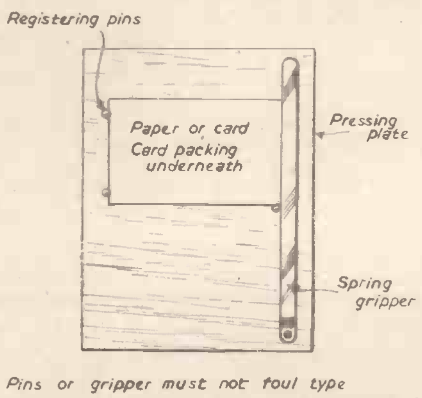


Fig. 5.—Method of registering the position of the type.

spacers between each word, and line spacers between each row, and finally pack up at the bottom, thus filling the chase. This must be done with the chase on a flat bed, and the bed of the press can be used for the purpose. All the furniture as required can easily be made from oak.

Levelling

This operation is a very important one. At the present stage the tapered quoins which must be all cut to uniform and standard taper, should just hold the "set up" in position. The chase is in the bed of the machine. Now take a piece of flat oak, measuring 10in. × 8in., and place this over the type. Gently tap it in all positions with a wood mallet, and this will ensure that all the type is sitting perfectly on the bed of the machine. Tap the quoin-pieces to get a firm grip, and then level up again. The chase should just fit in the bed if the dimensions given have been carefully followed, allowing 1/32in. clearance all round, and this should also be rigid. If not, it should be packed in with a strip of card at each side.

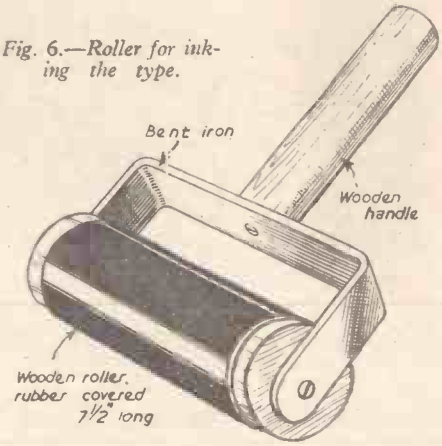
Making an Impression

Before attempting to take a number of "pulls" you must get a perfect specimen impression. First of all, register the position of the print on the pressing-plate. This is set by the simple expedient of using three drawing-pins, and the paper is set in position and held by the spring gripper. This part of the work is clearly indicated in Fig. 5. Do not, however, place your paper or card to be printed direct on the face of the pressing-plate. It must first be packed up with card, which must not measure more than 10in. × 8in. The cards should be thin and have a good surface. Try first using one card and then adding others until the best impression is obtained. This is the art of obtaining just the right even pressure all over the type-setting; insufficient cards will make a poor impression, while too many cards will make an uneven impression. The packing must be just right, and the thickness of the print card or paper must be taken into consideration.

Printing

Assuming that everything is set, prepare the inking-plate. A small tin of ink will go a long way and can be obtained either from a manufacturer or from a local printer. The ink should be dabbed on evenly all over the plate and then rolled in with a roller. Rollers such as photographers use will serve if of suitable size, or, alternatively, one can be made. This item is shown in Fig. 6. The ink must be applied to the plate thinly and rolled perfectly even, otherwise there will be too much ink on the print in one

Fig. 6.—Roller for inking the type.



place, and not enough in another. Now, close the press, run the roller over the plate, open the press, set the paper, run the roller evenly over the type with a swift movement, once forward and once back, close the press again, apply hand pressure, and open the press, and the impression is made. Before opening the second time, ink the roller ready for the next print. As regards pressure, it will be found that this differs for the best results, and the amount to apply will become known with practice. In many cases the weight of the pressing-plate alone will suffice. It will now be found possible to take a considerable number of impressions in an hour and a wide range of work—letter headings, cards, and so forth, and even school magazines—will be possible.

A ROLL-AWAY PROJECTION SCREEN

(*Concluded from page 124*)

over the "end grain" of the closures, and the entire casing was given a coat of aluminium paint. Such later treatment is, of course, a matter for the individual builder. The principal advantage of such treatment is that it is more weatherproof and presents a more "finished" appearance.

Should a constructor be unable to obtain a tube of the type mentioned, any good stationer can supply, at a reasonable price, a card tube of the type used for sending drawings, etc., through the post.

Holding the Screen

When projection is normally done in one room it is as well to choose a fixed position for screen and projector. In this case, two short chains screwed to each end of the tube, terminating in picture hooks, will hold the screen to the picture rail. In a class or clubroom, the tube might well be fixed permanently to the wall (Fig. 5).

If it is intended to carry the screen from place to place, an old violin music-stand makes an ideal support, see Fig. 3. No modification is needed. A bar of any light metal, shaped to fit the "shoe" which carries the folding music holder, is made up. This bar projects from the top of the stand, and the free end fits into a small clip, made up from light metal and screwed to the centre of the lower batten.

A small tube, plugged at one end and with a removable cap at the other, makes an excellent carrier for the stand. The two tubes, strapped together, form a compact load or storage unit, as can be seen in Fig. 4.

Two further uses of the screen are possible. In emergency either side of the screen can be used as a uniform and wrinkle-free background for portrait photography. The silvered side also serves as an ideal reflector for posed photography in any light.

Fig. 5.—The screen ready for projection.

TRICKS FOR CHRISTMAS

Specially Selected
by John Dee

Some Baffling Illusions Performed Without Special Apparatus

"Influencing" Tongs

SAY that strongly magnetic people can influence inanimate objects. Take a pair of tongs and holding them edgeways with one hand stroke the metal with the other to produce "the right conditions." Now bring a finger carefully down to the uppermost leg as shown in Fig. 1, then raise the hand slowly and the leg comes up with the finger as though magnetically held.

The illusion is effected by making use of the fact that the handle and one leg of a pair of tongs is always in one piece, it being thus possible to raise that leg by pressure from the hand holding the handle.

Carefully done the appearance of the leg coming up by attraction from the finger is very convincing. Should anyone else want to try their "degree of magnetism," pass them the tongs the other way round so that the loose leg is on top. This is an illusion not easily solved by onlookers and it can give quite a lot of amusement.

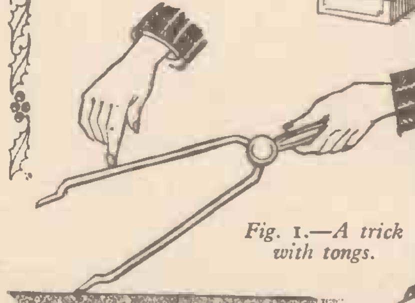


Fig. 1.—A trick with tongs.

A Mysterious Disappearance

A PENNY is placed on a sheet of white paper so that it can be seen by all. Beside it, standing also on the paper, is an inverted tumbler. This is then covered with a paper shape and the glass with its covering is set over the coin. The paper shape is removed and the penny has completely vanished, see Fig. 2. The illusion is brought about by a disk of the same paper as the underlying sheet being gummed carefully over the mouth of the tumbler which obscures the coin though still giving the perfect impression of continuous paper below.

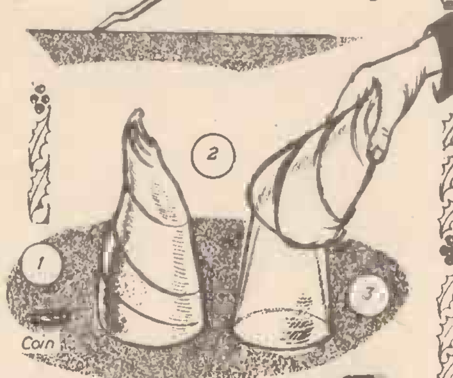


Fig. 2.—The vanishing coin trick.

Making Your Arm Longer

STAND with one shoulder to the audience (i.e., sideways) and stick out the further-side arm with the hand vertical and open, and with the cuff of your coat pulled well down the wrist (Fig. 3). Now grasp the outstretched hand on its lower edge with the thumb and fingers of the near hand and go through the actions of pulling the gripped hand outwards, at the same time stretch this forward a little which will make the cuff ride up the wrist a shade. Readjust the thumb and finger grip a bit higher up the hand and go through the pulling action once more, stretching out the hand further still, which makes the cuff ride still more up the wrist. This can be repeated several times before a limit is reached and the impression given of the arm being pulled out of the cuff and elongated is quite realistic.

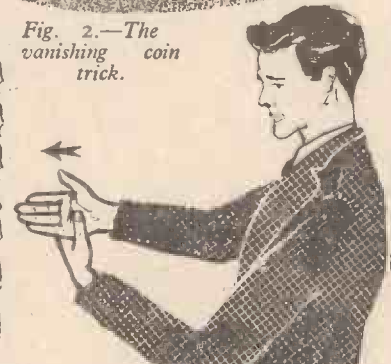


Fig. 3.—Making your arm longer.

Balancing a Cork, Forks and Shilling

WHEN the centre of gravity is below the point of suspension it is not hard to perform what appear to the onlooker to be almost impossible feats of balance. A highly scientific principle is also being demonstrated.

Take a cork, slot one end and insert the top of a shilling, and at the sides push in two forks as shown in Fig. 4.

Set up a bottle with a cork in position in the neck, protruding from which is a needle with the eye embedded and the point sticking upwards. With care the edge of the shilling can be placed on this and the whole arrangement of upper cork and forks twirled quickly round. To the watcher it all seems very wonderful. See to it, of course, that the forks chosen are of similar weight.

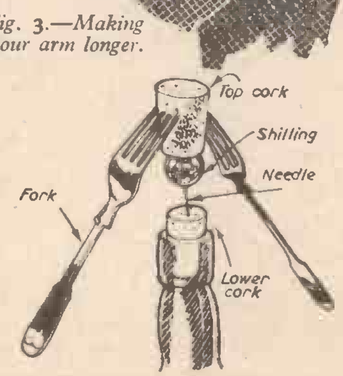


Fig. 4.—Cork, forks and shilling balance.

A Wood and Knives Balance

TAKE a piece of wood some 12in. long and insert two knives in one end sticking out at an angle as shown in Fig. 5. Now place a tumbler on the edge of the table nearest the audience and proceed to balance the cumbersome and quite weighty wood and knives on the rim. Experiment beforehand, but with the knives and wood equalling each other in weight the balancing is quite simple.

Raising the Stick

"CAN you do it?" tricks always go down well and here is a good one. Place a medium weight walking stick on a table with a few inches of the ferrule end protruding over the edge. You ask can anyone raise the stick clear of the table top using but two fingers and touching nothing but the overhanging bit.

This can only be done one way and that is with the hand positioned palm upwards, the second finger being under the stick (to act as a fulcrum) and the first finger over it applying a firm downwards pressure, as shown in Fig. 6. For some reason most people try with the hand palm turned down, when any lifting is quite impossible.

Fun With Cigarette Ash

THIS is just a trick. Ask the guests who can keep the ash on their cigarette the longest. Everyone tries hard, but one by one the residues fall off. Your own ash, however, sticks out straight and firm till the cigarette is finished (Fig. 7). The secret is that unnoticed you ran a fine needle down the entire length of the "smoke" which has given just the support necessary.

Balancing a Cigarette

ASK if anyone can balance a cigarette on the first finger (Fig. 8). Nobody succeeds, but you can get a cigarette to stand quite well. This again is a trick, for you have pressed a trifle of worked up bread into the nail which enables the "feat" to be done by slightly holding the end. As you put the cigarette in position and are apparently trying to balance it, give it a slight downward press.

A Test of Personal Balance

ASK if anyone can grasp their left ankle with the left hand and bringing it up behind so that they are standing on one foot, then bend down and pick up a matchbox set a little distance in front, as shown in Fig. 9. It needs a good sense of balance and co-ordination in the individual. This is an amusing "can you do it?" stunt to watch—and try yourself!

Turning Wine Into Water

A LITTLE tincture of iodine in water makes a strong yellow solution, but the colour disappears instantaneously, leaving clear liquid, on the introduction of even the smallest amount of photographic "hypo." This fact can be made the basis of several tricks.

Show a glass of yellow iodine solution and tell the audience it is "rare wine." Surround the glass with a cloth, and holding it up make passes over the top. Remove the cloth and the glass now contains "pure water"! The procedure was that during the passes you dropped in one of two crystals of hypo, which even the movements of holding up and setting down dissolved enough to give the desired result.

The Changing Glasses

DISPLAY two large wine glasses, one holding water and the other the yellow liquid. Have a small card screen on the table behind which a glass will just go (Fig. 10).

Drawing much attention to what you are doing, place the glass of yellow liquid behind the card. Remove and replace the screen several times to prove that the glass with its contents is indeed there. Place the glass of water out of sight on a chair behind the table.

Say you are going to change the glasses over by force of will. Magic passes again across the glass behind the screen, a few moments' patter and the card is whipped away showing now the glass of water. To prove the change is complete you reach down to the out-of-sight chair and pick up a glass of yellow liquid.

This last bit of magic is done merely by having ready there a third glass containing iodine solution. So amazed, however, are the onlookers with the glass that has altered before their very eyes that they do not think anything about the one from the chair, accepting it as the one you had put down there. Again during the passes you dropped in hypo crystals and agitated the glass a trifle.

The Obedient Card

TELL your audience that it is feasible to call a card from a pack. You hold up a pack in its case, top flap open and bent back, and loudly name a card, say three of spades. There is a pause and then the three of spades slowly raises itself. The oracle is worked by cutting a slot in the back of the case just large enough to take a finger end. See that the card named is at the back, when it is a simple matter to work it up (see Fig. 11). By memorising the last few cards the trick can be repeated several times with good effect.

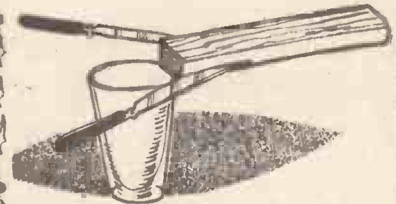


Fig. 5.—Wood and knives balance.

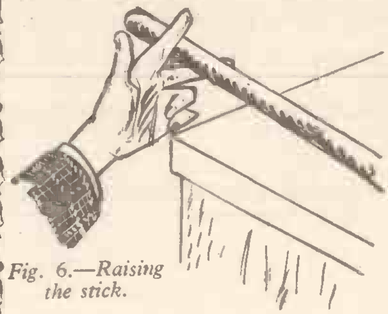


Fig. 6.—Raising the stick.

Fig. 7.—The cigarette ash trick.

Fig. 8.—(Right) Balancing a cigarette on the finger tip.

Fig. 9.—A test of balance.

Fig. 10.—Changing glasses trick.

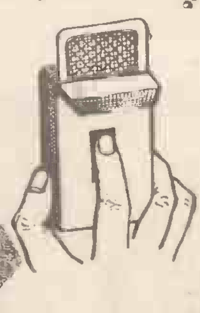


Fig. 11.—The obedient card.

SCIENCE notes

"Stellarator" for Research

AS a further step towards harnessing the sun's power, a "Stellarator" is to be built in the U.S. This already exists in smaller models and consists of a hollow tube containing gas and surrounded by coils which produce a magnetic field to confine the gas.

Bridge Raising Project

THE southern end of the Jacques Cartier bridge in Montreal, Canada, is the site of a unique engineering feat. Hydraulic jacks are being used to raise the spans from their present height of 60ft. to 120ft. The spans are raised in 6in. stages, concrete blocks being inserted after each lift. Concrete courses are poured on to the piers supporting the spans at intervals of 2ft. It is intended to keep traffic moving across the bridge without interruption throughout the whole of the two years required for the project.

Natural Steam Power Station

A NEW power station is scheduled for completion within a year on the banks of the Waikato River in New Zealand. At this station it is proposed to utilise natural steam, caused by ground water coming into contact with subterranean rocks, for electricity production.

Simultaneous Auroras

ONE of the first discoveries made during the International Geophysical Year is that the patterns of coloured lights sometimes seen in the sky and known as auroras occur in the Arctic and Antarctic simultaneously. This shows that the streams of charged particles follow the earth's magnetic field.

Jupiter's Broadcasts

STUDY of the radio noise from the planet Jupiter has shown that the sources are localised, tending to support the theory of electrical storms. It has also been concluded that the electron density is about the same as on Earth and that Jupiter possesses an earth-like ionosphere.

Radio-active Farm

A FARM near Harwell Atomic Research Station has been made radio-active to simulate contamination from an H-bomb explosion. Experiments are being carried out to find out how soon it would be possible to eat crops from the area, whether special methods of cultivation will shorten the contamination period and to what extent crops are contaminated by radio-active dust from the soil.

The most dangerous part of H-bomb fall-out is Strontium 90, but because this would cause many years of soil contamination, Strontium 89, with a half-life of only 54 days, was used for the experiment.

The Sun Photographed from a Balloon

THE first photographs of the sun to be taken from above the earth's atmosphere have been made from a giant "Skyhook" balloon. The balloon carried a specially designed 12in. telescope, a light-sensitive pointing mechanism and a ciné camera. The Office of Naval Research was responsible for this project and the balloon was unmanned.

A RADIO CONTROLLED MODEL OF THE ROYAL YACHT

The Concluding Article of a Series Describing the Construction of a 6ft.-long Boat, Electrically Driven

By G. W. PATTISON

THE transmitter in use at the present time is a crystal controlled one using two 6V6 valves drawing H.T. from an ex-Government "Hoover" dynamotor driven by a 10v. accumulator which is a duplicate of the one in the boat; they are, therefore, interchangeable. The transmitter is housed in a wooden box, outside measurements being 10in. × 8in. × 4in., see Fig. 18.

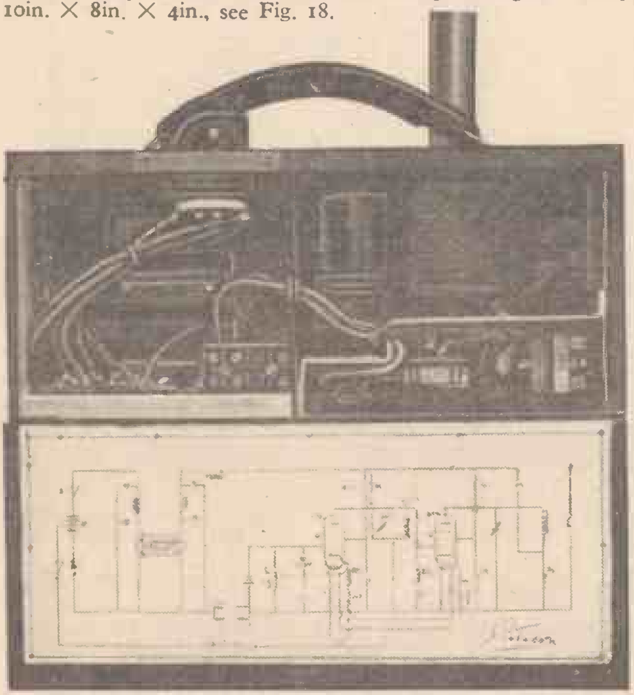


Fig. 18.—A view of the transmitter in its wooden case.

The intergear used in the "Britannia" is adequate for all normal sailing. Response to signals is only limited to the time it takes to dial a number on an ordinary telephone dial and even this has been speeded up by making the dial return to its original position much quicker than normal. Apart from this there is no delay greater than with any of the other types of control. From full port to full starboard takes about four seconds, which is usual in any type of boat. Engine controls act instantly, no mark space is used which does away with at least one source of trouble. The rudder holds in any of seven positions as long as desired and is not affected in any way by engine control. There are four engine controls, "Full Ahead," "Half Ahead," "Stop" and "Reverse." "Stop" is instantaneous by pressing a button, no dialling being necessary.

Fig. 19 shows the interior of the hull. From this it will be noted that all the intergear except the rudder motor is mounted on a board of 3/16in. plywood, stiffened by aluminium girders at the forward and after ends. Three ex-Government ratchet motors are used, one for the engine-change switch and the other two coupled together for the rudder. They are used purely as motors and are very fast in action, stopping and starting instantly. There is no "hunting" as can happen when ordinary motors are used. The selector is of the type having a double row of ten contacts bridged by a movable arm. The arm is moved by an electric magnet operating a ratchet against the pull of a spring. Another magnet pulls the pawl out of action and the spring instantly pulls the arm back to zero. Two extra contacts have been added in place of zero and these are connected to "Stop," so that by energising the release magnet, "Stop" is in action instantly.

Where considered necessary the magnets have been rewound to give ample power margin using 10v.

To key the transmitter a telephone dial is used, the numbers being replaced by the name of the signal sent out. These are arranged as in Fig. 20. The dial is mounted on a shallow box for convenience in holding and carries a coloured disc corresponding to the rudder movements. Sunk in the top-side of the box is a micro switch for the "Stop" signal. Altogether eleven different signals can be sent out, seven for the rudder, leaving four for engine control. The dial is arranged so that the finger holes on the right hand side correspond to the boat going right or starboard and those on the left to port. "Astern" and the two "Ahead" signals are situated below this arc and opposite each other so that there is no mistake when operating. "Stop" is, of course, always with the micro switch.

Dialling a Signal

Suppose we dial "Full Ahead"—this is number 2 on a normal telephone dial. Placing a finger in hole 2 and turning the dial to its check stop sends a long mark, no matter how quickly it is done. Upon release the dial returns and sends out two short marks, thus whatever the signal dialled a long mark goes out first, followed by a series of short marks corresponding to the number dialled.

The Circuit

The intergear circuit (Fig. 21) looks formidable but is really very simple and certainly very easy to get working, there being no relays to be critically set and all are amply powered. The complete circuit diagram is drawn so that it should be relatively easy to understand, but to help those who are not familiar with such diagrams it may help to follow a signal through the circuit.

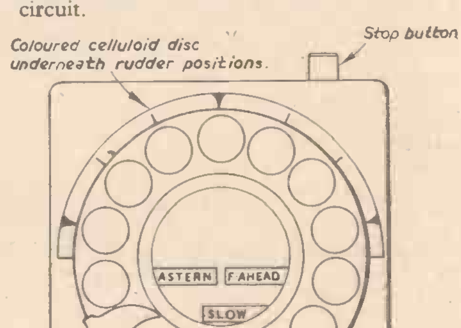


Fig. 20.—Telephone dial used to key the transmitter.

Suppose a signal "Hard-a-Port" is sent —corresponding to number 9 on the dial. This will give one long mark followed immediately by nine short ones, coming to

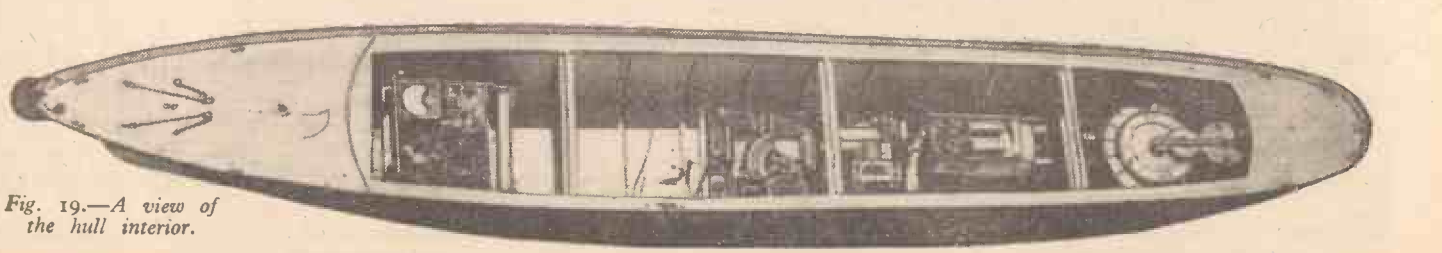


Fig. 19.—A view of the hull interior.

rest on no signal. These signals are picked up by the receiver and operate the Rx relay. The initial long mark closes the double pole secondary relay A. This immediately energises delayed relay E and opens its circuit. At the same time the selector coil C is energised and moves the contact arm one step forward, but these contacts are dead, the circuit being open at E. This "long" mark also open circuits the coil of relay B which, after a very short delay, drops off and energises the release coil D allowing the contact arm to return to 0. At the termination of this long mark relay A opens and again closes B, then follows the nine short marks. These make relay A contact nine times so quickly that relay B has not time to drop off, therefore the selector coil C steps up the contact arm until it comes to rest on number 9. The relay A then comes to rest in the off position and after a short delay, relay E falls off. The current then passes through contact 9 along the wire marked orange, through the plug connection B1, to the contact finger bearing on one of the metal discs which connects it to the port rudder motor. This immediately turns to port carrying with it the rudder and the metal discs and finally comes to rest when the circuit is broken by the insulated gap between the two discs. Should the next signal be an engine change one, say "Full Ahead" the contact arm of the selector will again fall to zero and then slip up to contact 2. The engine switch will then turn, carrying with it the disc G until this comes to rest with the insulated segment resting on the arrow marked brown. Carried round by the engine switch is also a drum on which are several projections. These close the contact points 7 and 8 also 9 and 10 applying 10 volts to the prop motor to give full ahead. From this it will be noted that the contact arm of the selector is always on the position of the last signal received and never comes to rest on 0, except when "Stop" is signalled by the micro switch. This, of course, corresponds to 0 on the selector. All these movements take place while the dial is turning and as soon as it comes to rest the changeover is in operation. Fig. 22 shows the intergear.

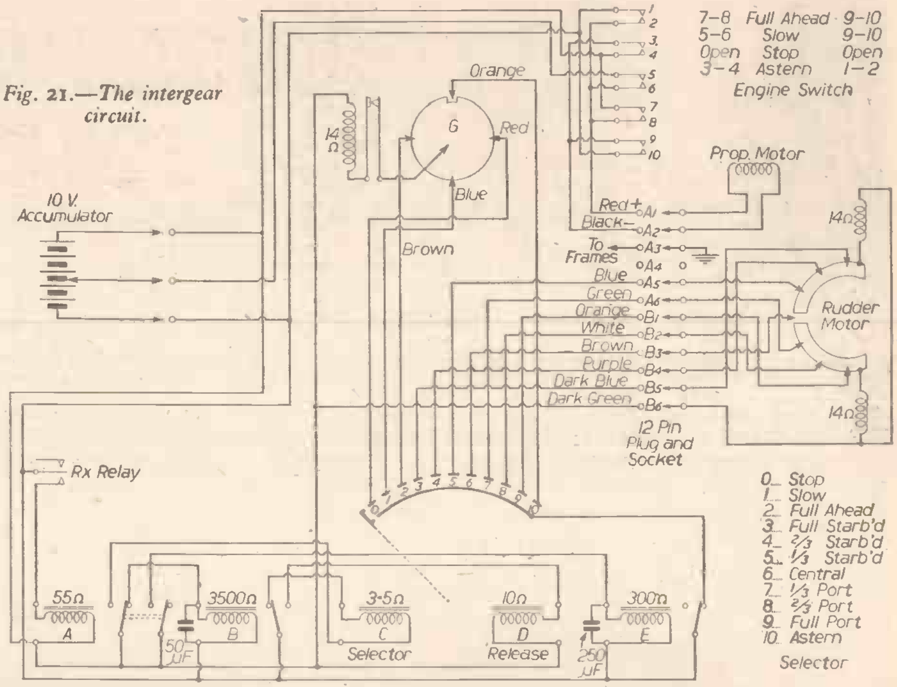


Fig. 21.—The intergear circuit.

Finishing

The last job of all is to give the hull its final coat of enamel and to fit the numerous port holes along the sides. To make the port holes wind a length of soft copper wire around an $\frac{1}{8}$in. rod and then carefully cut the coil from end to end to form a series of rings. Take care that they are all flat with the joints neatly butted together. Just before the final coat of enamel is applied to the hull is the time to fix these port holes. Do one side at a time and let it dry before tackling the other side. First lay the hull on its side and mark off the positions of all the port holes. Take one ring at a time, dip it in the enamel, shake off any drops and place in position on the hull. The enamel will contact the hull and when dry the ring will be securely held. Complete one side and allow to dry before proceeding with the others and when all the port holes are in position and thoroughly dry, give the entire hull above the water line a final coat of enamel going over all the port holes. These are then picked out with a pale blue enamel just inside the ring.

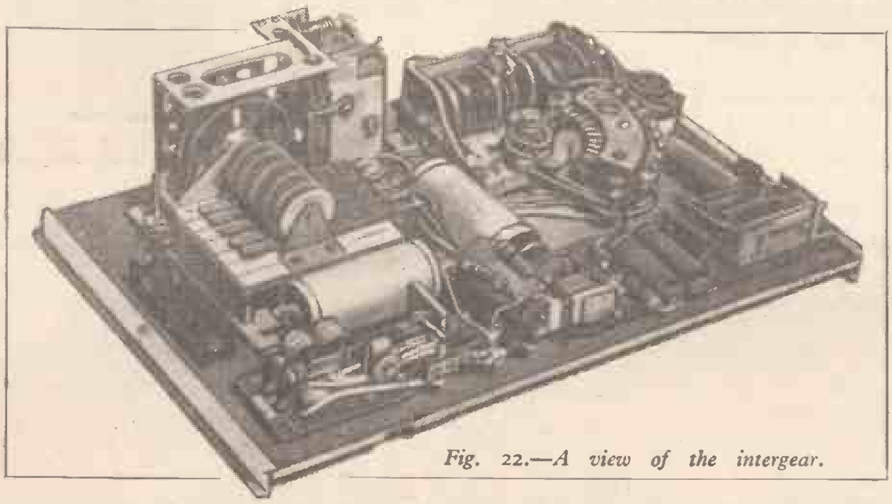


Fig. 22.—A view of the intergear.

The colours are Royal blue for the topsides with red under water. Brown is used for the toprail on all bulwarks and also the toprail of all wire railings. Boats are Royal blue, all the decks are painted buff, and lined and varnished. The funnel is painted buff together with the masts. All cabin sides are white with windows and port holes lined out with pale blue and shaded with a touch of deeper blue. The dome on the funnel and what can be seen of the inside should be painted eggshell black. All cabin doors are made in mahogany and varnished. Do not forget the gold line all round the side of the hull at deck line with the coat-of-arms on the bow. There is a small crown on each of the three mast heads and these are painted gold. Flags if neatly made and not overscale add considerably to the appearance. The full complement would be—starting at the fore end—on the jack staff a small Union Jack, then the fore mast carries the flag of the Lord High Admiral which has a red background and on it a yellow anchor, then the main mast with its Royal Standard followed by the mizzen mast with a Union Jack and at the stern a White Ensign on the ensign staff. These flags are all flown when the Queen is on board.

Fig. 23 is a further photograph of the completed model.

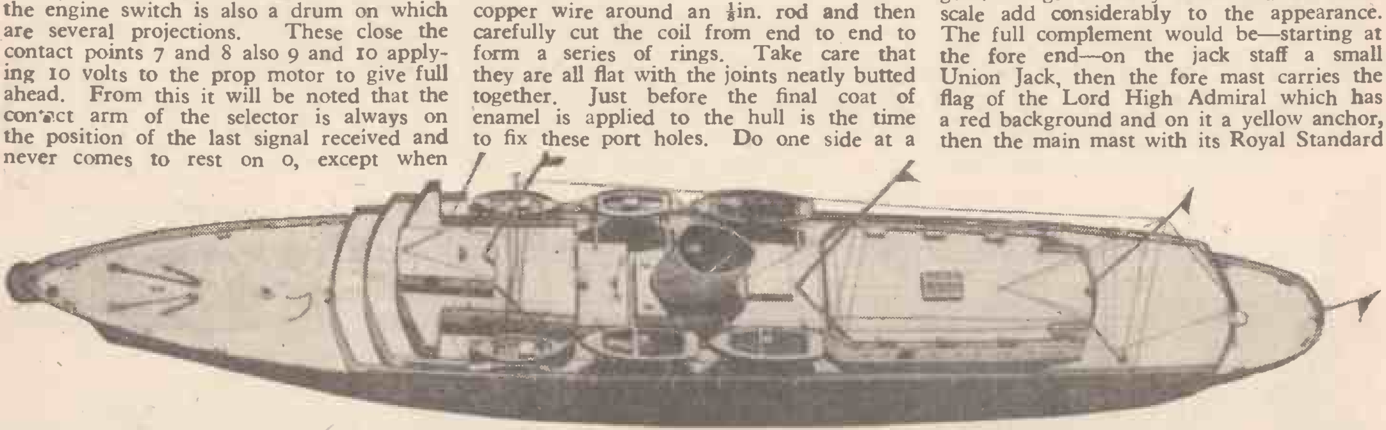


Fig. 23.—A view from above of the completed model of the "Britannia."

CURTAINS AND LIGHTS FOR THE STAGE

A Simple Curtain Raising Arrangement and System of Footlights

By H. A. ROBINSON

A STAGE must have a curtain and at least a little special lighting or much of the best efforts of actors or variety turns is lost. Small stages need these things every bit as much as larger ones; indeed perhaps more so, for here they tend to produce the impression of size and an illusion of distance between stage and audience, though the two are really quite near together.

The Curtains

To be efficient, curtains should be drawn apart by apparently invisible means and similarly dropped and there are two methods by which this can be achieved. One is the "side-drawing" arrangement and the other, which is much simpler in principle, is described here. In this method no top sliding bar with its accompaniment of runners is necessary, which is a great saving in both construction time and expense, while the cordage is reduced to a minimum. This kind of curtain has the added advantage of being noiseless in operation, which is not always the case with the sliding bar type.

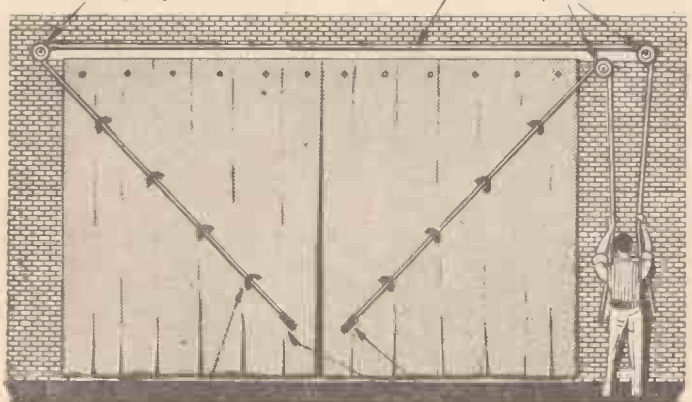


Fig. 1.—Arrangements of rings and cords.

Two rectangles of cloth must first be obtained of such a size that they comfortably fill the stage opening with an overlap in the centre. This opening can sometimes be narrowed a little with advantage by means of permanently fixed side strips thus reducing the amount of curtaining required.

Having obtained the rectangles, lay them out on a clear floor and chalk a diagonal line on each from near what will be the inner bottom corner to the top outer and along these lines sew a series of small rings—about 1in. dia. will do. The more rings there are the better the curtains will drape in their "up" position, but four or five on each line will make a workable job.

The cloths are now firmly fixed along their upper edges to the top of the stage opening as shown in Fig. 1. Where there is no proper stage front the tops of the curtains can be secured to a length (or built up length) of wood having the necessary strength and rigidity, the whole assemblage then being slung from, say, a roof beam directly above or from other suitable points.

Pulleys or solidly fixed rings are next fitted as shown in Fig. 1, a single ring or pulley on one side and two rings or a double pulley on the other. The rings are shown larger and more widely spread than they need be, for clarity. If using an independent top spar everything is fixed to it, as shown in Fig. 2.

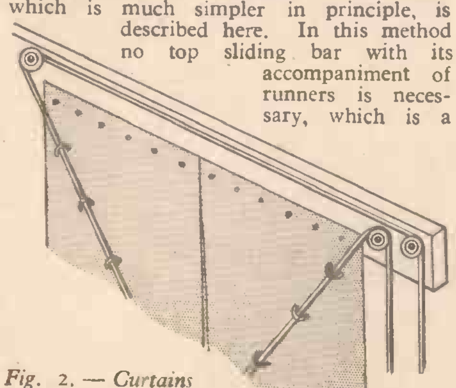


Fig. 2. — Curtains fitted to an independent top spar.

Operating Cords

Finally, pliable cords are taken from the bottom inside corners, up through the small rings and then the large ones to a location at one side. Fig. 1 makes their "route" quite clear. It is important that the cords are thin and pliable and that they are well sewn to the curtains at the lower inner corners. Plaited cord should be used rather than twisted as it has greater pliability, and gets better in this respect the more it is used.

When both cords are pulled together, the curtains will swing aside and up as in Fig. 3, draping themselves neatly. With plenty of material and an amount of room at the back of the opening, curtains like this can be made to disappear entirely, but this is not always an advantage.

Depending on the material, it may, or may not, be necessary to weight slightly the lower inner corners of the rectangle to get positive dropping and counteract any slight friction set up by the rings. If weighting seems desirable, this can be best done by sewing on a length of old cycle chain at each side.

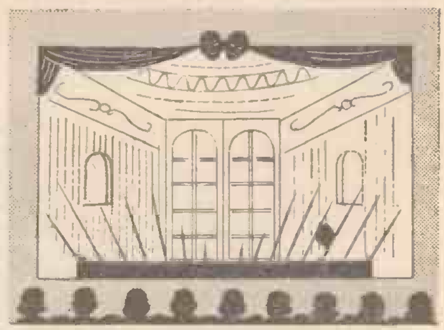


Fig. 3.—View from the front with curtains up.

With regard to satisfactory falling of the curtains, a lot depends on the even and fairly complete release of the two cords by the operator. Sliding them too slowly through the hands is fatal to a neat drop. As a fitting the operator should have a bracket near on which he can wind the cord when the curtains are to be up for some considerable time.

Footlights

For official stage work footlights are

(*Cont. on p.* 137)

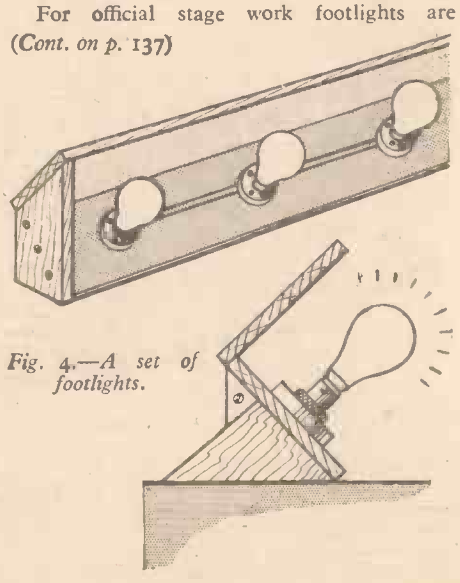


Fig. 4.—A set of footlights.

B. Parker Tells You How to Make

A Useful Drop-Leaf Table

THE drop-leaf table shown above has the advantage of occupying very little space when folded, and when open it is a surprisingly rigid structure. Its design is simple yet on sound principles and offers very little difficulty in its construction for the handyman.

The Framework

Fig. 1 illustrates the framework. It will be noted the top rail, uprights, and bottom rail are framed together, and between the top and bottom rails are the swinging arms which, when open, support the table top. These arms, turning on central pins, fold neatly within the framework, thus allowing the hinged table top to hang quite freely when not in use. Fig. 3 shows the alternative use of metal shelf-brackets as supports between the upright horizontal members of the swinging arms.

The construction of the frame should be the first consideration. Fig. 4 shows the method of jointing the various members, where, it will be seen, through tenons are employed in addition to housing. By these means, rigidity of the structure is obtained. The framework is of 2in. × 7/8in. material. This should be planed to size if sawn wood has been purchased. If the material has been machined it is advisable to check carefully the finished sizes before marking out the different joints. The measurements given in the illustrations are finished sizes. First mark out the top and bottom rails, noting especially that the distance between the shoulder lines on the bottom rail is 3/8in. longer than the distance between the inside lines of housing on the top rail. This allows for the 3/16in. housing at each end of the bottom rail into the uprights (see Figs. 1 and 2).

LIST OF MATERIALS

2	Uprights	...	2ft. 6in. x 2in. x 7/8in.
1	Top rail	...	3ft. x 2in. x 7/8in.
1	Bottom rail	...	2ft. 3 3/8in. x 2in. x 7/8in.
2	Swinging arms		1ft. 5 1/2in x 1 3/4in x 7/8in.
2	,, ,,		1ft. 3 3/4in. x 1 3/4in. x 7/8in.
2	,, ,,		1ft. 3in. x 1 3/4in. x 7/8in. Optional.
	Top	...	Boards to make up, 3ft. x 1ft.6in. x 7/8in.
2	Battens	...	1ft. 5in. x 2in. x 7/8in.
2	Metal shelf brackets, 8in. or 9in. Optional.		
1	pair Tee-hinges, 6in.		
4	Wall plates	...	2in. x 2in. x 7/8in., or
4	Holdfasts	...	6in.

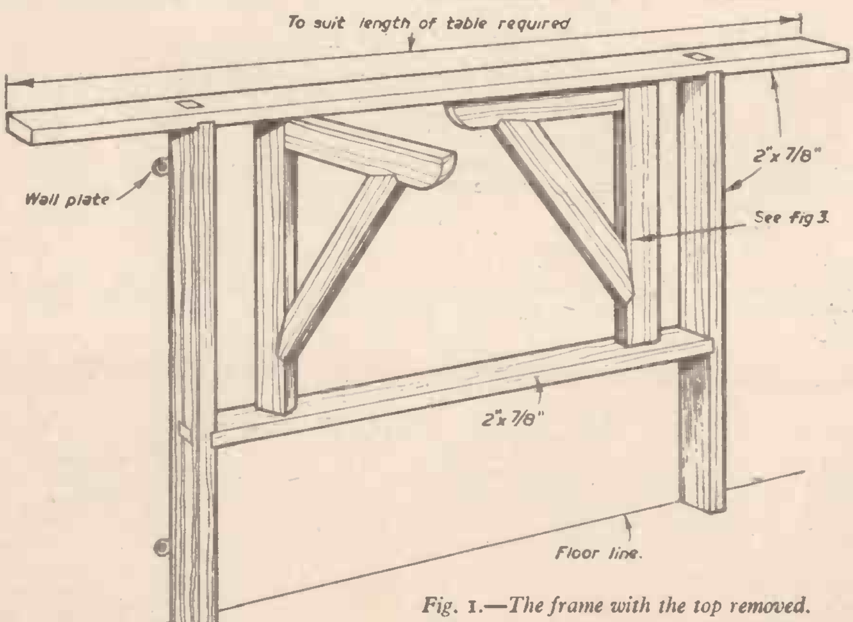


Fig. 1.—The frame with the top removed.

Mark the positions for the joints on the uprights, carefully gauging to 3/16in. for the depth of the housing. This gauging should be carried out on both edges of each piece. After carefully checking all measurements, proceed to cut out the trenches, keeping the saw and the chisel on the waste side of the lines and working from both edges of the timber.

Next mark the positions for the holes (mortices) on the bottom of the trenches, making certain these correspond to the markings on the other side. A 1/2in. hole drilled through the centre of each will assist in cutting the mortices. Again it is advisable that the cutting be done from both sides of the timber. When the four joints are cut the frame should be temporarily assembled in order to check the dimension between the top and bottom rails. This measurement is the true height from shoulder to shoulder of the swinging brackets.

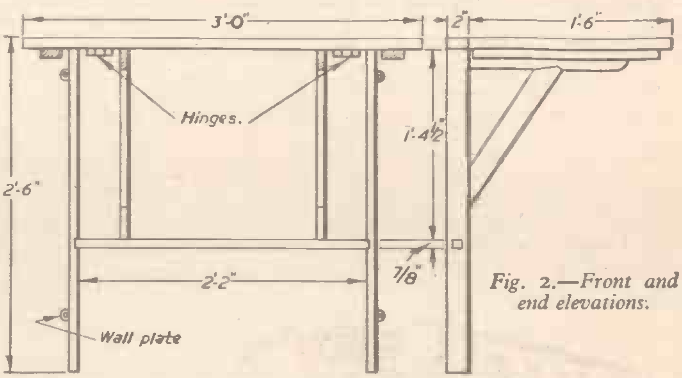


Fig. 2.—Front and end elevations.

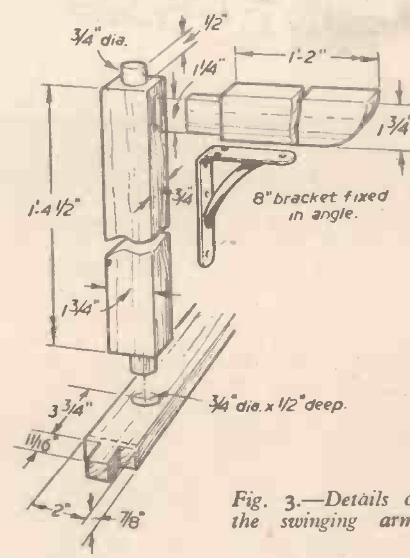


Fig. 3.—Details of the swinging arm.

The Moving Joints

Fig. 3 illustrates the details of the joints, also how the ends of the uprights are rounded to form circular pins. The length of these pins, 1/2in. each, must be added to the true distance between the two rails when cutting the lengths of timber for the vertical members of the brackets, thus these will measure 1ft. 5 1/2in. Mark out with try-square and gauge the tenon on the horizontal piece and the mortice on the vertical piece. It will be noted the tenon is reduced in width. When cutting keep strictly to the lines to ensure a well-fitting joint.

The shoulder lines for the base of the pins can now be marked with the try-square and by carefully placing a sixpence on the centre of the end, the outline of the

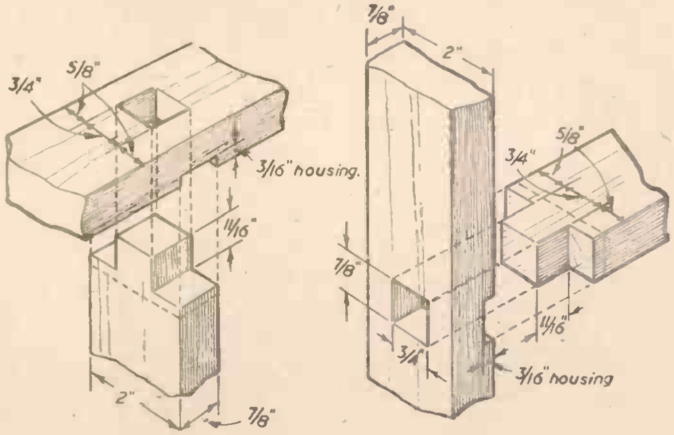


Fig. 4.—Details of the joints.

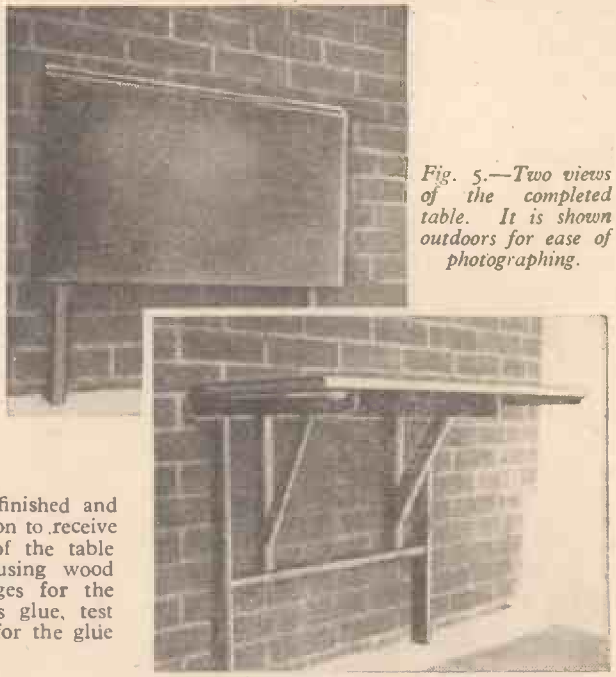


Fig. 5.—Two views of the completed table. It is shown outdoors for ease of photographing.

pin can be drawn. Care must be exercised when sawing the shoulders and also when chiselling round the pins.

Strengthening the Arms

There is a choice of two ways by which strength can be added to the swinging arm. Both are shown in Figs. 1 and 3, the use of metal shelf brackets being, of course, the simpler way of the two, yet the skilled woodworker will no doubt prefer to complete the arms in timber. In the latter case the timber braces must be accurately cut and fitted and, when glued, should be securely fixed with screws.

The swinging arms being finished and the ¾in. holes drilled in position to receive the circular pins, this part of the table may be finally assembled, using wood glue and a few short wedges for the tenons. Remove any surplus glue, test for squareness and set aside for the glue to harden.

The Top

The table top will offer few difficulties. It may be made by using several boards glued together or one piece of multiple board, strengthened in either case with battens. When all is ready, the top is hinged with 6in. Tee-hinges placed as shown in Fig. 2.

Finally, the table is fixed in the desired position by means of four stout wall-plates screwed to table and plugs in the wall, or by four 6in. wrought-iron holdfasts.

PUZZLE CORNER

HERE are some very old problems. The first concerns a hen and a half and is very well known. However, it is of perennial interest and yields a new crop of puzzlement at every revival. The problem is, "If a hen and a half lays an egg and a half in a day and a half, how many eggs will six hens lay in seven days?"

Now according to two rival camps, the answer is either 28 or 42. Which faction do you belong to?

The mathematician will say that it is too simple to be called a puzzle and that it is a straightforward piece of arithmetic. Six hens are four times one and a half hens. One and a half hens will lay one egg in one day or seven eggs in seven days, so that the total seven day output will be $7 \times 4 = 28$ eggs.

Others say that it comes to one egg per day per hen. The laying period is divided into periods of 1½ days. Total days 7. Hence batches of eggs $= 7 \div 1\frac{1}{2}$. Each batch consists of 1½ eggs per hen. So total production is $7 \div 1\frac{1}{2} \times 1\frac{1}{2} \times 6$. The 1½s cancel out, leaving $7 \times 6 = 42$.

The Share-out

This problem is very old and in quite a number of books the alleged solution is given without any hint (or apparent knowledge) that the whole thing is a fallacy.

Here is the problem. In his will a sheikh left 19 camels to his three sons. The first son was to get half of them, the next was to get one quarter and the youngest to get one fifth. No camel was to be cut up and all the camels were to be disposed of. For a long time the brothers quarrelled as to the right division and at length were persuaded to lay their case before the wise man of the neighbouring town. He found a solution. He added one of his own camels to the 19 thus making 20. To the first son he gave 10, to the second 5, and to the third 4. He then had his own camel left. Can you see the flaw in all this?

The answer is that the old sheikh made an impossible bequest. $\frac{1}{2} + \frac{1}{4} + 1/5$ adds to 19/20 not to unity. If, as suggested, the eldest son gets 10 camels, he does not get half of the original 19 but 10/19 of the whole. It has been suggested that the wording could be rearranged to permit of a logical solution, viz.: "The camels to be divided *in the proportion of* $\frac{1}{2}$: $\frac{1}{4}$: 1/5, leaving out the impossible clause that all camels had to be disposed of.

On the House!

A thirsty cowboy arriving at the U.S.A./Mexico border found that the American and Mexican dollars were at a discount of 5 cents on opposite sides of the border, i.e., an American dollar was worth 105 Mexican cents or a Mexican dollar was worth 105 American cents. In an American bar, the cowboy ordered 5 cents worth of beer, tendering the Mexican dollar. He got his drink and one U.S.A. dollar as change. He then went to a saloon on the Mexican side, ordering another 5 cent drink and paying with the U.S.A. dollar. He received his change in the form of a Mexican dollar. He repeated the process until finally jailed and this with a Mexican dollar still in his pocket. Who paid?

Curtains and Lights for Your Stage

(Concluded from page 135)

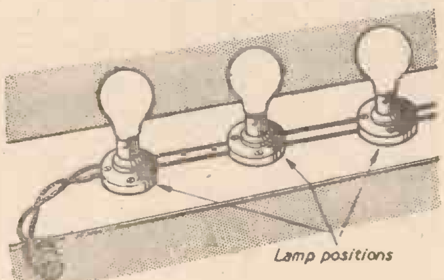


Fig. 5.—Method of wiring the lamps in parallel.

now obsolescent, their place being taken by other forms of lighting. In amateur shows, however, they are still the best sort of lighting to use, and moreover they are quickly rigged up. Fig. 4 shows a row of such lights that any handyman can make. If the stage front is narrow, the lights can be made in one length, but if it is at all wide two separate lengths are the best.

The strip which actually holds the lights is 6in. wide and about ½in. thick and the lamps are mounted in batten holders at about 1ft. intervals and should be wired up in parallel (Fig. 5). The end pieces are of ¾in. wood (Fig. 6), while the top shield is 7in. wide and made of ½in. material.

All the parts are held together by a series of fairly short screws along the seams at close intervals, this giving a stronger connection than a few longer screws wider spaced. A length as described will stand well, but if greater stability is thought desirable this is given by a triangle of ¾in. wood, as in Fig. 4, screwed on at either end. Lights of this nature can be used well with some form of "dimmer."

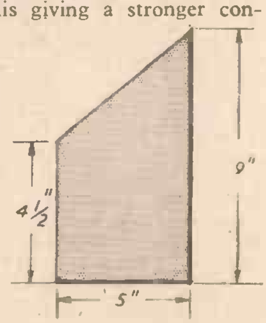


Fig. 6.—Dimensions of end pieces.

THE RUSSIAN

Its Importance in Relation to Space Explorat

Discussed by

WHILST extending sincere congratulations to those Russian scientists responsible for the design and launching of the first Earth satellite, the official radioed picture of which is shown in Fig. 2, it must be understood that the feat was in the nature of a try-out. Possibly by the time this issue is on sale the U.S.A. will also have accomplished at least one trial launching, where the accent is on projection technique with only moderate importance being placed on how the satellite itself responds in respect of any instrumentation it may possess. Provided the time lag is not markedly great, the chronological order of the Russian and American launchings has but negligible significance in the minds of those scientifically disposed. This becomes obvious when it is realised that the age of space exploration is just clear of the starting blocks.

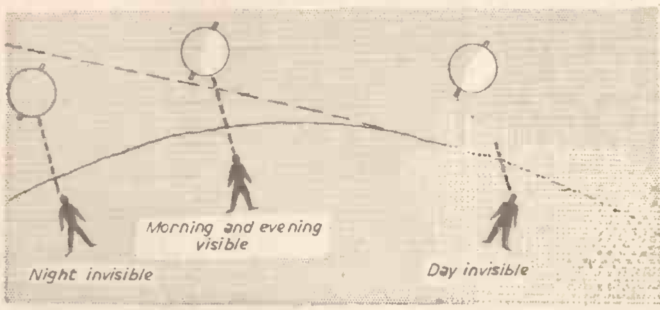


Fig. 1.—The positions of the satellite in relation to Earth.

Heavily instrumented satellites such as those which America will launch in 1958 (Fig. 3) as part of the International Geophysical Year programme, will contribute extensive knowledge regarding temperatures, cosmic radiations and meteor prevalency, all of which have a great bearing on the question of human beings leaving their terrestrial anchorage and traversing solar space. A survey of the many scientific investigations served by these complex and delicately instrumented satellite vehicles was published in PRACTICAL MECHANICS last April.

Fig. 4 shows a design from a Russian periodical of the type of satellite envisaged in the Soviet Union.

Satellite Orbits

A comparison of the Russian satellite orbit (Fig. 5) and the proposed orbit of the American vehicle is of some interest. The latter orbit will possess an obliquity (the angle of inclination of the satellite orbital plane to the equatorial plane) of 40 deg., thus affording scientists situated within a belt 40 or 50 deg. north and south of the equator the desirable opportunity of fairly continuous observation. On the other hand, the Russian trial satellite possesses an initial obliquity of about 65 deg., which is virtually a semi-polar orbit. Whilst this type of orbit provides a greater latitude coverage—much appreciated by European observers—it is unfavourable in that the satellite is lost track of whilst traversing sub-Antarctic latitudes. Fig. 1 shows why the satellite is visible only at certain times.

As all satellite orbital planes must pass through the Earth's centre, the possible orbits may be described as radially extended great circle paths. A little reflection on these circumstances will show that the initial obliquity of a satellite orbit can never be less than the latitude of the launching site. Thus the Russian vehicle could have been launched from any point south of 65 degrees N., but not from any point in latitudes north of 65.

A Surprising Weight

The October satellite, along with its temperamental radio transmitter, provokes many intriguing speculations, especially those regarding its weight, which has been stated as approximately 180 pounds. This is truly surprising, if it has been quoted correctly. One is compelled to consider the overlooking of a decimal point. The U.S. satellite will weigh about 21.5 pounds fully equipped. If we accept the quoted weight of 180 pounds, it indicates that the total mass of the launching rocket system was anywhere between 60 and 100 tons. This is an impressive rocket by any standard. Fig. 6 shows in diagrammatic form the type of rocket used. The American surface-to-surface Corporal E rocket weighs less than 6 tons and the German A4 (V2) rocket missile had a launching weight of about 13 tons.

The successful launching of such a large rocket by Russia, or any nation for that matter, bodes very well or very ill for the future, according to the tasks it may be employed in. If it, or a derivation of it, is used as an Intercontinental Ballistic Missile, there is the as yet unsolved problem of re-entry into the Earth's atmosphere at great and unchecked velocity. Unless very special cooling arrangements were made, the rocket would vaporise or disintegrate just as surely as the "shooting star" meteors we observe in our night sky.

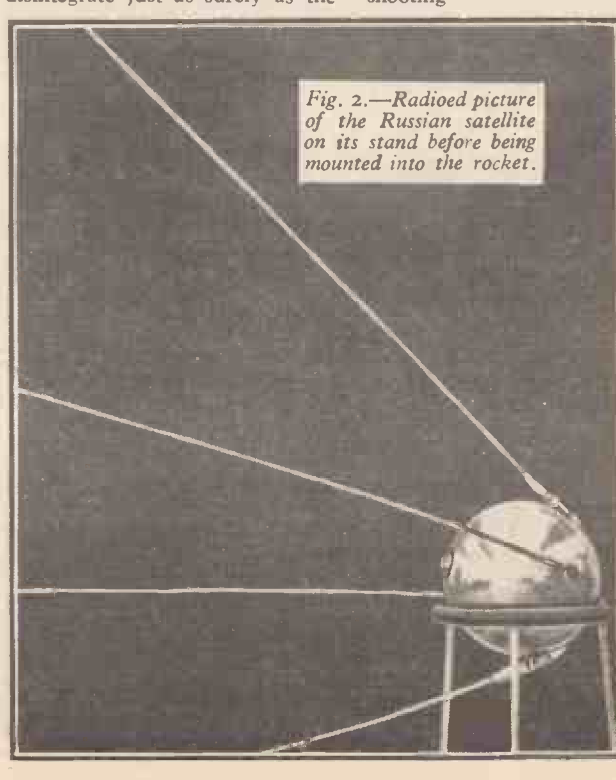


Fig. 2.—Radioed picture of the Russian satellite on its stand before being mounted into the rocket.

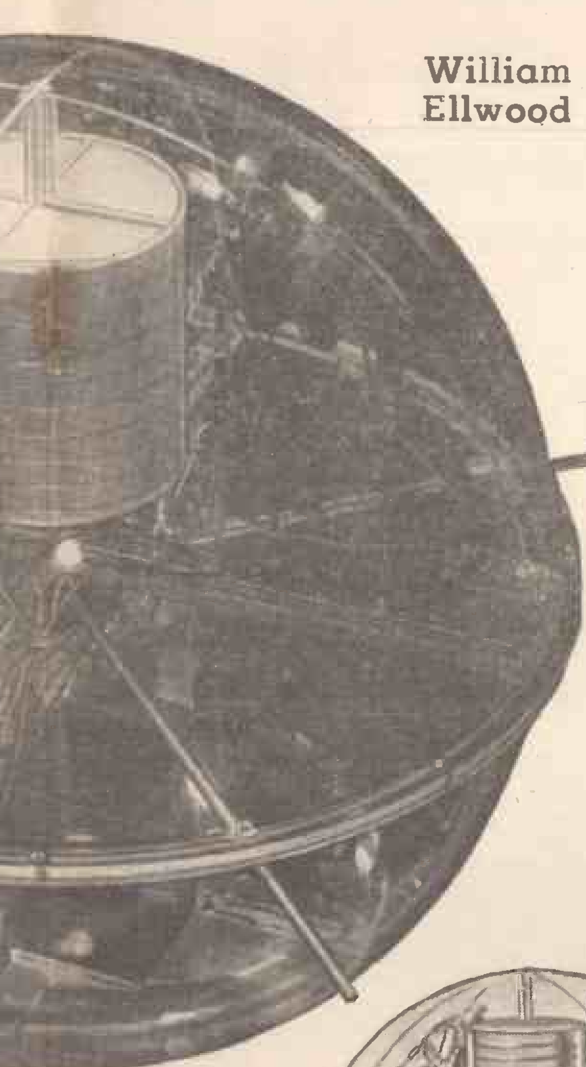
Fig. 3.—This m
reputed to be ver
real thing which
It will

It is, however, more sane and congenial to consider the descendants of these giant rockets as Man's coaches to the solar planets. There is every chance that an extra step on the probable three-stage rocket devised by Russia could give the final or pay-load step the necessary escape velocity from Earth of 25,500 m.p.h., and allow it to cruise away into solar space. Thus it is feasible to accept the proposition that the Moon could be reached in the near future by an unmanned though fully equipped space vehicle. Such experimental

SPACE SATELLITE

...tion and the Form this Exploration is Likely to Take

William Ellwood



...model of an Earth satellite is ...y similar in appearance to the ... America will launch in 1958. ... be coated with gold.

vehicles for the present, however, would only possess single tickets as there would be no fuel provision for the return journey.

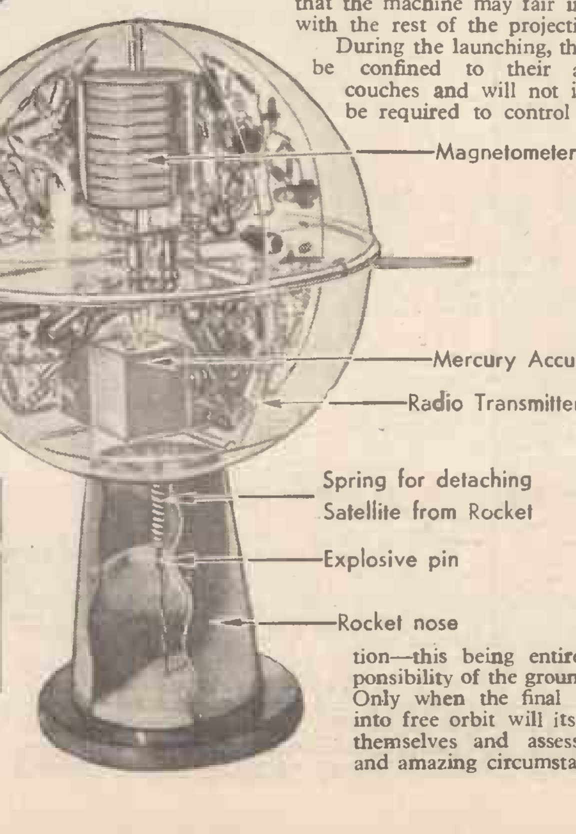
Fig. 7 shows the paths space ships will follow and the speed required to escape from the Earth's gravitational pull.

Manned Re-entry Vehicles

Animals such as mice and monkeys have of recent times been safely projected to great altitudes by specially prepared rockets (Fig. 8). If the knowledge gained from these experiments and the extensive exploration by unmanned space satellites indicates that life may be sustained outside our protective atmospheric shell, the next logical advance will be to construct and put into orbit a vehicle manned by a single individual, or at most two people.

The need for this experiment or exercise—possibly the most hazardous and delicate undertaking ever attempted by human beings—will be to develop and perfect the technique of re-entry into the Earth's atmosphere and landing safely. It is imperative that this problem be completely mastered before embarking on the next stage, which will entail placing a large and permanent space station in orbit. It is inconceivable to send forth any large number of people into solar space without first ensuring that they may return safely to the planetary surface.

In this re-entry experiment we can assume that the small crew will be housed in the final step of the rocket system and be provided with all necessary provisions and accessories for survival in space. This final step will possess the essential mechanical and flight characteristics of a high-speed rocket/jet aircraft, the wings of which must be capable of being retracted or folded so that the machine may fair in smoothly with the rest of the projection system. During the launching, the crew will be confined to their acceleration couches and will not in any way be required to control the operation—this being entirely the responsibility of the ground personnel. Only when the final step swings into free orbit will its crew bestir themselves and assess their new and amazing circumstances.



Fi[illegible].—(Right) A diagram of a model of the Russian Earth satellite. It is taken from the Russian publication "Young Technique."

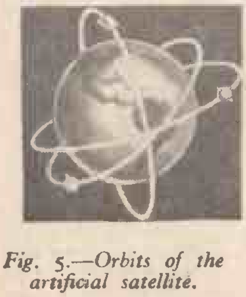


Fig. 5.—Orbits of the artificial satellite.

The Unwinking Star

Outside they will behold a monstrously large and unwinking star set against the diamond-studded blackness of space. This will be our Sun, seen for the first time by human eyes in all his celestial grandeur. Looking away from this pivot of the solar system, they will discern through the reflected glare from the Earth's surface, the subdued greens and browns of the continents, the dazzling whiteness of the polar regions, and the vast dark areas indicating the great oceans of our planet. The stark and airless form of the Moon slips behind the Earth, only to reappear time and again at intervals of an hour or two as the manned vehicle pursues its rapid course.

Descent from Space

For a few days the crew will make careful observations and investigations with the aid of highly specialised instruments. At certain intervals contact will be made with terrestrial headquarters, but for much of the time the crew will be very alone in a tiny world of their own; in a silence broken only by the desultory arrival and crackle of micrometeors as they speed in from stellar space and impinge on the outer casing of the vehicle.

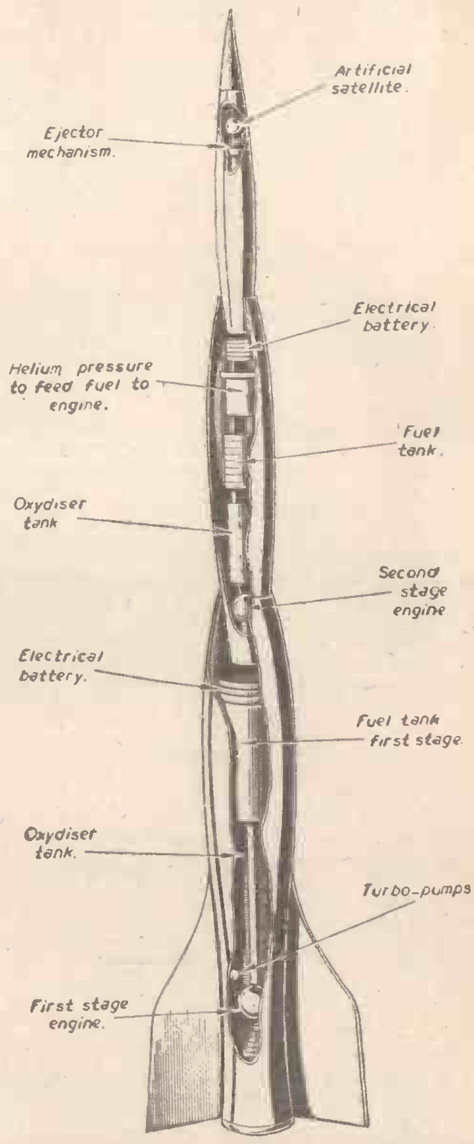


Fig. 6.—A typical three-stage rocket like that which lifted the Soviet artificial satellite into its orbit.

Eventually the critical moment will arrive when these space pioneers will commence their journey back to Earth. By adroit use of reverse rocket motor thrust, the direct orbital velocity of the vehicle will be reduced, thus decreasing the degree of centri-

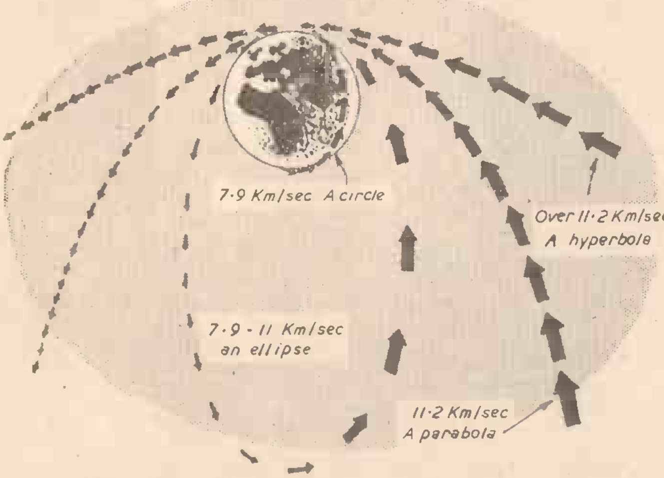


Fig. 7.—Spaceship paths. The illustration is from Soviet publication, "Interplanetary Travel."

fugal force which has hitherto kept the vehicle balanced in orbit against the Earth's gravitational pull. This gradual reduction of true orbital speed will cause the vehicle to approach the Earth in a shallow spiral, analogous to a coiled spring. With the wings and other flight surfaces of the vehicle extended and the machine nursed into the atmosphere the task will become less acute, for the jet engine may then be brought into service. Before this happy altitude is gained, however, the inevitable duel with the increasing gravitational force, counteracted or damped solely by the precious thrust of the rocket motors, intimates very plainly indeed the super mental category to which space pilots will have to belong.

Fig. 8.—Living monkey being removed from "Aerobee" rocket after being projected to a great height from Holloman Air Force Base, New Mexico.—Official U.S. Photo.

The Space Station

With the re-entry problem resolved, the next stage on our journey to the Moon and planets will be the erection in space of a station or large satellite, where vehicles from Earth may anchor and where the construction of a large nuclear-powered interplanetary spaceship can be undertaken. If this space station is achieved within the next 10 or 15 years, there can be little doubt that men from Earth will have set foot on Mars long before the end of this century.

The idea of utilising the Moon as an interplanetary base is not feasible; for although its gravitational force is much less than that of Earth, it is still strong enough to make frequent landings on and launchings from its surface a precarious and uneconomical proposition. The Moon will certainly be explored and probably colonised, but it is unlikely that it will ever become a final departure point for interplanetary "orbit - to - orbit" spaceships.

The space station will be constructed of pre-formed parts. These parts will be launched from Earth in medium - sized rockets capable of projecting a modest though useful payload step. The launchings, of which there will be many, will be carried out in such a manner as to place pay-load steps in a sensibly close group in the selected orbit, say, 2,000 miles from the Earth.

After all necessary parts have been projected, it will be the turn of the constructional engineers to be launched into the orbit. Each personnel vehicle—a larger and modified version of the re-entry vehicle described previously—will carry one pilot and about three technicians or engineers.

Each of these personnel vehicles will also incorporate an airlock entry so that passage to and from the vehicle may be effected without depressurising the main cabin.

Construction Capsules

The space engineers may wear space suits fitted with miniature rocket motors and also, as an extra safeguard, arrange a network of hand-wires between the orbiting personnel vehicles and the various component supply steps, before starting work on the station. Alternatively, they may emerge from their airlocks in pressurised rocket manipulated capsules which incorporate mechanical handling devices similar in type to those used in atomic laboratories and power stations.

Whichever way they go about their task, it is certain that construction will proceed quite rapidly, for girders, metal sheets—in fact everything—will be virtually weightless. There will be no need of cranes or other lifting mechanisms at any time throughout the whole construction of the space staion.

Artificial Gravity

It is not known what effect prolonged zero *g* conditions have on human beings.

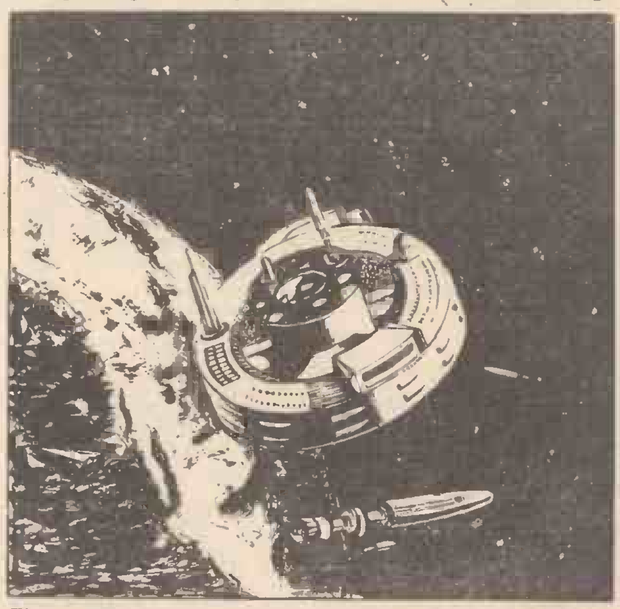


Fig. 9.—An impression of a space station orbiting the earth at a range of between 2,000 and 3,000 miles.

If a "gravitational" force is desirable or deemed necessary in the new space station, an artificial force may be conveniently introduced. This could be achieved by simultaneously firing a series of rockets positioned tangentially to the external surface of the station's outer rim. The resulting revolving motion of the whole station irrespective of the latter's attitude or velocity in orbit, would induce a centrifugal force. In brief, the inside surface of the outer rim would become the "floor."

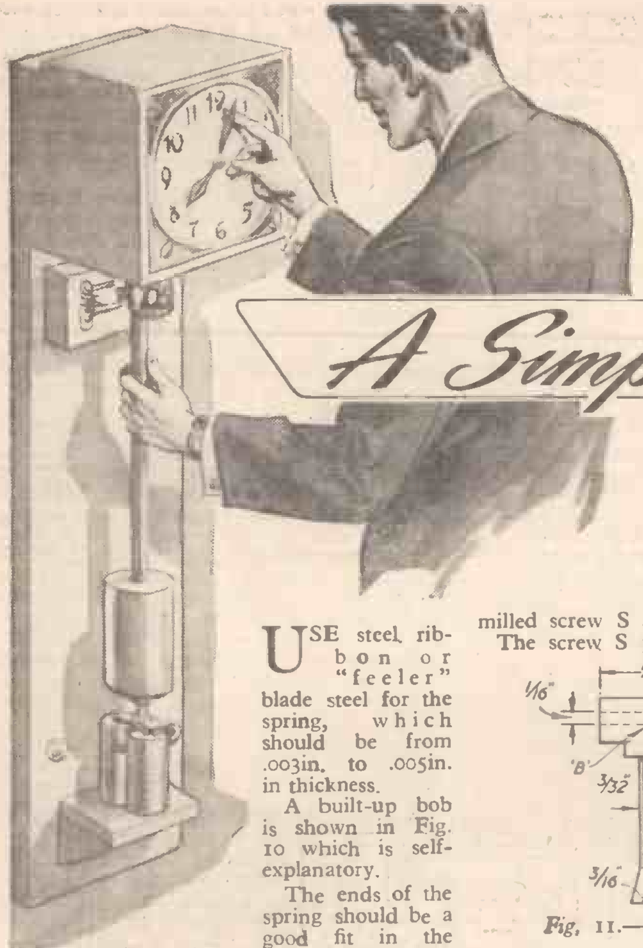
In this case, entry to the station would be made by passing into the central duct and berthing—if in a spaceship—in one of the anchorage channels. Disembarking space voyagers would then be admitted to one of the airlocks in the central duct, where they could then "descend" by stairway to the perimeter apartments of the space station (Fig. 9).

A Simple Electric Clock

Making an Accurate Battery-operated Timekeeper

By "HOROS"

(Concluded from page 70, November issue)



USE steel ribbon or "feeler" blade steel for the spring, which should be from .003in. to .005in. in thickness.

A built-up bob is shown in Fig. 10 which is self-explanatory.

The ends of the spring should be a good fit in the suspension bracket and the end of the pendulum respectively; the upper end of the spring has a pin Q (Fig. 7) that normally rests in the notches of the bracket. The length of the pendulum is measured from the bottom of the bracket to the centre of the bob; any slight error in length is easily corrected by altering the position of the bob by means of the timing nut U (Fig 9). Figs 7 and 9 appeared last month.

Trailer or Finger

A piece of steel wire D (Fig. 11) is flattened at one end, the other end being driven into and soldered to the block B. The latter has a hole drilled at right angles to D to take the pin carried by the pendulum fitting.

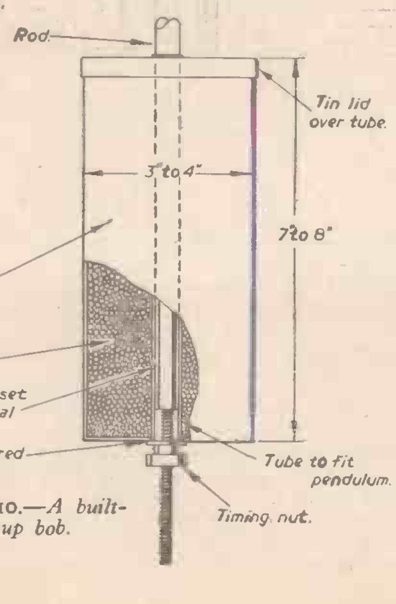


Fig. 10.—A built-up bob.

The whole fitting should be as light as possible; to reduce wear the flattened end of the wire D should be filed to a point and hardened.

To support the finger the special fitting shown in Fig. 12 will have to be built up. This consists of a piece of thick tube T to fit the pendulum rod R freely, and on opposite sides of the tube are soldered the bosses A and B; these are drilled and tapped to receive the milled screw S and the pin P.

The screw S provides for adjustment of the finger up and down the pendulum rod relative to the contact-maker.

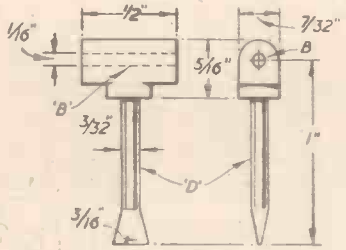


Fig. 11.—The trailer or finger.

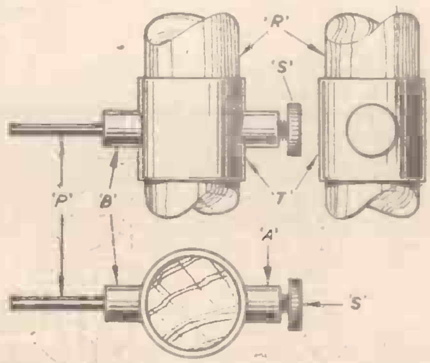


Fig. 12.—The fitting for the finger support.

The Wheelwork

To reduce the amount of work and the tedium of building up the wheelwork it is proposed to utilise the movement of an alarm or other clock.

It will be appreciated that, although certain additions are made to the frames, and wheels removed, the positioning of the wheels will not be affected.

If the movement has a seconds hand, remove all the wheels in the alarm train, followed by the "balance wheel" and "escapement"; after that, dismantle the large wheel carrying the main spring of the going train. The movement will now consist of the wheels shown in Figs. 1 and 2.

Pendulum Size

If a three-quarter seconds pendulum is used, its length will be 22in., measured as shown in Fig. 9, and the number of teeth in the ratchet wheel will be 40, since a three-quarter seconds pendulum makes 80 swings per minute. On the other hand, if a long or seconds pendulum is preferred, with a length of 39.12in. the ratchet wheel will have 30 teeth. Frequently, on counting up the number of teeth on the highest driven wheel of the movement, they will number 40, which is suitable for a three-quarter seconds pendulum.

In this case it is not absolutely necessary to substitute a ratchet wheel of 40 teeth, but the driving pawl will have to be carefully shaped to fit the teeth of the wheel. If it is decided to replace the wheel by a ratchet-wheel with either 40 or 60 teeth, particulars for setting out will be found in Fig. 13.

The length of the pendulum will not affect the other details of the clock, which can now be considered in detail.

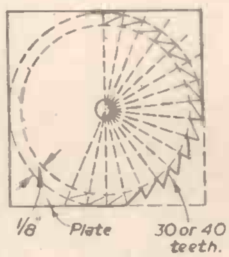


Fig. 13.—Details for setting out the ratchet wheel.

The Frames

To support the arbor carrying the gravity arm it will be necessary to rivet or bolt to the frames two brass strips K (Fig. 14). These are tied together at the upper ends by a length of 2BA threaded rod F. A piece of tube T slipped over the rod serves as a distance piece when the nuts are screwed up. Viewing the movement from the back it will be advisable to remove the top right-hand pillar originally fitted for keeping the frames the correct distance apart.

Holes are drilled in the strips K to take the gravity arm arbor O.

As clock frames vary in size it may become necessary to modify slightly the dimensions given in Figs. 14 and 15, but no great difficulty will be experienced.

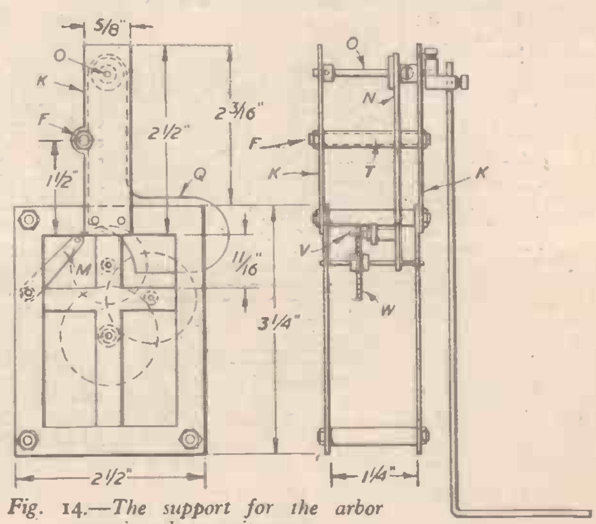


Fig. 14.—The support for the arbor carrying the gravity arm.

The Gravity Arm

This component is made from a piece of sheet brass and should be of ample proportions and heavy enough to propel the ratchet wheel.

A projection Q (Fig. 15) on the lower end of N carries the pawl R, engaging with the teeth of the wheel W, whilst its upper end is fitted with a bush to suit the arbor O. Dimensions can only be given approximately here and the constructor can modify this to suit his special requirements.

The pawl is built up from a brass strip X, mounted on and soldered to a piece of thick tube T to act as a bush, which in turn oscillates on the pin P projecting from Q.

A pin V, riveted to the outer end of X, engages the teeth of the ratchet wheel; the pin should be filed to suit the shape of the teeth.

To prevent the pawl from dropping and picking up more than one tooth when withdrawn by the pendulum, a pin Z may be set in the arm on which the pawl may temporarily rest.

The back stop M can be manufactured in much the same way (see Figs. 14 and 16).

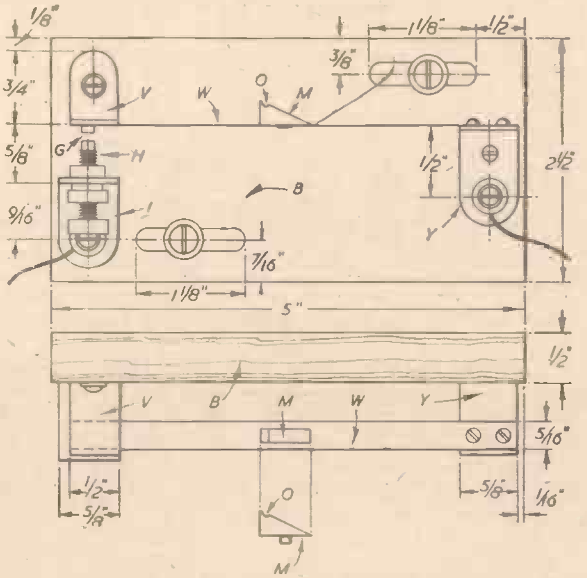


Fig. 17.—The contact maker.

Contact-maker

This device takes the form of a light spring W, riveted at one end to a brass bracket Y (Fig. 17), screwed to a wooden

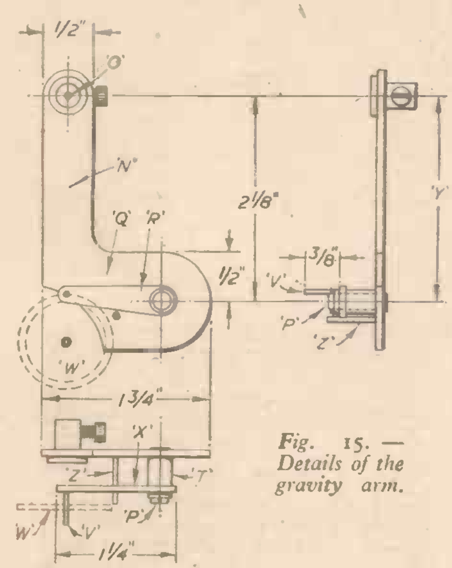


Fig. 15.— Details of the gravity arm.

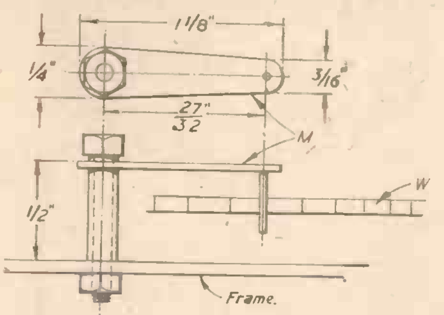


Fig. 16.—The back stop.

or ebonite base B. The free end of the spring is provided with a contact G, engaging with an adjustable contact H, carried by the bracket I.

To restrict the play of the spring an adjustable stop V is introduced; thin strips of leather, etc., may be glued to it to silence the action when the spring is released.

The spring should not be too stiff, otherwise in depressing it a lot of unnecessary work will be thrown on the pendulum.

Riveted or otherwise mounted on the spring is a small wedge-shaped steel block M; the latter has a small nick O cut at one end of the entry of the point of the finger.

The base-board B should be provided with slotted holes for adjustment.

Crutch Rod Details

The connecting link between wheelwork and pendulum is the crutch rod L (Fig. 18). To render the rod adjustable up and down the pendulum, as well as along the gravity arm arbor A, a small fitting B is cut from a block of brass and has two holes drilled at right angles to take the arbor A and the lever L respectively; tapped holes receive set screws S for locking purposes.

Hands and Dial

The design of the hands and dial are left to the constructor's taste. The former should be fairly light and correctly fitted to the movement. The dial may be made of cardboard, brass or any other suitable material and should measure 7in. across. A suitable dial may be purchased for a few pence, although there is no reason why it should not be home produced.

There are various ways of mounting the dial, one being shown in Fig. 19. Here the dial is secured to a three-ply dial-board, which is in turn screwed to the pieces C and D.

Mounting and Wheelwork

All the components are erected on a substantial back-board so that the whole may ultimately be placed in a suitable case. The batteries may also be housed in the bottom of the case. The clock frame fits over the block W, attached to the board B. The board slides in between two wooden uprights C and D, and rests on the strips E and F which are attached to them. The sizes of C and D will be decided by the dimensions of the framework. Holes are drilled in the clock frame for the screws S, securing the frame to the block W.

The back-board A should have a centre line drawn on it and, when hung up or set, the line should be truly vertical. Screw the pendulum suspension bracket to the top of the board so that the pendulum hangs in front of the line on the board. Next place the electro-magnet in position so that the cores are central with and about 1/16in. below the armature; the gap can be reduced to a minimum later by packing up the magnet with cardboard. The magnet is best supported by a bracket or shelf as shown in Figs. 2 and 3.

The position of the contact-maker is found by experiment, mounting its base-board a little above the mid-position of the pendulum rod. The rod should hang vertically at the time and the board set so that the nick in the steel block is on the left of the finger. Then lower the finger attachment on the pendulum, until the former is about 1/16in. below the block. A little experimenting will be necessary to get the best results, raising the finger may be necessary if the spring is depressed more than, say, 1/32in.

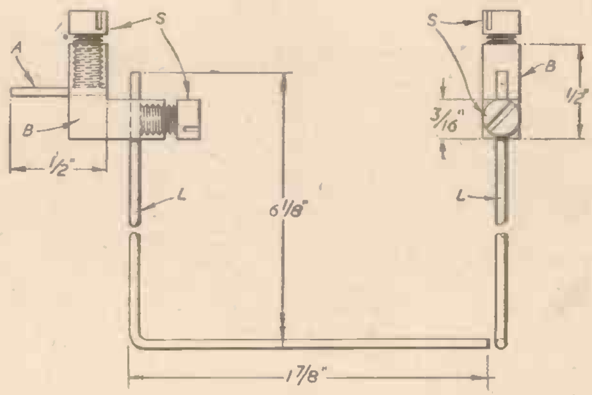


Fig. 18.—The connecting link between the wheelwork and the pendulum.

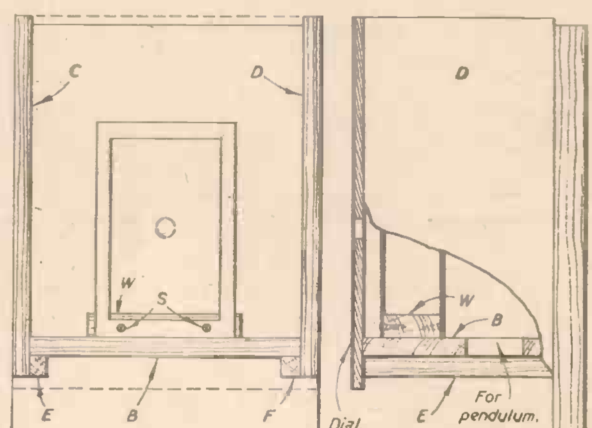


Fig. 19.—Mounting the dial.

CORRECT ADDRESS WANTED

We wrote a reply to a letter received from Mr. M. Fellows who gave his address as 38 Severn Street, Worcester. The Post Office has returned this marked "No such number—Not known." Perhaps Mr. Fellows would let us have an explanation.

A 6" Personal TV for £10

TIMEBASE H.T. is derived directly from the smoothing choke, while the sound and vision receiver supplies are separated by the voltage dropping resistors R81 and R82. These resistors should be rated at 5 watts. It is wise to insert a fuse in the circuit as shown, because a complete breakdown of C79 would result in the loss of the 5U4G rectifier valve, V21.

The on/off switch can be incorporated with the volume control.

No details of chassis construction are given because any type which will accommodate the components will do.

Before connecting the televisor to the mains, the wiring should be checked thoroughly. Make certain that no contacts exist between the H.T. line and filaments, or between H.T. line and earth.

Turn all controls to zero. Now switch on and wait for the unit to warm up. After about one minute, advance the brilliance control until a pattern appears upon the screen, now adjust the focus control until the lines forming the raster are finely focused ; next centralise the raster by means of the shift controls.

Receiving Sound

Screw the iron cores until they are level with the tops of the formers. Advance the volume control to maximum position ; now adjust L1 and L2 cores until the sound is heard. Bring the sound up to its full volume by adjusting T1, T2 and T3 in that order, reducing the volume control as required.

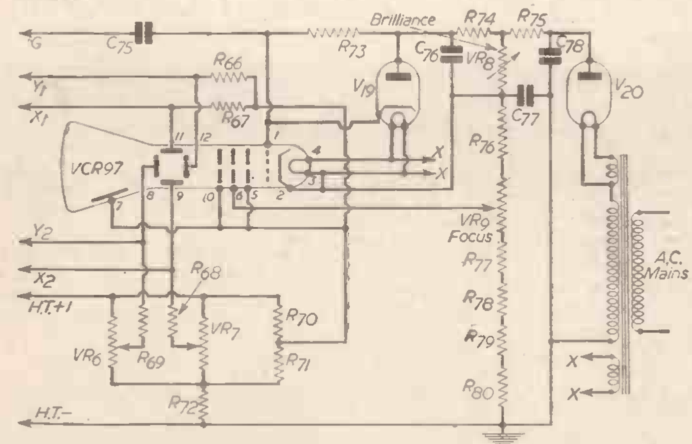


Fig. 7—Circuit of C.R.T. network.

Should it not be possible to get a peak due to the stray capacitances of the wiring, add half a turn of wire to the secondary of those coils which will not peak when the trimmer is set at maximum without peaking, until the peak point is found.

Receiving Vision

Insert a pair of headphones in the anode circuit of V7 between R24 and R23 and disconnect the lead to the C.R.T. grid. Set all cores level with the tops of the formers ; now turn the contrast control to maximum and the vision signal should be heard. It sounds like a peculiar mixture of 50 cycle hum and "motor boating." L1, 2, 3, 4, 5, 6, 7, 8 and 9 are then adjusted for maximum signal reducing the contrast accordingly.

How to Convert the ex-Government Indicator Unit 62

(*Concluded from page 89, November issue*)

At the back of the vision signal will be heard the sound programme. Adjust L5 and L6 until the sound is no longer heard. Then readjust L4 and L7 maximum vision signal.

It will be discovered that a peak value cannot be found on some of the coils ; this is arranged purposely so that adequate band width can be received.

Now turn the contrast control to zero, restore the anode circuit of V7 and the lead to "A," reduce the brilliance control so that the raster just disappears ; now, by turning up the contrast control, a pattern should appear on the screen. Turn the "line hold" control in either direction slowly and it will be found that a certain critical setting will resolve the pattern into a picture. Adjusting the "frame hold" will lock the picture in a vertical direction.

If the picture is upside down, reverse the connections to 12 and 8 on the C.R.T. If the picture is inside out reverse the connections on 9 and 11 on the C.R.T.

The quality of the picture will probably be very poor, L3, 4, 5, 6, 7 and 9 should, therefore, be adjusted to give the best quality. The contrast control will have to be advanced in step with this operation.

If at all possible final adjustments should be made on Test Card C. When the televisor is finally set up, the coils L1 and L2 should be adjusted between the sound and the vision signals. If you have plenty of signal strength in hand, the quality of the picture can be improved by adding damping to the coils. A 4.7 KΩ resistor can also be connected across the vision receiver coils, but not across the rejector coils.

V19. (Fig. 7.) General Notes

The cathode of this valve should be connected directly to the grid of the C.R.T. In the unit it will probably be found that the anode is strapped to the grid of the tube and the anode and cathode leads will have to be reversed.

Although this valve is rated for 6.3 heater volts it performs its function of D.C. restorer although only fed with 4v. from the C.R.T. supply. This method avoids using a non-standard type of transformer, or the employment of a separate transformer with highly insulated windings.

The VR54 valve is an Osram D63 in some units and a Mullard EB34 in others. Either of these valves is suitable although their characteristics differ a little. A 6H6 will perform equally as well in the circuit.

The values given for C60, 61, 68, 74, are quite suitable to provide an adequate scan if the H.T. voltage is over 400v. Should insufficient scan be obtainable 0.1μF condensers can be employed. Use condensers available from the unit.

Timebase current. Although six SP61s are used (whose normal current drain is 10.5 mA each) it will be found that the actual current drawn is not six times 10.5 but somewhere between 20 and 30 milliamps. The reason for this is because the valves are not working under their normal conditions. Current readings taken when the timebase is in operation can be very misleading.

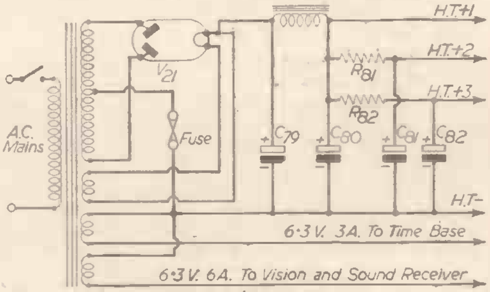


Fig. 8.—Circuit of the power pack.

It has been pointed out that the efficiency of SP61s begins to fall above 45 Mc/s. However, this fact has been taken care of by the provision of an EF50 in a common R.F. stage to boost up the signal. In places close to the transmitter this valve can be omitted.

Due to the fact that long leads are required to the grid caps of the SP61s, it may be found that the stray capacitances necessitate some slight variation (plus or minus one turn) to the coil windings.

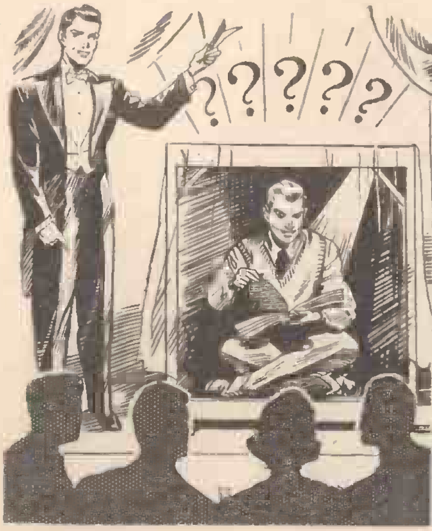
C58 has been made variable so as to obtain a greater control over the amplitude of the line sync. pulse. If desired, it can be substituted by a fixed capacity one, and the optimum value obtained during the alignment.

The pins of the VCR97 are numbered as follows looking at the tube from the back. Observe the first pin on the right of the top projecting key at about one o'clock. This is pin 1 and the base is consecutively numbered in a clock-wise direction from this pin.

The EHT transformer has two 4v. centre-tapped windings. Transformers of this type are readily obtainable and if a 2v. rectifier is used (such as 2X2) one half of one of the windings only is used, the other lead being left free. A 4v. valve can be used if desired.

Error

The references "Fig. 6" which appeared at the top of Fig. 5 (last month's instalment) should have read "Fig. 7."



THE TELEPHONE DIRECTORY TRICK

Entertain and Baffle Your Friends This Christmas

THIS trick can be performed in a small hall or classroom where there is a stage that will position a table set on it slightly above the general eye-level of the audience, and which also has a curtain.

What the Audience Sees

"Marvello," the man with the astounding memory, enters. The table was already on the stage when the curtain went up, and Marvello, going to it, addresses his listeners. He says that for many years he has been training his memory and now it has reached such perfection that he can memorise a whole telephone directory. Indeed, although he has only come to the area that very afternoon he has already committed all the numbers in the local book to heart and his desire is for the audience to put him to the test.

"What's my number?" calls someone

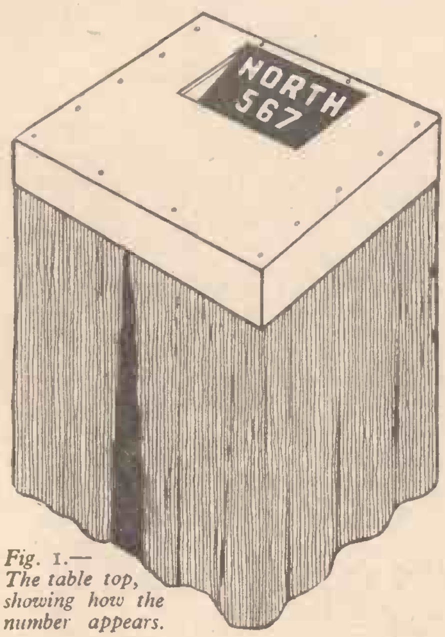


Fig. 1.—The table top, showing how the number appears.

from out in front. "Name please?" queries Marvello. "Williams, R. J." comes the reply. "I see," says the Memory Man, rolling the words "Williams, R. J." There is nothing rushed about it. Everything is deliberately done.

"Let me see," he says as though running his mind's eye down a mental list. "Ah yes, here we have it, North 567, is that right?" The person from the audience says it is.

Others then ask for their numbers and in every case it is correctly given. Numbers of shops and other places can be asked for, the right figure always being given, this being checked by the people out in front by a directory that is handed round. It is all very remarkable. The Memory Man indeed seems to know the number of every telephone subscriber and place of business in town.

How it is Done

The table is a prepared one with a flap in the top and a concealed assistant inside. This helper is supplied with a telephone directory, a piece of chalk, and a hassock to sit on, also a damp sponge.

While the Memory Man goes over the

Fig. 2.—How it is done.

name slowly and indulges in other time-gaining play that the moment suggests, the assistant inside finds the required number and chalks it on the flap which he then tilts up at an angle so that Marvello, glancing down, can see. The action of glancing down is masked by a hand put to the brow as though he were in deep thought. It is quite simple to make the action look natural and completely conceal the downward peep.

If the number takes some time to find Marvello just continues to gag till it comes on the flap, asking for the name to be repeated, saying he did not quite catch the last initial, and so on.

The Table

This is a simple frame affair as shown in Fig. 3. The top is a solid piece of plywood with a rectangle taken out near one edge and hinged. It must be roomy and an electric torch is fixed to the underside of the top so that it shines down on to the directory held by the assistant. Fig. 2 makes the set-up clear.

Round the whole table goes a draping of cloth, some fairly opaque material being used. The danger of the torch showing

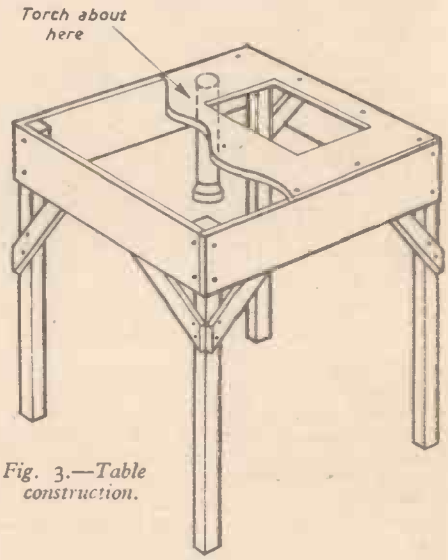


Fig. 3.—Table construction.

through, however, is counteracted by there being plenty of ordinary outside light on the stage, or the table top and Marvello being picked out in equalised spotlights from either side—this is in fact the best way to see the "tableaux."

Lighting is very important and the effect should be studied carefully from the front during rehearsals. The presence of the table on the stage at all can be made to look very natural by putting a large and heavy decanter on it with a glass, Marvello every so often stopping to pour out a drink with some remark about using your memory being a very thirsty job. Thus a quite logical reason for the table is subconsciously put into the minds of the audience.

Two final points about the mechanical side of the stunt. The table should be as small as possible and the flap must be painted matt black, both to make the chalk take well and make the figures easily read.

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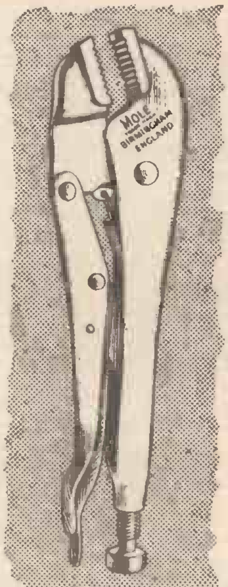

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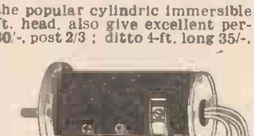

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REFLECTOR GUNSIGHTS by Ross, etc., consists of an optical mount which contains 4 high grade lenses, 3 are 34 mm. dia., bi-convex, plano-convex, concave negative, with smaller bi-convex objective, mount is in line with enclosed lamphouse, fitted reflector, rheostat and lampholder, new unused, cost £20, our price 10/-, post 1/9.

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58-60 NEW OXFORD ST.
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U.S.A. AIR FORCE 12/24 VOLT BLOWER MOTORS, size of motor 3in. long, 1½in. diam., size of fan housing, which is made of bakelite, 3in. diam., 1½in. deep, outlet ⅞in. diam., intake 1½in. diam. 25/- each.

AIR TEMPERATURE GAUGES, Ref. No. 6A/510, fitted Mercury in Steel Capillary Tube, Transmitting type. Reading —30/0/50° + Centigrade. Suitable for greenhouses, etc. 18/6.

OIL TEMPERATURE GAUGES, mercury in steel, 0/100° C., ref. 6A/722, with 50ft. capillary tube. 32/6 each.

CAPILLARY RADIATOR THERMOMETERS, with 20ft. of capillary tube, ref. 6A/1313, scaled 40/140 C. 27/6.

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"ROTHERHAM" CLOCKWORK-DRIVEN 7-DAY MOVEMENT, as fitted to Barograph units with 3½in. diam. drum, winding key, etc. New. 55/- each.

CLOCKWORK-DRIVEN TIMERS, variable, 5 to 30 mins. Fitted 15 amp. A.C. contacts. Totally enclosed, crackle finish. 17/6 each.

VENNER SYNCHRONOUS MOTORS 200/250 v. A.C. 3 watts. Final Speed 30 r.p.m. Ideal for Timers, etc. 16/6.

MINIATURE 24-VOLT D.C. PERMANENT MAGNET MOTOR-DRIVEN BLOWERS, 5,500 r.p.m., will give 2,500 r.p.m. on 12 volts, weight 7½ ozs., diam. of bakelite housing 3in., intake 1½in. diam., outlet 1in. x ⅞in., diameter of motor 1½in., 2in. long. 21/- each.

MOTOR-DRIVEN SELF-PRIMING PUMPS, ref. 5UE/6261, 24 volts, 2 amps., giving 7 g.p.h. at 15 lbs. sq. in., will give proportionately less at 12 volts, overall length 9in. x 2in. wide approx., ideal for pumping water or oil, etc. 35/- each.

PULSOMETER 24-VOLT MOTOR DRIVEN BOOSTER PUMPS, ref. 5UB/6137, gives 200 g.p.h. at 10lbs. per sq. in., overall diam. 5in., length 7in. approx. 60/- each.

Ditto, 24-volt, ref. 5UE/6166, gives 900 g.p.h. at 10lbs. per sq. in., overall length 11in. x 5½in. diam. approx. £4.3.0 each.

DITTO, 24-volt, ref. 5UE/5544, gives 900 g.p.h. at 10lbs. per sq. in., overall length 9½in. x 5½in. diam. approx. £4.5.0 each.

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8in. **DIAM. VENT-AXIA EXTRACTOR FANS,** 24v. D.C. or 36v. A.C. Fitted suppressor units. Ideal for caravans, yachts, etc. Unused, complete in transit case, £4.7.6.

WESTERN ELECTRIC BLOWER MOTORS, available 12 volts D.C. or 110 volts A.C./D.C. Suitable for car heaters, projectors or miniature vacuum cleaners, etc. Size 4½in. x 3½in. approx. Price, 29/- each.

TUFNOL PULLEYS, fitted ball-races, 3½in. external, internal ⅝in. bore. U-shaped groove, 3/8in. wide, 3/6 each, 37/6 per doz.

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SMALL D.C. MOTORS, made by "Hoover," Plessey, etc., 24 volts, with small fan blade fitted, size of motor 2½in. long x 1½in. wide x 1½in. high, diam. of blade 2½in. 14/6 each.

FULL MAILING PRICE LIST 6d.

A Cheap and Easily Made Sledge

By J. JOHNSTON

Be Ready for the Snow This Year!

THE sledge shown in the accompanying drawings is easy and inexpensive to make, most of the framing being cut from a single piece of timber. Fig. 1 shows a side elevation and Fig. 2 a perspective section.

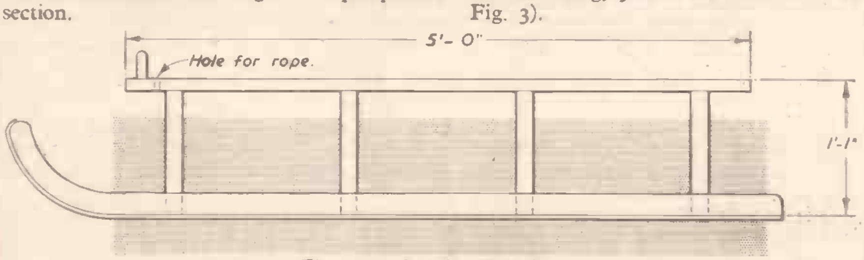


Fig. 1.—A side elevation.

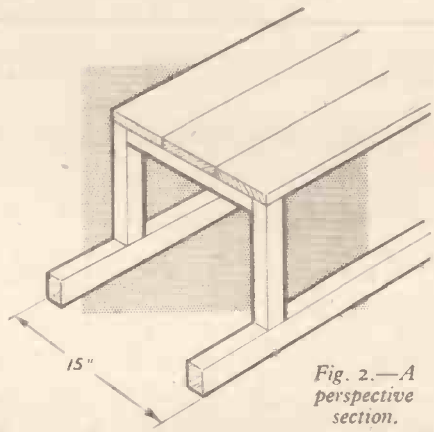


Fig. 2.—A perspective section.

Material

The best timber to use would be a hardwood such as ash or birch, but as these timbers are inclined to be expensive a good quality Swedish red wood could be employed, the cost of which should not exceed 25s.

The sledge, being intended to carry three or four persons, must be rigidly built and strongly jointed.

Construction

The runners are 6ft. 3in. long, 2in. wide and 1in. thick, and these, with the upright pieces which are 1¾in. wide, 1in. thick and 12in. long (including the 2in. at the bottom for the tenons) can be cut out of a board 6ft. 6in. long, 9in. broad and 1in. thick (see Fig. 3).

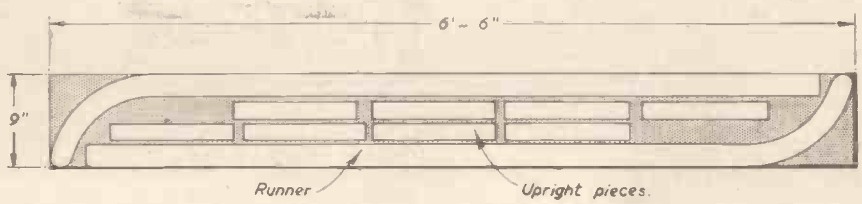


Fig. 3.—How the parts are cut from one plank.

After the runners are cut, set out the mortises in the top edge for the uprights and in setting these out place the two runners together so that the mortises will be exactly opposite each other. The tenons are made to fit tightly into the mortises and glued and wedged. Each pair of uprights is connected with a crosspiece at the top, 1¾in. × 1in. × 1ft. 3in. long, open mortised and tenoned to the uprights, the joists being glued and screwed.

The top consists of three 5in. × 1in. boards screwed to the crosspieces, the edges being rounded off. A bar 2½in. × 1in. rounded on the top is screwed to the boarding at the front and two holes are bored in the latter at the front to take a rope for pulling the sledge about.

Iron strap 1in. × 3/16in. is bent to shape and screwed to the bottom of the runners, as shown in Fig. 1.

The sledge should be painted three coats in bright colours.

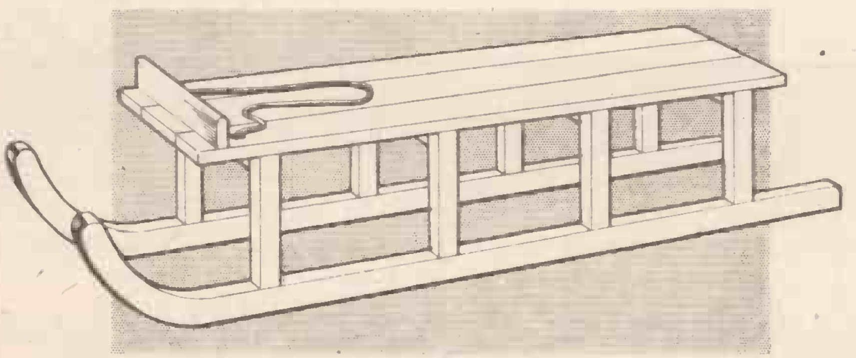


Fig. 4.—The completed sledge.

Cutting List

1 Board, 6ft. 6in. × 9in. × 1in.
4 Crosspieces, 1ft. 3in. × 1¾in. × 1in.
3 Boards, 5ft. × 5in. × 1in.
1 Bar, 1ft. 3in. × 2½in. × 1in.

MAKING INVISIBLE INKS

ONE of the simplest of all invisible inks is milk. Prisoners have been known to send letters to friends which seem quite all right, but in between the lines they have written messages in milk. Then, when a soiled finger is rubbed over the milk, the writing appears. Two other simple invisible inks are formed from the juices of lemons and onions. When using these, however, it is better to write with a piece of pointed glass, otherwise, if steel pens are used, the juices act on the metal and discolour the paper.

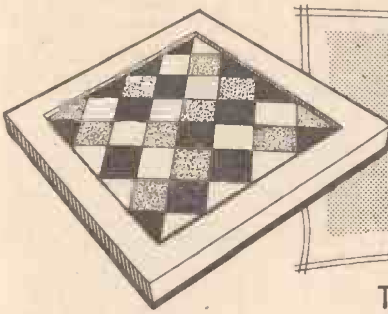
A message written in rice water can be made visible by brushing some tincture of iodine over the paper, whereupon the message is revealed.

If one drachm of chloride of cobalt and one drachm of gum arabic are dissolved in an ounce of water, you have an ink which is invisible. To make the writing appear it is necessary to warm the paper. This ink produces blue writing; green writing can be made with a solution of ten grains of chloride of nickel and ten grains of chloride of cobalt in one ounce of water.

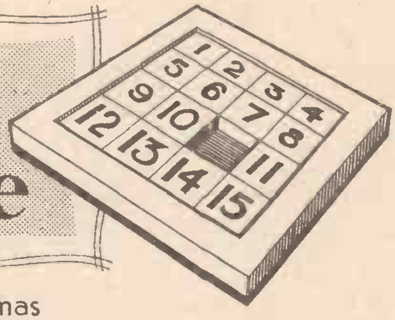
More elaborate inks can be made as you become expert in their uses. Most of the chemicals can be obtained from any chemist's shop.

Colouring With Invisible Ink

Ferrocyanide of potassium dissolved in water makes a fluid which is invisible, until a weak solution of perchloride of iron is added. Perchloride of mercury dissolved in water makes writing which can only be read when a solution of iodine of potassium is lightly brushed over the paper, scarlet lettering then appears. If weak caustic soda is applied instead of iodine the lettering appears yellow. All these inks, producing differing colours, suggest still another manner in which they can be used. By taking a picture from a periodical and filling in blank spaces with invisible inks, curious colours can be produced by the use of correct chemicals. The prettiest method of testing this is to find a picture of a winter scene printed on good paper and to brush over it in appropriate places certain chemicals. When this picture is held in front of the fire the colours appear and the scene becomes one of high summer. The chemicals to use are, for deep green, a mixture of nickel chloride and perchloride of iron solution, for red, zinc salts dissolved in water, and for yellowish green, a mixture of copper chloride solution and cobalt chloride solution.



TWO PUZZLES for you to make



These Will Intrigue Your Family at Christmas

The 15-square Puzzle

THIS puzzle takes only a short time to make, but looks well and will give a lot of enjoyment, though it is not as hard to solve as some.

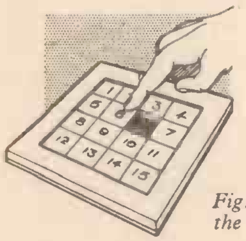
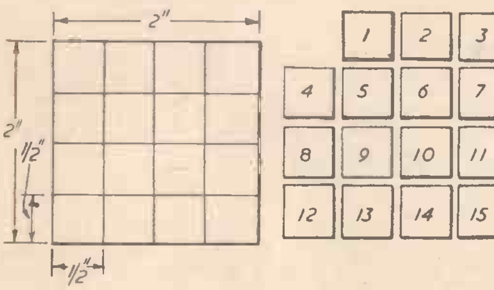


Fig. 1 (*Left*).—*The completed puzzle.*

Fig. 2 (*Below*).—*How the blocks are made.*



There are fifteen square blocks each marked with a numeral up to that figure. These are put in a jumbled state into the accompanying frame, and then they have to be moved into correct order by simply sliding them about with the forefinger (Fig. 1).

The Blocks

To make, cut a square of material ¼in. thick with 2in. sides. Mark each side off at the ½in. positions and rule up to make 16 squares.

Cut along the lines, if possible with a fine fret-saw so as not to lose too much at the cuts (Fig. 2). Polish up and inscribe

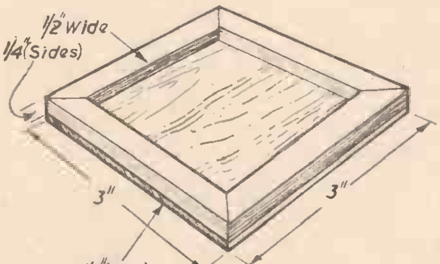


Fig. 3.—*Details of the tray.*

fifteen of the pieces with serial numbers. Keep the blank sixteenth piece, it may be useful for putting in to keep the other pieces in position when sending through the post.

The Frame

The tray is 3in. × 3in. plywood, ⅛in. thick plywood being used for the base, and ½in. × ¼in. wood for the side border. Bevel the corners and secure with pins and glue (Fig. 3). This container can with advantage be stained, but the blocks are left in plain wood. A lid can be fitted but it is not absolutely necessary.

The Baffling Mosaic

Eight strips of material each bearing colours have to be placed together so that all the adjoining colours agree. It is quite difficult to do this, and having done it once does not mean you will be able to succeed a second time without further thought.

To make the puzzle, first, on a piece of three-plywood, draw out a square with 4in. sides. Mark these at the inch positions and mark off with diagonal lines.

Now with four bright colours fill in the diamonds formed as at A in Fig. 4. The colours suggested are for their brightness, but any four colours available would suit. Note that the colours do not follow in sequence across the area. If necessary put on a second coat to get vividness, and finish with an application of clear varnish.

Cutting

When dry, cut the square into eight strips, as at B in Fig. 4, using a cutting knife and steel rule rather than a saw. The pieces so formed should all be exactly the same size so that they always make a square, no matter how they are placed together.

The Tray

Finally, make the simple tray shown at C in Fig. 4. This consists of a base 5in. × 5in. × ⅛in. thick, with a border ½in. wide and as deep as the thickness of the pieces. Bevel the corners and secure by glue and one or two very short model-maker's pins.

Write the "instructions" neatly on a rectangle of paper and glue this to the base.

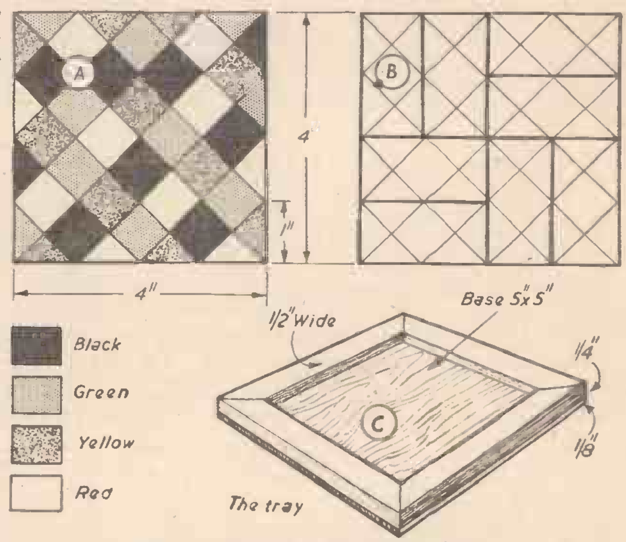


Fig. 4.—*Details of the baffling mosaic.*

If desired, a simple lid could be fitted to the tray. This, with the name "The Baffling Mosaic" painted on the top, makes an attractive finish.

Both puzzles make pleasing presents.

Some Problems and Posers

Try These on Your Friends!

An Arithmetical Mystery

THIRTEEN commercial travellers arrived at an inn, and each desired a separate room. The landlady had but twelve vacant rooms, but she promised to accommodate all according to their wishes. She showed two of the travellers into room No. 1 asking them to remain a few minutes together. Traveller No. 3 she showed into room No. 2, traveller No. 4 into room No. 3, traveller No. 5 into room No. 4, and so on until she had put the twelfth traveller into room No. 11. She then went back to where she had left the two travellers together, and let the thirteenth traveller into room No. 12, the remaining room. Thus all were accommodated. Explain the mystery.

The explanation is, of course, that the man whom the landlady put into room No. 12 was traveller No. 2, and No. 13 remained unprovided for.

The Two Trains

TWO trains start at the same time, one from London to Liverpool and the other from Liverpool to London. If they arrive at their destinations one hour and four hours respectively after passing one another, how much faster is one train running than the other?

The answer is that one train was running just twice as fast as the other.

Chiming Time

IF a grandfather clock takes three seconds to strike four o'clock, how long will it take to strike eight o'clock? The answer is that it will take seven seconds.

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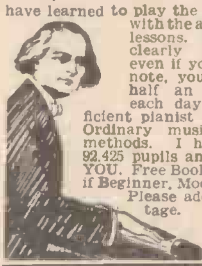

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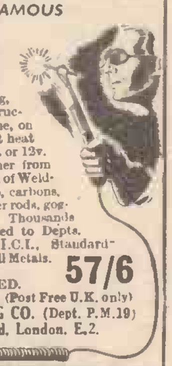

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How to make an INFINITE SCENE VIEWER

An Intriguing Novelty

By A. LUTMAN

THIS simple piece of apparatus can be made as small or as large as you wish, the size being determined by the available mirrors. Fig. 1 shows the general arrangement and it consists of a box with two mirrors slotted in grooves, one at each end. The top is open, or if desired a sheet of glass can be placed over to exclude

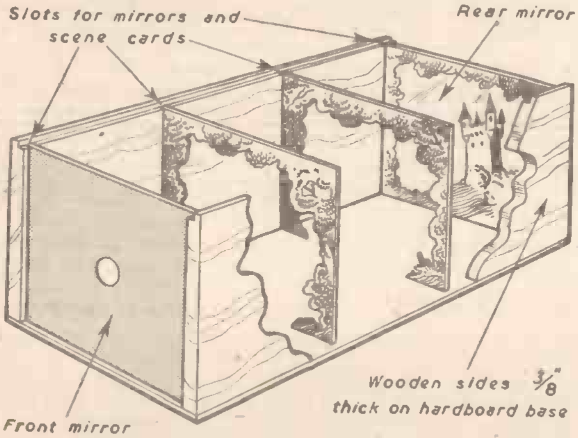


Fig. 1.—A general arrangement.

dust. The front mirror has a sight or peep-hole in the centre. The arched scenes, placed in the intermediate positions shown, are made of card painted on both sides, and can be slotted into grooves in the sides of the box. A better scheme is to make each scene a unit fixed to a card base on which can be stuck pebbles, sea shells, etc., so that the whole scene can be changed by dropping a different unit into position, as shown in Fig. 2.

The Peep-hole

The mirrors should be obtained first, and those sold at the multiple stores will answer quite well. They are about 8in. × 5in., though smaller ones would do. The box is about 1ft. long. The front mirror should have a piece of paper stuck to the back with a clean ½in. diameter hole in the centre. With a sharp knife scrape away the backing and silvering at this point until a clear ½in. window of glass is left. The effect is very striking when viewing through the peep-hole as the scene appears to recede to infinite distance. Each scene should have a central object placed in front of the rear mirror, such as a castle in a landscape or an actual piece of crystal mineral in a grotto. The reason for this is to cover the reflection of the eye-hole. The object need only be small.

Suggestions for scenes are shown in Fig. 3.

The open top allows daylight or room light to be used, but flash lamp bulbs can be secreted behind the two scene arches to give various lighting effects. The lamps should be cloaked by small pieces of painted scenery or the naked bulb would be reflected in the mirrors.

You can introduce to your scenes small living creatures such as butterflies and moths: or even a white mouse if you have one. It is very amusing to see thousands of mice doing precisely the same actions.

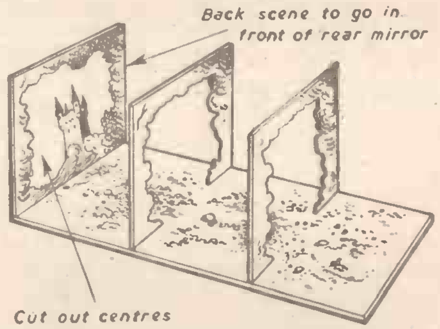


Fig. 2.—An interchangeable unit.

Fig. 3.—Some suggestions for scenes.

A PANORAMIC 3.D. VIEWER

Details of a Simple but Effective Instrument

By D. NEWMAN MANNERS

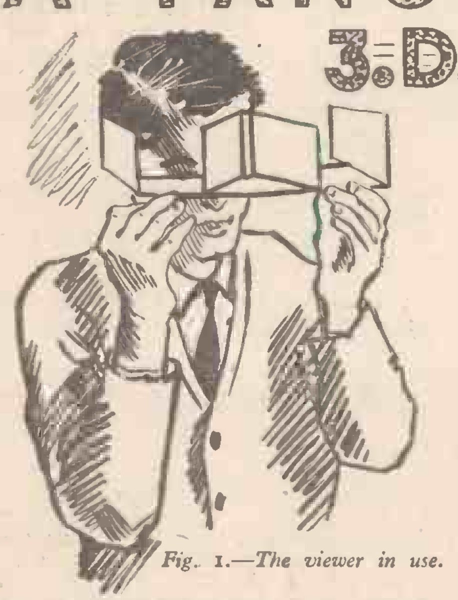


Fig. 1.—The viewer in use.

STEREOSCOPES of this nature are used in R.A.F. surveying units. Viewing aerial photographs in this way gives, for example, a good idea of the height of mountain ranges

3D Photography

If you are lucky enough to own a stereo camera then photography in 3D is as straightforward as it is in 2D. If you only have an ordinary camera, then briefly the procedure for 3D is as follows:—

Set up the camera on a firm base, make an exposure, wind on the film carefully, move the whole camera a distance of 2½in. to either the left or right between parallel lines, and make a second exposure.

The plan of the viewer is shown in Fig. 2. The mirrors are two ordinary handbag mirrors measuring about 2in. × 3in. They are set on their longest edges and at right angles to each other by means of a short length of right-angled beading fixed to the back of the mirrors with transparent cement.

The base can be a piece of plywood cut to shape. The photographs, mounted on card are held in tinplate holders at each end of the stereoscope as seen in Fig. 2.

The photographs must be enlarged from the negatives made. A good general ratio for the length and height is 2½:1.

The two photographs are viewed as shown in Fig. 1.

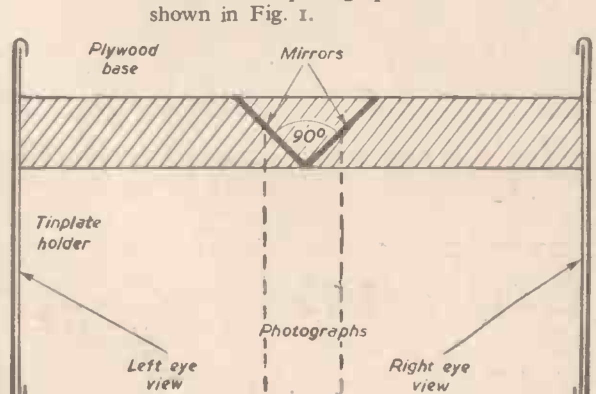


Fig. 2.—Details of construction.

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

Is the Speed of Light Fundamental?

SIR,—Whilst reading a modern book on the Universe I noticed that it was stated that the speed of light is fundamental and cannot be exceeded, also that any speed or frequency must always be measured relative to a fixed point and given time interval.

This is well illustrated by the Doppler Effect, the principle of which is now used in many radar and electronic devices. In one example (in use in certain radar equipments and "homing" missiles), a fixed frequency is, in effect, beamed on to a moving object, which reflects back the frequency (known as an echo). This reflected frequency differs according to the speed and direction of movement of the object.

A more common example, of course, is the text book one of a train whistling as it approaches and passes an observer. At the moment of passing the pitch or frequency of the whistle appears to change, due to the fact that (a) as the train approached the observer the sound is a combination of the speed of the train plus the speed of the sound wave; (b) as the train passes the observer the sound drops in pitch because it then becomes a combination of the speed of the sound minus the speed of the train, both (a) and (b) altering the speed/frequency of the sound relative to the observer.

If we consider a wireless frequency emitted by, say, the present Russian satellite encircling the earth, is the speed of the wireless wave a combination of the speed of the satellite plus or minus the speed of the wave, relative to an observer? If this is so, then the speed of light is not a fundamental, and theoretically could be varied.

Perhaps you or some of your readers can offer enlightenment?—F. J. NEWTON (Pembroke Dock).

[*Readers are invited to debate the point in these pages.*—ED.]

A Daylight Cinema

SIR,—With further reference to my article entitled "A Daylight Cinema," which appeared in the November issue, I should like to mention a point, which I seem to have overlooked in the original manuscript. This is that films have to be inserted in the projector and worked in reverse, because of the second mirror. This presents no difficulty to the user of 35mm. film strip, but 16mm. movie operators may be unable to work in reverse.—T. FRIEND (Sunderland).

Electric Pottery Kilns

SIR,—The use of silica insulating bricks for electric kilns (October issue) gives great economy in power consumption. They can be red-hot on one face and comfortably carried in the hand, resting on the other face, 3in. distant.

Furthermore, they are finished exactly to size and require no fireclay "grouting." They are very light in weight and can be easily sawn and chiselled to any desired shape. Their cost may be higher, I believe about 1s. 3d. each, but it is more than repaid by the saving of fuel or electric power, not to mention avoiding overheating of the workshop.

Such a type of brick is made by The Derbyshire Silicate Brick Co., Ltd., Friden, Startington, Derbyshire, and there are doubtless other sources of supply.

In general, the normal refractory firebrick is not a good heat insulator. It is essential for solid fuel grates, being hard and durable, but electric heating imposes no mechanical strain or wear.

A silica brick measuring 9in. × 4½in. × 3in. weighs under 3lb. A similar firebrick I have weighs 7lb.—F. D. BROWNSON (Bedford).

Bunsen Burner

SIR,—Re the article on making a Bunsen Burner, which appeared in PRACTICAL MECHANICS, August 1957, page 542, may I point out that such a burner would undoubtedly be a direct source of danger from fire?

Having worked as a practical chemist I enjoy the novelty of the "Junior Chemist," but this improvisation of a Bunsen, while ingenious, would be most dangerous with a wooden piece in its construction: the heat reflected from a hot metal body is much greater than normally suspected and it used to be the practice, even with a standard all-metal Bunsen, to place a slate or asbestos sheet over the bench to stand the burner on.—W. WARE (Birmingham).

HOME-MADE ELECTRIC FENCE PULSATOR

SIR,—I read the article "A Home-made Electric Fence" by R. J. Hodnett, which appeared in your August issue.

It is obvious that the author does not appreciate the dangers of improperly constructed apparatus nor the British Standards Nos. 1222 and 2632, which are designed to safeguard not only the farmer but the general public.

To the best of my knowledge the only accidents which have occurred due to the use of electric fences have been in cases where the unit has been home constructed.

To satisfy myself regarding the unsuitability of the unit described I inspected a pulsator built in accordance with the instructions.

When first switched on, the unit "chattered" for fully half a minute, giving a continuous succession of high voltage discharges of about 10,000 to 12,000 volts which, under certain circumstances, might well prove fatal to anyone in contact with the fence. These phenomena could very easily be reproduced should the unit get out of adjustment in use which is highly probable, especially since the unit must be mounted in a vertical position to maintain correct adjustment.—C. W. ROBSON, B.Sc. (Eng.), M.I.E.E., A.M.I.Mech.E.

THE AUTHOR'S REPLY

SIR,—*Mr. Robson seems to be greatly perturbed by the dangers which he chooses to associate with the home-made electric fence described by me in the August issue of your magazine. He endeavours to give the impression that the unit described is a diabolical machine which, when in operation, would cause certain death to anybody in contact with its output terminals. This, of course, is utter nonsense.*

Before writing the above-mentioned article I constructed and tested two pulsating units similar to the one described. I have seen and inspected several others. In cases where the wheel was improperly balanced the "chatter" mentioned by Mr. Robson was present, but disappeared when the necessary correction was made. With reference to the alleged excessive output, I would like to make the following observations:

(1) *As the input is only 30 watts approximately, the output—allowing for a not unreasonable efficiency of 80 per cent.—would be 2½ milliamps at 10,000 volts.*

(2) *Anybody with a knowledge of elementary electrical principles—not to mention a member of the Institute of Electrical Engineers, knows that a transformer such as a car ignition coil would build up an output voltage of 10,000 only when the external resistance of the circuit was in the region of 100 megohms! As the human body has not a resistance even bordering on this figure, the resultant voltage would be* much *lower than that quoted by Mr. Robson.*

(3) *I know at least 20 persons who are willing to testify that the shock from the pulsating unit described proved not in the least harmful. The shock is, of course, unpleasant, but necessarily so unless we assume that the bovine species is more sensitive to pain than the human being.*

In conclusion I think it is a great pity that Mr. Robson neglected to specify under what "certain circumstances" the shock "might well prove fatal to anyone in contact with the fence."—R. J. HODNETT (Co. Cork).

TRADE NOTES

Wolf Jigsaw Attachment

Wolf Jigsaw Attachment.

A JIGSAW attachment has now been added to the Wolf Home Power Equipment range. The Jigsaw Set No. 16 (see photo) will enable users to make straight, curved or complicated cuts in a variety of materials including wood, metal, hardboard and Formica. The pressed steel foot allows for movement up to 45° for mitre cutting.

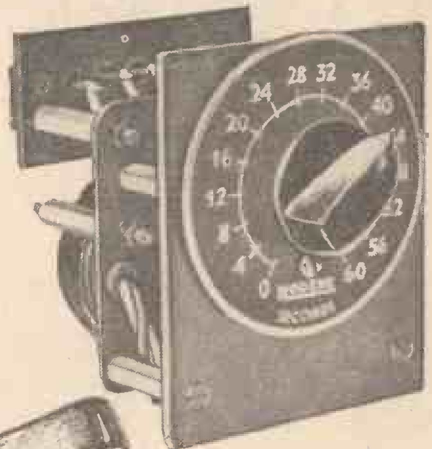
With a depth of cut of 1½in. in wood and 1/16in. in steel, it is designed to appeal to those interested in joinery work, cabinet making, toy and model making, metalworking and all jobs calling for intricate cutting. This unit is quickly and easily attached to either the Cub or "Quartermaster" power unit. Two saw blades are supplied. The price is 47s. 6d.

A New Process Timer

A NEW self-resetting synchronous timer has just been added to the Rodene range (see photo). It employs the instant-start, self-clutching Rodene timer motor.

There are four standard models, providing ranges of 0-15 secs.; 0-60 secs.; 0-5 mins.; and 0-10 mins. Due to the low stalled current and torque the first two models can be left "timed out" with the switch actuated for as long as required.

The two longer period models each have a built-in relay arranged to reset the mechanism at the end of the timed period and



New Process Timer.

to hold a contact operated during the "timed out" period thus providing the same action.

Behind-panel dimensions of the "seconds" timers are only 3½in. high × 3in. wide × 3in. deep. The "minutes" models are 3½in. × 3in. × 5in. deep. The output switch has change-over action and is rated at 3 amps.: at 450 v. A.C. and 5 amps.: at 250 v. A.C. Motors are wound for most standard voltages and frequencies.

Further details can be obtained from D. Robinson & Co., 58, Oaks Avenue, Worcester Park, Surrey.

Anti-vibration Pads

"VULCASCOT Anti-vibration pads for machine installations are made by

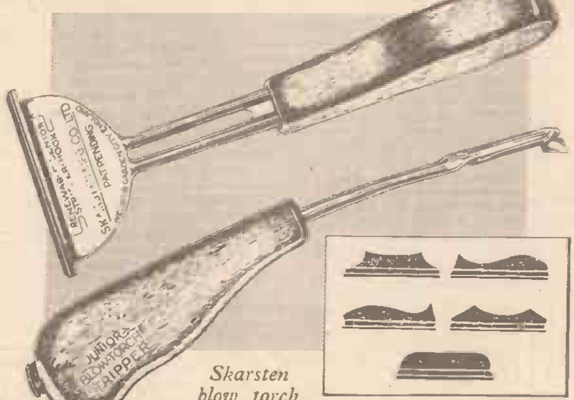
(Left) Anti-vibration pad.

Vulcascot (Great Britain) Ltd., 87/89, Abbey Road, London, N.W.8. They are 5/16in. thick and come in two sizes—18in. × 18in. and 36in. × 18in., the prices per pad being 47s. 6d. and 95s. respectively.

The pads are made from oil resistant rubber of special resilient, non-ageing quality and are ribbed as can be seen in the photograph. Use of these pads eliminates the necessity for bolting machinery to the floor, simplifying the erecting and shifting of equipment and preventing vibrations being transmitted through the floor. Machinery is merely placed on the pads, where its weight causes the ribs to grip the floor firmly. Loads up to 4 tons per sq. in. are capable of being supported.

Blow Torch Scrapers

THE latest edition to the Skarsten range of products is a set of scraping tools for use in conjunction with blow torches. These are designed to be used in reverse to the old methods, and are employed with a downward strike. They remove, in addition to the melted paint, burned, scorched or decayed wood surfaces, leaving a clean surface for the application of new paint. There are two models, the Senior for use on flat surfaces and the Junior which has a magazine of blades stored in the handle and is intended for use on mouldings, window frames, etc. The Senior stripper costs 10s. and the Junior, with five profile blades, 12s. 9d. The manufacturers are Skarsten Manufacturing Co., Ltd., Hyde Way, Welwyn Garden City, Herts.



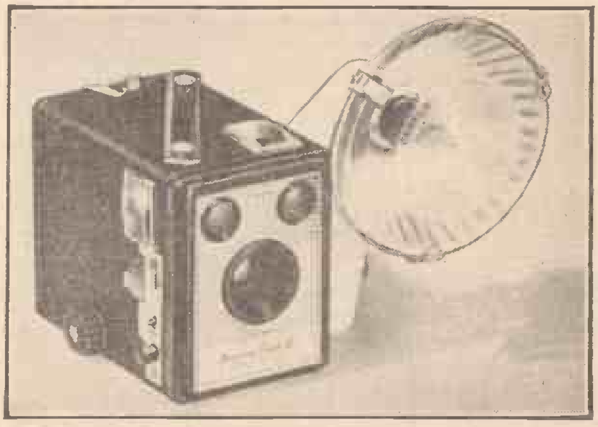
Skarsten blow torch scrapers.

Box Cameras With Flash

KODAK LTD. has recently introduced a new series of "Brownie" box cameras, designed to take both daylight and flash photographs. The accent is on simplicity and flash photography is merely a matter of pushing the button.

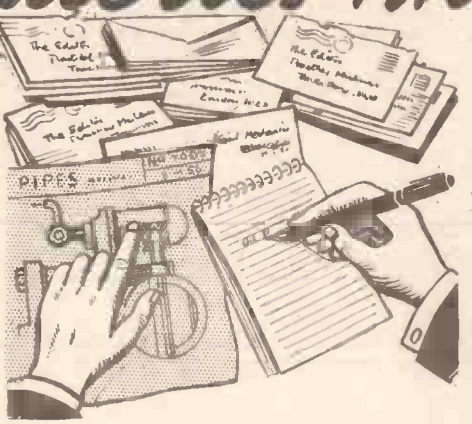
The "Brownie" Flash-holder is styled in cream plastic and has a simple exposure guide printed on one side. The reflector is detachable so that the flash-holder can be carried in the pocket. The Brownie flash II camera has a built-in close-up lens, Model III has an additional cloud filter and the Model IV is a de luxe version of Model III.

The price of the Brownie Flash II camera is £2 12s. 6d.; the Model III costs £3 2s. 7d. and the Model IV £3 6s. The Flash-holder is £1 5s. 9d. and the Flashguard 4s. 2d.



Brownie Flash II Camera and flashgun.

Your Queries Answered



Paint Removal from Chromium

I HAVE a chromium-plated tank, the top of which has been coated with silver or aluminium paint. How could I remove paint and not mark the chrome beneath?—John Hamilton (Lanark).

FIRST of all try to soften the hard paint by pouring boiling water over it. Then, very cautiously, scrape it away using a blunt edge.

If this does not work, make up a solution of 1 part of caustic soda in 10 parts of water. With an old brush apply this solution to the paint. Give it a few minutes to act. Then scrape the softened paint away, subsequently rinsing the underlying plating with plenty of cold water.

If carefully done, neither of these methods will affect the chromium plating. The job is quite a straightforward one but it calls for a certain amount of patience. It is important not to use a sharp instrument for the scraping. If the paint is adequately softened, the finger-nail should be able to remove much of it.

The necessity for scraping can be eliminated if the paint is first softened, by rubbing it with a rag charged with acetone or if a good paint-softening preparation is first applied to the painted area.

Hub Dynamo Adjustments

I HAVE a cycle fitted with a rear hub dynamo and filter switch unit lighting set, and, although correct bulbs as specified are used (6 volt 0.2 amp. head and 6 volt 0.04 amp. rear) I do not get a very good light unless going fairly fast. At walking pace there is just a glow when battery is not in place. I am also not able to focus the headlight so that I get a fairly wide beam. The focus adjustment seems to produce either a pencil beam or a ring of light with a black centre.

Please tell me how to eliminate these troubles.—A. J. Osman (Kent).

THE lighting unit is apparently one in which a rectifier is incorporated through which the generator passes current to charge the battery when the lights are not in use. The output of the generator will be quite low at walking pace and may not then light the lamps very brilliantly. It seems likely that the poor illumination in general is due to the battery being in a poor condition, or discharged due to considerable night riding, or due to loss of magnetism of the generator.

We suggest that the battery be checked up and recharged if necessary. If the lamps fail to light well when the rectifier unit is lifted out, and the generator supplies the lamps direct at about 10 miles per hour the most probable cause is loss of magnetism. In this case we would advise that the generator be remagnetised.

It would seem that the adjustment of the lamp should be moved in the opposite direction. Something may be obstructing the movement in the right direction or the bulb holder may have been moved from its correct position.

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.

Hand-operated Pump

I WISH to install a hand-operated pump to lift water from a rain-water butt to a cistern in the loft, about 12ft. high. Can you give me details of the type of pump, where it can be bought, and method of installation?—W. J. Osborne (Warw.).

WE suggest that a semi-rotary type of pump would be suitable, probably obtainable from the following: Millar's Machinery Co., Ltd., Thorley, Bishop's Stortford, Herts. Henry Sykes, Ltd., Southwark Street, London, S.E.1. Wickham Engineering Co., Ltd., 34, Victoria Street, London, S.W.1.

Cigarette Lighter Element

I HAVE an American cigarette lighter, designed to work on the mains, but unfortunately the element has burnt out.

The element fits into a U-shaped channel in a piece of porcelain. The overall length of this channel is about 3in. and the diametre of the element, which was the ordinary coiled type, was about 3/16in.

Can you suggest a suitable wire that I could wind into an element for 230 volts? Unfortunately, the overall dimensions of the ornament into which the element unit is fixed preclude the use of dropping resistances or a transformer.—E. C. Hobday (Folkestone).

IF the length and diameter of the original element can be determined, we would advise you to use an element of nickel-chrome resistance wire, having twice the length of the original element and half the cross sectional area of the original wire; i.e., 0.7 of the original diameter. Alternatively, you could use about 8ft. of 41 s.w.g nickel-chrome resistance wire.

The Ammonia Process

I UNDERSTAND there is a method of reproducing drawings known as the ammonia process. If it is possible to use this without expensive equipment, can you let me have full directions?—E. Billings (Luton).

THE ammonia process is quite simple, the procedure being to expose the negative drawing in close contact with the sensitised paper to strong lighting. This usually takes the form of mercury vapour lamp, but if speed is not essential blue fluorescent tubes can be used.

After exposure the sensitised paper is then placed in rolled form on a rack in a box in the bottom of which is a dish containing concentrated ammonia. This developing process should only take about five minutes.

There is a full section on all methods of reproducing drawings in Newnes "Engineers' Reference Book."

Coloured Flame

IS it possible to obtain a small, highly-coloured flame (any colour) which will burn for ½ hour or so? Could I dissolve something in methylated spirit or paraffin?—P. G. Kernick (Cardiff).

ASSUMING that you can rig up a methylated spirit burner that will maintain a flame for half an hour, and to do this you will have to experiment on the rate of burning and use the appropriate size of container accordingly, then arrange a bridge of asbestos fibre over your flame and devise a method of feeding an aqueous solution of strontium nitrate (for red) on to the asbestos "bridge." Probably a single drop per minute would be sufficient to maintain the colour of the flame. The flame must impinge on the asbestos fibre.

Alternatively you could try feeding the asbestos strip by capillary attraction from a wick dipping into a bottle holding the strontium nitrate solution, the asbestos fibres maintaining contact with the wick.

Glass Christmas Tree Decorations

SIR,—I am anxious to make a number of glass globes 3in. in diameter for Christmas tree decorations. I presume that these will have to be blown from glass tubes after inserting the tube through a hole in a two-part mould . . . and also presume that the mould would have to be heated. I had in mind using a mould made from Pyruma fireclay, heated by a gas jet from below. Would this suffice?

Where could I obtain suitable glass tubes and what is the formula and process of applying the silvering and coloured metallic colourings used on these?—R. F. Smart (Dartford).

FOR your work in blowing glass tubes, a mould of polished metal would be preferable to a non-metallic one, since it could be more uniformly heated. Any metal could be used, and the heat of a single bunsen burner would suffice, for if the mould were made too hot, the glass bulb or globe would stick to it.

The best glass for your purpose is soda glass, which is a soft type, melting at a relatively low temperature. This is the glass supplied in the form of tubing of various diameters for laboratory use. It is not expensive, and can be obtained from any of the London dealers in laboratory supplies, such as Messrs. Griffin & Tatlock, Ltd., Kemble Street, Kingsway, London, W.C.2.

The coloured glass spheres are produced by blowing coloured glass. We do not think that you can obtain this material from any laboratory dealer. You will have to apply to an actual glass manufacturer, such as Messrs. Pilkington Brothers, Ltd., St. Helens, Lancs, or Wood Brothers Glass Co., Ltd., Borough Flint Glass Works, Barnsley, Yorks.

The "coloured metallic" effect which you mention is obtained by silvering the coloured-glass globes. A suitable formula for this purpose is:

Solution A.—Rochelle salt, 25 grams. Water 250 ccs.

Solution B.—Silver nitrate 2.5 grams. Water 250 ccs.

Solution C.—Ammonia (.880 S.G.) 50 ccs. Water 250 ccs.

(All solutions should be made up with distilled water for preference.)

To 50 ccs. of solution B add solution C drop by drop until the precipitate which is first formed just redissolves. Then add one more drop of Solution B until a faint permanent turbidity is formed. Then add 10 ccs. of solution A. Mix thoroughly and use immediately. The separate solutions will keep well in bottles, but the mixed solutions will not keep.

Pour the mixed solution into the glass bulb so that the latter is completely filled. Immerse the bulb in a bath of water at 70 deg. F. (about 21 deg. C.). Silvering of the glass will begin immediately and will be completed within 20 minutes. The silvering solution should then be discarded, the interior of the bulb rinsed out and the bulb then put away in a warm place to dry.

Note carefully that the brown precipitate formed on the addition of ammonia to the solution is explosive if it is allowed to dry, but is perfectly safe if wet or moist.

Pin Drills and D-bits

SIR,—I find on reading model engineering literature that D-bits and pin-drills are frequently mentioned. Please let me know how and from what material these are made, also their particular uses and advantages, if any, over twist drills.—G. D. G. Newell (N.I.).

THESE tools are seldom larger than ⅝in. diameter.

The word pin drill is perhaps a little misleading as the tool does not bore as does the orthodox twist drill; its primary object is to counterbore a hole already drilled to provide a flat facing on which a component rests. Holes for cheese-head screws are typical examples.

Fig. 1 shows how these are made and also a commercial countersink. Silver steel hardened to a bright cherry red and then plunged into water is the correct type of heat treatment. Afterwards temper to a light straw colour.

"D" bits are used for the accurate finishing of holes where the usual reamer would not prove satisfactory. For instance, long bores tend to wander from the true path—"D" bits, if carefully applied, will correct such a hole and at the same time produce the correct size. They do *not* drill material and only about .01 to .02 inches is removed by them. In fact, for very small holes of 1/16in. dia. .005in. is usually sufficient. To prevent rubbing make the first ½in. on the front end parallel and taper the remainder backwards approximately .002in. on diameter. Never attempt to cut at a fast rate with them.

Start then by boring the hole for a depth of about ½in. with a tool clamped in the box, this will ensure the "D" bit has an excellent chance of correcting a hole which "has run" while drilling.

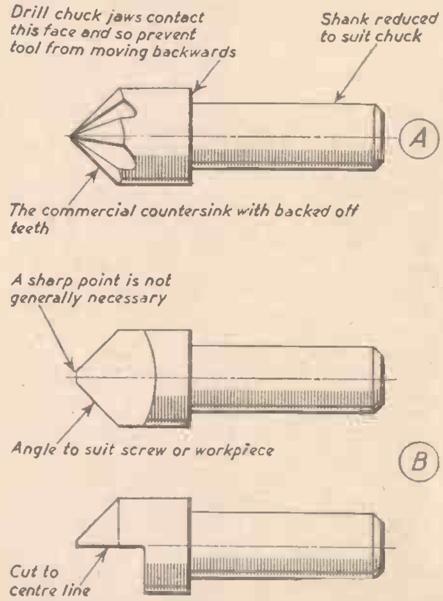


Fig. 1.—A, the commercial type of countersink and B the simple home workshop articles.

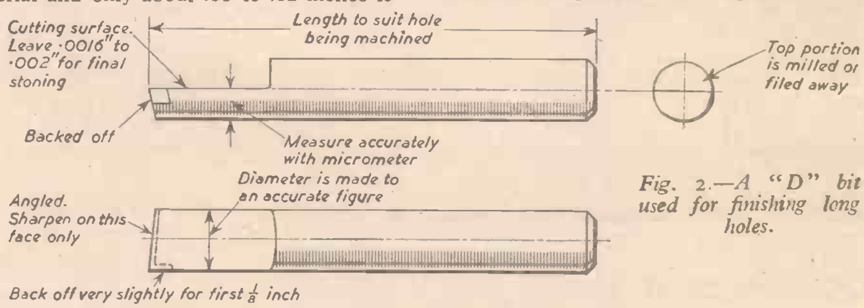


Fig. 2.—A "D" bit used for finishing long holes.

Dyeing Flowers

CAN you please tell me how to dye small white everlasting flowers, i.e., those found in the posy baskets in shops?—D. Stanley (Worcs).

IT is not an easy proposition to dye flowers satisfactorily. We suggest that you first dip your everlasting flowers into a starch size solution, allow to set and then immerse the flowers in an appropriate aniline dye.

Typical dye solutions are:

Yellow—Auramine O 1 oz., denatured alcohol 4oz., water 4oz.

Peacock blue—Patent blue 1oz., water 2oz., denatured alcohol 2oz.

Pink—Eosine 1oz., water 2oz., denatured alcohol 2oz.

Coal Bricks

I HAVE accumulated a quantity of slack coal and would like to make it into coal bricks. Could you please supply me with details of a suitable mixture?—S. Schofield (Yorks).

INCORPORATE as thoroughly as possible a mixture of 5 to 7 parts coal dust and 1 part cement. Moisten mixture and transfer to convenient size of flower pot. The cone shape of pot and the drain hole facilitate eventual emptying of the briquette from this mould.

Information Sought

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

Book Required

I AM in the process of building a small blast furnace for casting and general foundry work. Please will you tell me what is the best book for the amateur on the subject of preparing the moulds, casting and blacksmith's work, and where I can get it?—G. M. HEATHETE (Co. Down).

Tanning a Sail

I AM working on the restoration of a sailing dinghy, the sail of which is quite serviceable but stained and repaired and thus of rather poor appearance. I would be glad if you can tell me how it may be "tanned."—K. SPINK (Leics).

Time Switch

PLEASE tell me how to make a time switch, using an alarm clock, to operate a light in my fowl house.—A. BARNARD (Norfolk).

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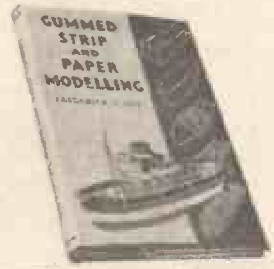

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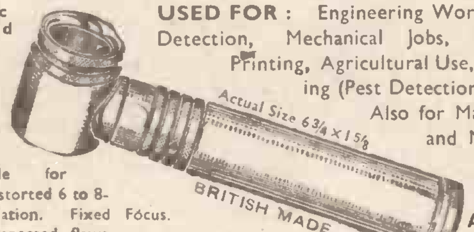

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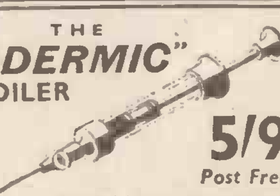

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THE Cyclist
Editor : F. J. CAMM

VOL. XXVI DECEMBER, 1957 No. 425

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

Wanted—A Moped Association

NOW that riders of mopeds and motor-assisted bicycles can be considered on a national scale, the time has arrived when a national association should be formed to watch their interests. One such attempt has already been made, but I have in mind a much larger organisation. At first sight, it must appear that the Auto-Cycle Union would be the ideal body to represent this comparatively new class of road user, but I feel that such an association should be entirely independent of any existing committee or organisation so that it may, so to speak, start afresh and untrammelled by past history or misunderstandings. Some may think, as the movement is an offshoot of pedal cycling, that either the NCU or the CTC should take over this new interest, especially in view of their declining membership. Owners of mopeds, however, would be most unwise to allow either of these bodies to handle their affairs in view of their well-known views on mopeds and motor-assisted bicycles. They have vented their spleen on these lively and useful vehicles, hurled vulgar sneers at them ("pedal-assisted motors," "buzz bikes," etc.) and have endeavoured to discourage their use. The views of the CTC are well known. They were expressed in a double-page article by the secretary of the CTC a few years ago, in which he implied that they were neither fish, flesh nor fowl. Any attempt by either of the bodies to change their Articles of Association to include the new vehicles should be carefully watched. That such an association is necessary, is proved by recent court cases in which defendants have been fined for inefficient brakes, although such brakes are manufactured as standard. Some of the new machines are having their teething troubles, but undoubtedly manufacturers will continue to improve their products. The association which I envisage should be totally disassociated from any cycling interest and its personnel should not be those holding any position of importance in existing cycling organisations. I fear that they would have too lively an eye on the interests of cyclists, and where a particular matter was considered to be inimical to the interests of cyclists the interests of the riders of mopeds would be subjugated.

The cycling world is full of boneless wonders! They express rabid views and a few weeks later completely change them. I fear, however, that, as with the leopard, they cannot change their spots.

This new movement is here to stay and it is wise that it should have a representative organisation.

Brakes on Bicycles

MR. H. ADDIE, of Manchester, disagrees with my views on cycle braking as expressed in the October issue. He points out what I have already stated, that there is less load on the front wheel than on the rear when the brakes are not in use. It is also true that when the brakes are applied the inertia of the rider causes some weight to be transferred to the front wheel, thus increasing the adhesion or tractive resistance of the front tyre, correspondingly decreasing that of the rear tyre. My reader, however, has totally ignored the effect of this on caster action, which is likely to give rise to tail wag and a skid. I do not agree with him, however, when he says that, when a cyclist descends a hill, the forward movement of the centre of gravity renders the application of the rear brakes practically useless.

He agrees that if a test were carried out with a motor cycle the result would favour the rear brake, but he puts this down to the method of operating the brakes, a short hand lever being comparatively inefficient against the braking power of a foot-operated rear brake. That, however, is a mere criticism of method and not of principle; if a longer hand lever were used the effect would be the same.

Chipping Campden—Cotswold architecture at its finest.

Cycle Sales Improving

I AM glad to note that cycle sales for the first seven months of 1957 had increased by 12½ per cent. over the figures for a similar period of the previous year. The industry has been embarking upon TV publicity and possibly this had some effect upon sales, but more probably the better weather in the first seven months of this year had an improving effect.

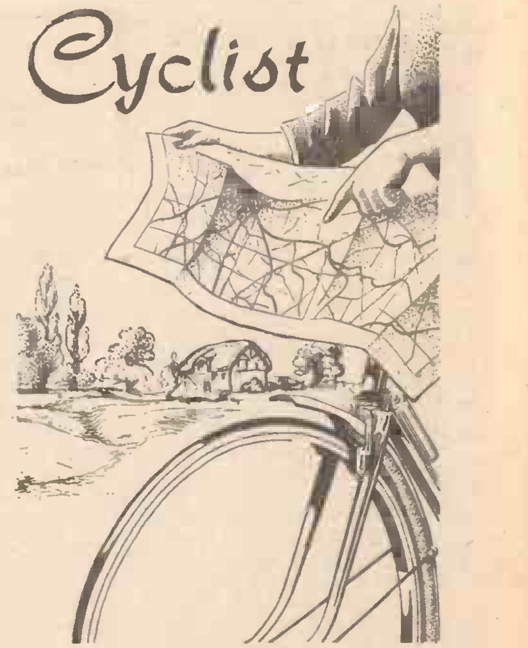
Petrol rationing in the early part of the year may have caused many of the moped fraternity to have returned to cycling in view of the very small petrol allowance made to them. However, it is good news to learn that the tide has turned. If greater attention was given by the Press to cycling as a pastime and as a doctor to many of the ills to which the human being is subject, and much less to sport, this would undoubtedly help to sell cycles. The sporting element is the noisy minority of the movement, and only a comparatively small number is interested in sporting results.

Cycle Racing—Regulations Deferred

ONCE again the Minister of Transport has deferred making regulations governing cycling sport. He has stated, after his second thoughts on the matter, that he will not introduce any legislation to become effective before 1959, but he has informed the BLRC that when the regulations do come into force, it is his intention that the authority will be delegated to the Chief Officers of Police to give permission for a particular event to take place. Equally, this means that the police will have power to ban events. The League is naturally not prepared to accept the position where the police in certain areas may adopt an unfriendly attitude and capriciously ban racing. It has happened in the past and will happen again. The regulations must be made on an agreed formula, and the discretionary powers of the police strictly limited. There must also be right of appeal against negative decisions. However, the field is left clear for 1958 promotions.

The BLRC is naturally taking vigorous action in the matter and is closely watching events. It is now well over a year since cycling legislation was debated in Parliament, but draft regulations are not yet available for consideration by the interested racing bodies. The urgent need for such legislation was stressed in Parliament at the time. No doubt other affairs such as the Suez Crisis have caused the Government to set aside less important matters, but the time has arrived when draft regulations should be prepared, submitted to the BLRC and other bodies, and the matter made the subject of a public inquiry.

Map Reading for the Cyclist



How to Appreciate Your Tour in Full

By C. JEROME

IT may be argued in these days of well signposted roads that the ability to read anything more than a simple road map is unnecessary. Map reading, however, in the author's opinion, adds a great deal of interest to the ride ; in addition it is very useful for choosing the best route in advance.

Types of Map

Maps are made for a great many purposes and are usually classified by their size or scale. A motorist may plan his journey with the aid of a map scaled to 10 miles to the inch, but the usual scale used by drivers is 4 miles to the inch. This scale is sometimes used by the cyclist, but the ½in. to the mile is more usual. The 1in. to the mile is best of all for the cyclist who wants a full picture and wider appreciation of the country through which he is passing. Excellent 1in. maps are produced by the British Ordnance Survey Department.

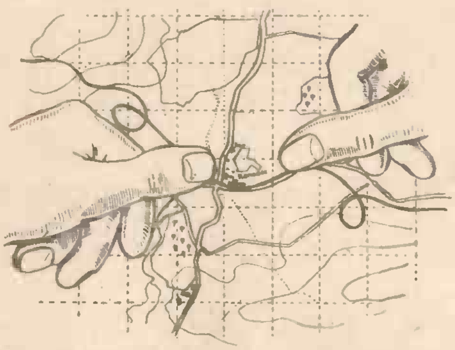


Fig. 1.—Measuring with a piece of thread.

Measuring Distance

Measuring distance between two points "as the crow flies" presents no problem. The straight edge of a piece of paper is simply laid across the two points on the map ; they are marked on the paper with a pencil, the paper is transferred to the scale at the foot of the map and the distance read off into miles, etc.

However, the distances the cyclist requires to measure are usually along a road and roads in this country are seldom, if ever, straight. There are several methods of measuring along a twisting road, perhaps the simplest of which entails the use of a length of thread, as shown in Fig. 1. The end of the thread is placed on the starting point and then laid along the road, following the bends, etc., as closely as possible. The thread is then measured along the scale of the map in the usual way.

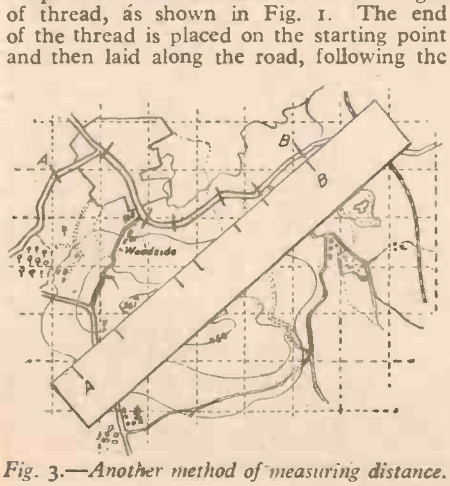


Fig. 3.—Another method of measuring distance.

A second method is to use a map measuring instrument, known as an opisometer: This has a small milled wheel, which is run along the line to be measured and, as it rotates, runs along a threaded spindle. One may be made easily as shown in Fig. 2. Measurement is started with the wheel at one end of its spindle, and when the distance is completed will have travelled some distance along it.. Direction of rotation of the milled wheel is then reversed along the scale at the foot of the map until the wheel is back at its starting point, when the distance in miles will be shown on the scale.

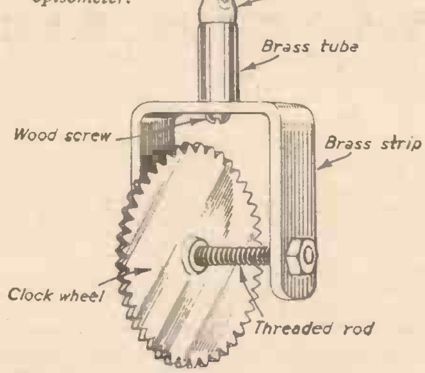
Another method is to use a pair of dividers, set to, say, ¼in. The distance is stepped out along the road and the number of steps counted. Some allowance will probably have to be made for very small bends.

Finally, the method shown in Fig. 3, using a pencil and a piece of paper, can be used.

Conventional Signs

The mapmaker cannot, on a 1in. map, show features such as churches, orchards, gravel pits, canals, woods, etc., pictorially, so a number of symbols are used, known as conventional signs. Most of them are perfectly obvious, but it is worth the cyclist's while to study the conventional signs panel at the bottom of the map. Practice at reading these signs, incidentally, can while away the tedium of a rail journey as a great number of topographical features can be recognised from the train.

Fig. 2.—A home-made opisometer.



Contours

Map reading by contours alone is a fairly complicated business and several books have been published on the subject. For the cyclist, reading the contours of a map in relation to the roads over which it is proposed to travel can be very profitable, especially in mountainous districts. To the rider using only the simple road map, a high mountain pass can come as a shock, but anyone preparing himself by consulting a large-scale map would allow adequate time for surmounting the obstacle.

In addition to the obvious utilitarian advantages of being able to read contours, a tour can be considerably enriched by the rider being able to identify the names of the surrounding peaks and mountain ranges. Fig. 4 shows some simple mountain shapes projected as contour lines and named.

It will be seen that lines close together indicate a steep slope, whilst wider-spaced ones show a gradual slope. A convex slope is shown by a series of close lines at the bottom and wider spaced ones at the top. A concave slope is just the opposite, having the close-spaced lines at the top. Two peaks with a dip between form a feature known as a saddle and would appear on the map as shown. Other geographical features are also shown in this diagram.

Heights are shown on a map by means of lines which are drawn through points of the same height. If two lines are shown, one marked 200 and one marked 250, it will be obvious that the ground slopes up between these two lines. On the ½in. scale map contours are shown by different colours.

The skilled mapreader can tell at a glance the shape of the hills in the whole area, and this is a skill which can only be developed by long practice.

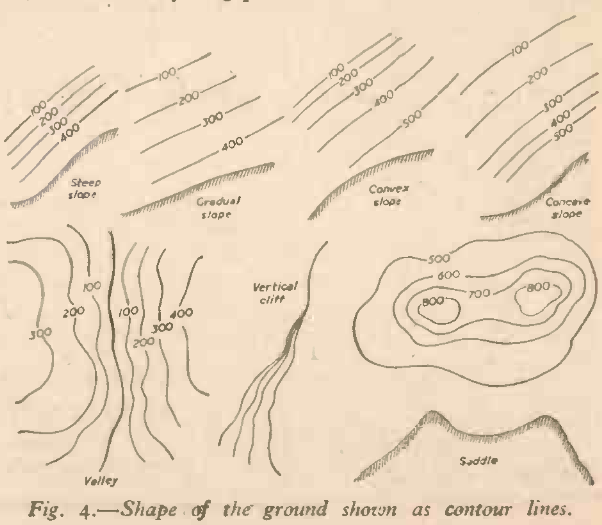


Fig. 4.—Shape of the ground shown as contour lines.

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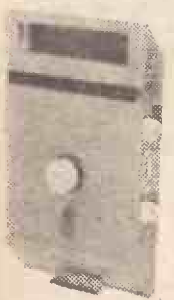

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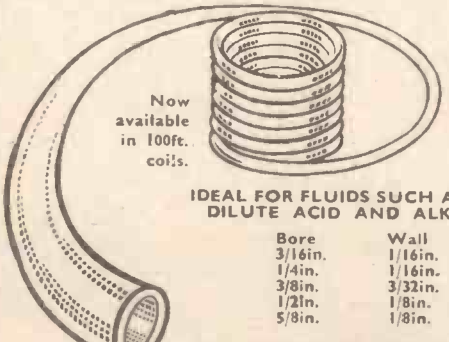

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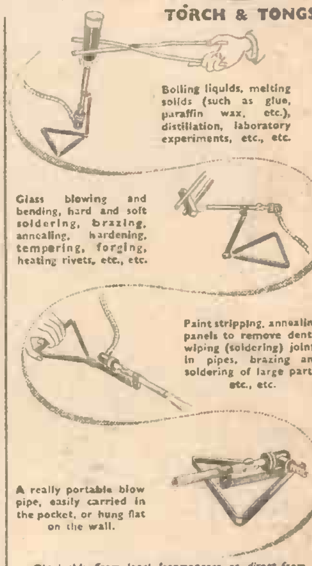

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