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EDITOR : F.J. CAMM

JUNE 1955

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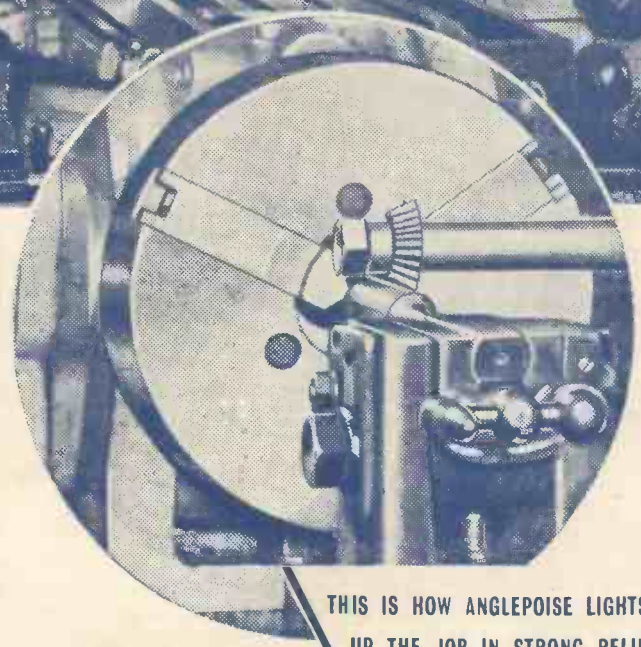

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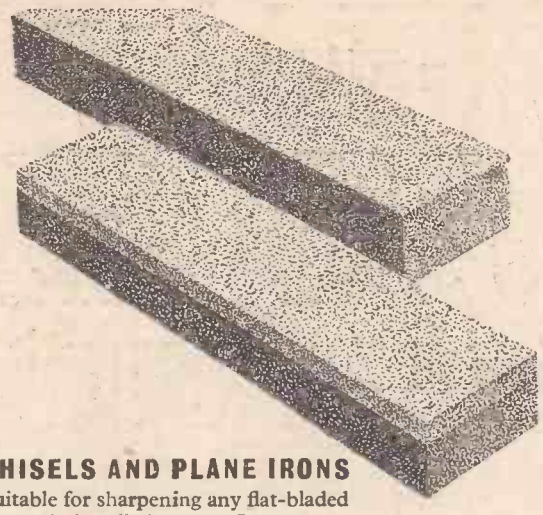

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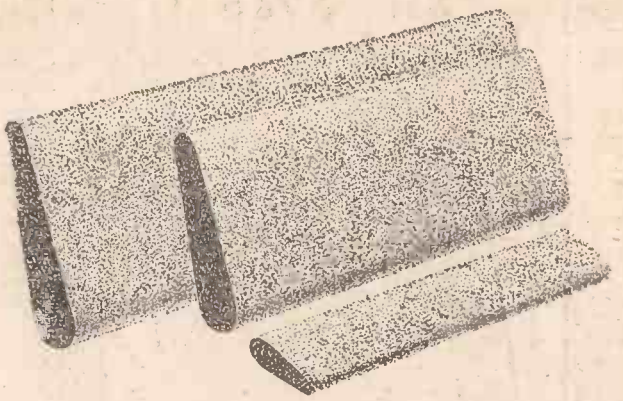

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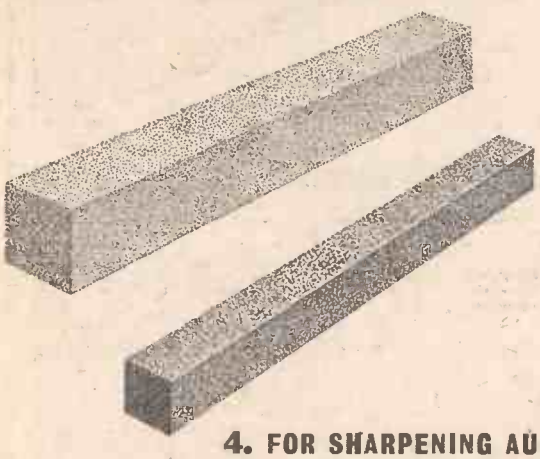

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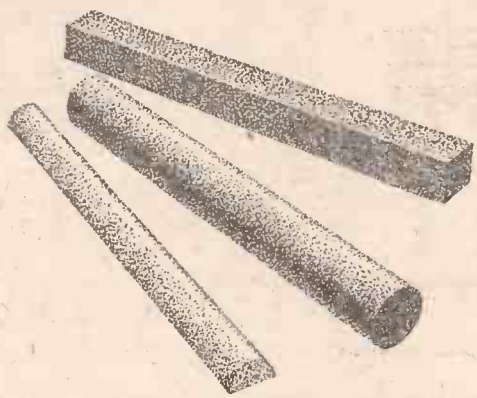

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Editor: F. J. CAMM
JUNE, 1955

FAIR COMMENT

By

The Editor

The Flying Saucer Controversy

SOME astonishing revelations have recently been made in a magazine published in New Jersey concerning Adamski's claim to have interviewed the occupants of a flying saucer. It will be remembered that one Jerrold Baker was credited in Adamski's book with having taken one of the photographs in it. Mr. Baker now denies that he took the photograph and enlarges on this denial by saying that the photo was not taken on the date indicated, that it was actually taken by Adamski, and that other photographs were destroyed on Adamski's instructions. Baker goes on to claim that he listened to a tape-recorded narrative of what was to occur some days before Adamski made contact with the space-ship and its occupants. He states that communication was received by psychic means, with Adamski acting as a medium.

A further astonishing statement by Baker is that he and Carl Hunrath saw what appeared to be the skeleton of a model saucer adjacent to the shack in which Adamski lived. He says that Adamski was nervous when questioned about it, but explained that it was an experimental television antenna.

James Moseley, who conducted an investigation into Adamski's claims, casts doubt as to whether any of the witnesses actually saw Adamski's meeting with the Venusians, and he makes the same points as I made in this journal when I dealt with Adamski's claims. Some of Adamski's witnesses now say that they were grossly misquoted in the book. Moseley, whilst not questioning the sincerity of Adamski, has come to the conclusion that the story is a hoax. At the moment of going to press Adamski has not issued any denial or comment on Baker's and Moseley's comments. It must be recalled, however, that Adamski had promised to come to England to lecture on flying saucers and I was to have been present to question him. He cancelled the visit on medical grounds.

Desmond Lesley, however, the co-author of Adamski's book, says regarding Jerrold Baker that he has a tape recording on which Baker explains how he took the photographs which he now denies having taken !

Whilst I still preserve an open mind on the subject of flying saucers, I want to say without equivocation that nothing has yet occurred which convinces me that flying saucers have landed, and my mind is filled with doubts which explanations since given have not removed.

Automation

A NEWLY coined word which has come into use in connection with factories is *automation*, and it refers to the automatic operation and control in industry and communications. It covers the use of automatic machines such as computers and electronic-controlled devices which take away the skill from the individual. In the early nineteenth century power-driven machines replaced man's physical strength. Handwork gave place to the machine-made product. In this new industrial age, which can be regarded as the second industrial revolution, a man's brain, intellect, reasoning and skill will be built into the machine. Science has slowly developed the automatic factory, and the major problem for management of automatic factories is one of training people so that the utmost can be obtained from automatic machines, processes, controls and communications. Science is endeavouring to co-ordinate scientific development in a number of independent industries and to apply them to the automatic factory. The factory of the future will be concerned with electrons and atoms, not only in nuclear reactors for power generation, but also in many control and inspection devices. Many factories to-day make use of automatic inspection in which machines are endowed with consciousness and the ability to decide what is right and what is wrong in connection with dimensions, weights and areas. Such automatic inspection will ultimately replace the large numbers of highly skilled human inspectors engaged in the ceaseless work of inspecting tens of thousands of manufactured products, and looking with difficulty for the few defective products which occur from time to time and contaminate the output. In an up-to-date chemical factory manufacturing processes are already operated with very little human assistance, but no chemical factory is yet completely automatic. In offices, of course, mechanical computers will add, subtract, divide and multiply more speedily and with greater accuracy than is possible with human operators.

Production machines are endowed with sufficient consciousness to be able to inspect their own products at the right moment in the productive cycle, and are endowed with automatic stop switches which become disengaged instantaneously when the first defective product occurs. A printing machine, for example, can be automatically stopped by ray control when the paper tears.

In spite of all these developments, however, I cannot foresee a time when the human being will be able to dispense with work. We shall still have to work for our livings for a certain number of hours a week, and the result of automation must eventually be a lowering of manufacturing costs, if cartels will permit it, and an increase in the standard of living. All this presupposes that trade unions will permit the use of machines which replace labour, and it is problematic whether this state of affairs will ever come about. In certain industries, when labour-saving machines have been introduced, trade unions have insisted on the retention of men who would otherwise be replaced by machines, and who have nothing to do except to watch the machines. In other industries unions have insisted on the continued employment of manual labour and have opposed the introduction of machines which would supplant it. Progress, therefore, does not entirely depend upon scientific discovery, but upon breaking down the resistance to change brought about by fear of unemployment or fear that the machine will lower earnings.—F. J. C.

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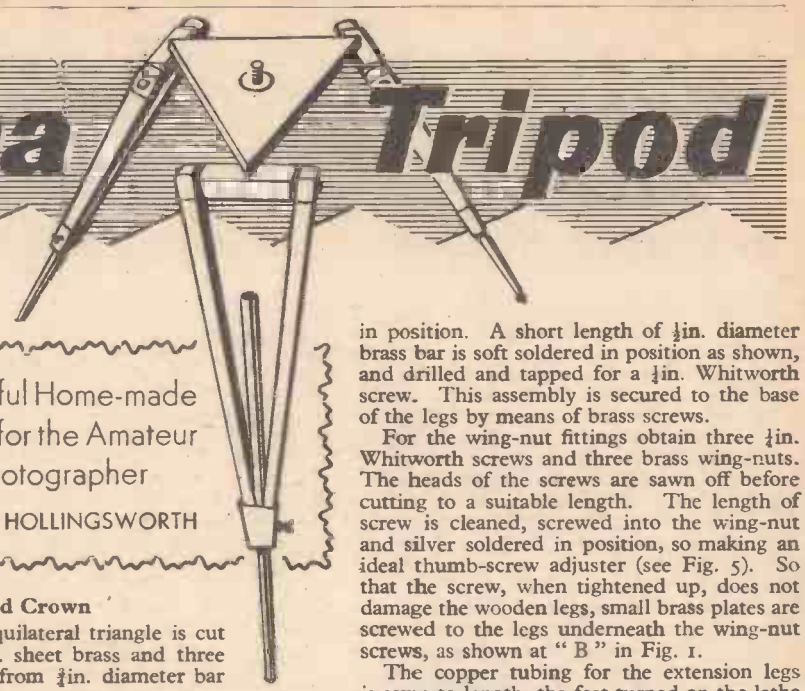
A Camera Tripod



A Useful Home-made Stand for the Amateur Photographer

By A. E. HOLLINGSWORTH

THE construction of this extremely rigid tripod is straightforward throughout and, when completed, it is suitable for the heaviest of cameras likely to be used by the amateur. It is not cumbersome when folded and may be extended from 25in. to about 50in.

The Wooden Legs

The wooden parts were made first; oak was used, but any straight-grained hardwood would be suitable. After being planed to size (⅞in. × ⅜in.) and sawn to length (25in.) a semicircular tapering groove was made in the bottom part of each leg with a moulding plane (see Fig. 1). Great care was taken in doing this accurately to ensure the smooth sliding action of the copper extension legs later on.

The next operation was to make the brass pieces for the top of the legs from 16-gauge material to the dimensions given in Fig. 2. Here again accuracy is essential and it is best to make the pieces a good tight fit over the wood. Silver solder was used to join the ends of the brass together. After cleaning up the brass pieces were tapped over the ends of the legs and a ¼in. diameter hole drilled through both wood and metal. The tops were then filed to a curve.

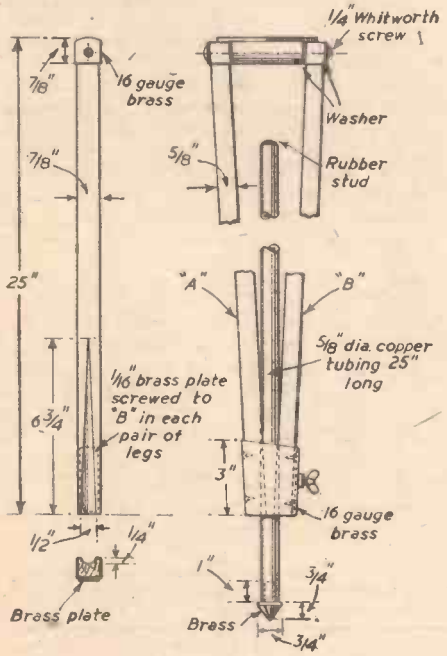


Fig. 1.—Details of one pair of legs.

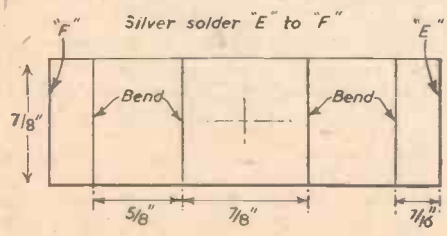


Fig. 2.—Development of brasswork at top of legs.

The Tripod Crown

A 3in. equilateral triangle is cut from3/16in. sheet brass and three pieces cut from ⅞in. diameter bar 2in. long. The ends of the bar are trimmed up on the lathe, then drilled to a depth of ⅜in. at each end and tapped for a ¼in. Whitworth screw. Flats are carefully filed on each piece of bar, which is then silver soldered to the 3in. equilateral triangle of 3/16in. sheet brass, care being taken that each is accurately aligned, as shown in Fig. 3.

A ¼in. diameter hole is drilled in the middle of the top after soldering the assembly together so that a ball and socket head may be fitted later.

The pieces for the bottom of the legs are marked out on 16-gauge brass, cut and folded as shown in Fig. 4, and then held together by a piece of 1/16in. sheet brass silver soldered in position. A short length of ¼in. diameter brass bar is soft soldered in position as shown, and drilled and tapped for a ¼in. Whitworth screw. This assembly is secured to the base of the legs by means of brass screws.

For the wing-nut fittings obtain three ¼in. Whitworth screws and three brass wing-nuts. The heads of the screws are sawn off before cutting to a suitable length. The length of screw is cleaned, screwed into the wing-nut and silver soldered in position, so making an ideal thumb-screw adjuster (see Fig. 5). So that the screw, when tightened up, does not damage the wooden legs, small brass plates are screwed to the legs underneath the wing-nut screws, as shown at " B " in Fig. 1.

The copper tubing for the extension legs is sawn to length, the feet turned on the lathe from ⅝in. diameter brass to the shape shown in Fig. 1, and tapped into position. Rubber studs are fitted to the top of copper tubes so that indoors the tubes may be reversed to avoid scratching floors, etc.

The legs are secured to the tripod head by means of ¼in. Whitworth screws.

All brass parts on the original were painted black and the wooden legs stained and polished to give a professional finish.

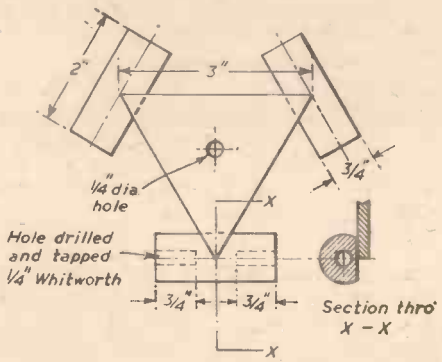


Fig. 3.—Details of the tripod crown.

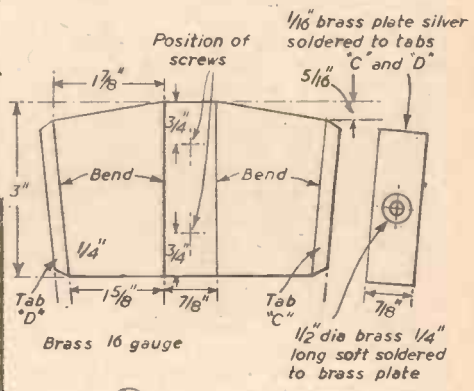


Fig. 4 (Above).—Development of brasswork at base of legs. Three are required.

Fig. 5 (Left).—Details of the wing bolts (three required).

MATERIALS REQUIRED

Brass

1 piece ⅞in. dia. bar 9in. long.
1 piece 16g. sheet 3in. × 3in.
3 pieces 16g. sheet 5½in. × 3in.
6 pieces 1/16in. × ⅞in. × 2½in.
1 piece 3in. × 3in. × 3/16in.

9 ¼in. Whitworth roundhead screws.
12 brass washers.
3 wing-nuts.

Copper

3 pieces ⅝in. dia. tubing 25in. long.

Oak

6 pieces 25in. × ⅞in. × ⅝in.

Building a Home Workshop

Details of Installing the Machinery

By "TUBAL CAINE"

(Continued from May issue)

ONCE the workshop is completed eagerness to see the wheels turning may cause the work of installing the machines to be rushed, the result being, perhaps, a poor finish on the articles, while there is also the possibility of straining the machine bed.

To avoid this and achieve the desired high degree of finish on the surfaces it is necessary to eliminate vibration, and this can be achieved only by careful and rigid installation. The work cannot be hurried and there are no halfway measures—the machines need fixing securely if they are to operate satisfactorily.

Installing the Lathe

This is the most popular machine in the home workshop, so let us deal with it first, The work does not differ on many points from other units, so most of these notes will suffice for those also. The cabinet machine has several useful features; chief among them is the fact that the cabinet is a firm base for the lathe, while it makes an ideal storage place for tools and chucks.

Another advantage is that if you decide to reorganise your workshop—moving the lathe to some other site—a quick slackening off of the holding-down bolts and electrical gear means the machine is ready for moving.

Fig. 1 is reproduced from last month's issue to refresh your memories regarding the floor construction. Holes must be drilled through the boards for the holding-down bolts; there is no need to drill these through the joists as this will weaken them, but if similar holes are made close up as indicated in Fig. 2 these will serve just as well.

Marking the Bolt Holes

When laying the floorboards each board is held with either one or two nails and the position of these latter items will show where you must drill the first hole. Stand the cabinet with the lathe temporarily in place—this is necessary in order to make sure the countershaft and, perhaps, cross slide do not strike the wall of your shop and to see that on finally tightening down the cabinet it lies square and not on an angle as this gives the impression of slip-shod installation work.

Mark the four holes with a pencil and move the cabinet away. The drawing shows that these bolts pass down very close to the joists—if you take steps to measure the centre distance of the cabinet holes before commencing the construction of a floor you can space the joists to enable each bolt to come close to a support as illustrated. If this is not possible, make the distance from each joist approximately equal as this gives just as good results if you take up the boards in question and introduce a "spacing collar" between them as shown in Fig. 3.

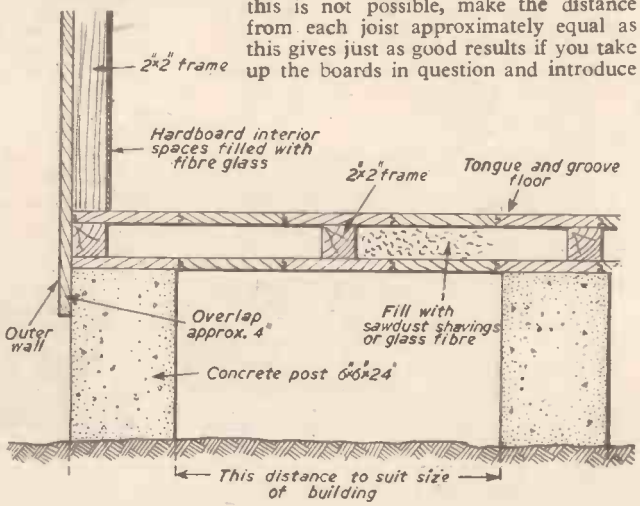


Fig. 1.—A cross-section through the floor of a workshop.

Drilling

The top hole may be drilled with the orthodox carpenter's brace and bit—making it about ⅛in. larger than those in the cabinet. This tool is not really suitable for the underneath hole and for this operation the twist drill is employed as this is longer and can pilot off the previously made hole and so ensure both are lineable. Drill the four holes in this manner and then stand the cabinet back over them.

Fixing the Bolts

The next stage is a little awkward because it means crawling beneath the workshop in order to insert the bolts from underneath, but usually this is not very difficult as the lathe is installed close to a window, and so, at the most, one's head and shoulders only go under the floor.

Push the bolts through the holes, not forgetting the large thick washers beneath the heads. The latter are essential to prevent the hexagons from sinking into the timber—the washers sink, but not to the extent the bolts do. Wedge them with a piece of wood to prevent them from falling out, and you can then re-enter the shop and run the nuts on with the usual washers in place.

Do not tighten the nuts at this stage, but check to see the facings on which the lathe stands are fairly parallel when a spirit level is placed over them. Finger tightness is sufficient.

Levelling

Few home mechanics will possess a level of the type used by millwrights in their work of installing machine tools, but many carpenters have a level which will prove suitable and a loan of one of these is perhaps easier to secure.

You may find the facings are too far apart to allow the level to contact both of them, but this difficulty is soon overcome by placing parallel strips on each face and spanning them with a length of straight bar. Bright mild steel will do, providing it has not been bent, and if the level is layed on this it will indicate how much your floor is out of truth.

A perfectly level machine is rather difficult to secure on this type of floor—in fact, this is not really necessary as the lathe tightens down on the facings, and if the cabinet is not distorted, then there is no risk the bed will follow suit.

However, if the level shows there is a bad slope, say, more than ⅛in., then you must pack up the lower end with steel packing pieces; and remember to prevent them from sinking into the boards as described above; make them about 4in. square. When all is set properly final tightening can commence. Give each bolt about half a turn and again check to see whether one end has moved more than the other; then if all is well continue tightening each nut a half turn at the time. There is no need to exert a lot of force as this will only cause the steel packing washers to sink deeply into the woodwork—about one turn to a turn and a half over what is termed finger tightness is sufficient and will hold the cabinet rigidly. Check the facings once more and place the lathe in position; whereupon you can tighten the bolts and so hold it securely to the facings, but do not forget only a quarter turn on each nut this time until all are properly

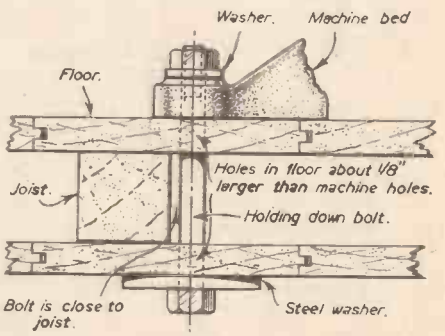


Fig. 2.—How the lathe cabinet is bolted to the workshop floor.

down tight. Another check along the bed and across the ways will show whether the lathe is nicely level and the bed not twisted, but try this in several places for a good result.

A Periodic Check

Checking at intervals to see whether the lathe has moved slightly at one end after a period of use is necessary as the initial installation is not sufficient to allow the machine to operate for several years. If no steps are taken to ascertain if any movement has occurred, there is a risk the bed will take up what we call in the engineering workshops *a permanent set*. In other words, the bed is twisted and the only remedy is to again completely machine it. A check once a month is not an arduous task and it takes only a matter of 15 minutes to accomplish, but it does ensure the lathe is

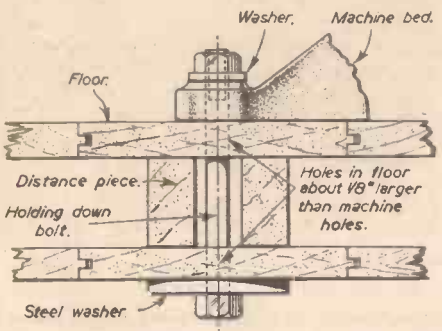


Fig. 3.—The spacing collar used to support the floor when the bolts are tightened.

properly set. After the first two or three checks it will be found to be more or less seated correctly and from then on there is usually no need for adjustment. However, the author still maintains that the monthly run over with the level is well worth while.

The Bench Machine

The bench machine is a little different proposition and more care is necessary to prevent distortion of the bed.

A rigid bench is the first requirement, and one with boards 1½in. thick is not too massive. To add to the general rigidity of this construction the provision of a leg immediately beneath the headstock is a wise precaution, but there is no need to incorporate another underneath the tailstock as there is no turning motion to create vibration.

Having marked and drilled the holes to match the bed casting, the lathe is placed in position and the level used provisionally to check to see whether it lies square and does not rock due to the general unevenness of the bench. If rock is excessive, then obviously the remedy is to plane the offending area; whereupon the level is again tried in both directions.

The author on one occasion used a ¼in. steel plate under both ends of a bench lathe instead of clamping it direct to the woodwork with another equally as thick on the opposite side. This gives an opportunity to install other packing washers between the bed casting and the steel plate instead of allowing them to sink into the wood. The tightening process is very important on this occasion, as there is a risk the bed will distort, so after the initial finger tightening a most careful check is essential to see if the machine is level. After one or two tries, the appropriate packing is installed, and you can again gently pull down the nuts—a quarter of a turn at a time. When the wiring for the motor is completed there is one further check which the machine tool makers suggest—a long bar of mild steel or brass is set to run truly in the chuck and the smallest of skims taken over the diameter. A careful measuring with a micrometer is necessary to see if the setting process has caused errors to appear, and if all is in order only .0005in. taper is permissible.

The Milling and Shaping Machines

There is perhaps less risk of distortion occurring when a milling machine is installed because the slides and base are only remotely connected together, but this is no reason why one should completely neglect the work and merely clamp the bed down in a haphazard manner. The same checks are advised because the miller will then stand rigid and free from any tendency to vibration—a factor to which this machine is prone due to the nature of the work it must perform. The cut is not continuous as in the case of a centre lathe—each tooth strikes the metal a heavy blow, which is, of course, transferred to the bed casting. If there is a lack of rigidity in setting the machine down, then this chatter is exaggerated and the surface finish suffers.

The miller is thus bolted down securely, and in the large engineering shops wedges are also installed between the bed and floor if there is any gap. This ensures the base seats properly, but even after all this a wooden frame is built round the flanged casting and cement poured into the mould so formed. This is known as grouting, and it gives an additional hold to the bed; a process which is unfortunately not possible in our case because the concrete is useless on the wood floor.

The shaping machine generally found in the amateur's shop is a bench machine, and the type seen in Fig. 4 has four bolts, one to hold each corner of the square flange securely. The apron is thus set to hang over the edge of a bench and if the angled table is also attached while installation is taking place this provides an excellent seating for the spirit level, and so a properly located machine can then carry out good work.

The Vice

A bench vice which moves when parts are filed is a nuisance, and a little extra time spent on fitting to the bench is well repaid with months of trouble-free use. For this accessory bolts which fit the holes in the bench are preferable. and a ¼in. plate underneath is better than three fairly small washers as these cannot sink into the plank on which the vice base is secured.

Some vices have three small vee-shaped projections on the face which contacts the bench top and these bite into the wood and so secure a more tenacious grip; they also prevent a turning action when an attempt is made to tighten various details in the jaws with a spanner. As they are about 3/16in. wide, a nick with a wood chisel is advisable as trying to force them into the grain can crack the base.

Drilling Machines

There is no need to elaborate further on the installation of a drilling machine as the operation follows on exactly the same lines. There is, however, one point which can be emphasised because it does allow a more efficient operating of the machine, especially when drilling holes in long components. Some drill heads can pivot, and this is a useful feature, because if you so arrange for it to overhang the bench when set in one direction shafts about 4ft. to 5ft. long can be drilled along the axis when stood vertically. The author does not suggest that components of this type are frequently encountered, and uses this description only to show the possibilities of such an arrangement, but occasionally the drilling of holes when several parts are assembled together makes a similar type of set-up essential. For orthodox drilling the head is turned at right angles until it again comes directly over the base and table. The spirit level placed on the circular table or the square base will show whether the drilling machine is level. Incidentally, the latter makes rather a useful marking out slab, especially if the reader will take the trouble to scrape the surface perfectly flat.

General Notes

Finally we come to the workbench, and though this appears to "put the cart before the horse" the author believes that all readers are aware how the construction is carried out, so there is no need to give detailed information on this part of a shop. However, many amateur mechanics tend to use timber of too small section, particularly for the top, and though the framework is usually rigid any attempt at hammering makes it necessary to do this directly over one of the supports.

The orthodox fitter's bench is of massive construction with cast iron legs at intervals of about every 10ft., and the top planks are always about 2½in. thick. Such an assembly permits the fitter to hammer away without causing the top to bounce at each blow—a covering of fairly thick lino is used to prevent such items as small screws and rivets from falling down between the cracks.

A heavy construction of this nature is not required in the home workshop, but

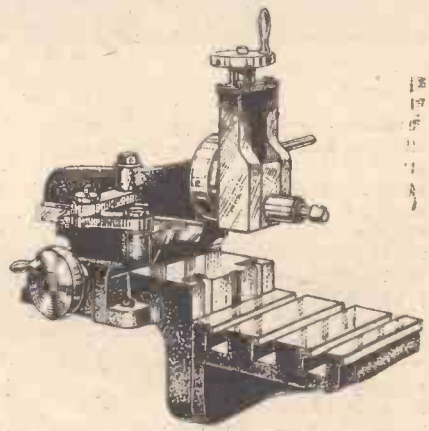
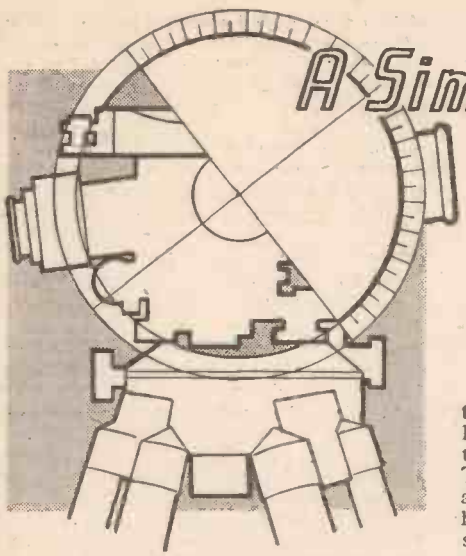


Fig. 4.—A typical shaping machine found in the home workshop.

something approaching what the author terms half-size is useful. Planks about 1½in. thick for the top with a framework 2in. or 2½in. square timber, well strutted, will make a useful bench. Screw all the parts together and do not use nails. This method of assembly is suitable for the floor and walls, but screws hold the parts together better, and you can occasionally go round and tighten any that have become slightly loosened.

(To be continued.)



A Simply made THEODOLITE LEVEL

A Simplified Version of the Professional Instrument Which Can be Made at Home

THE level (see Fig. 1) is simply a "U" of ¼in. diameter thin glass tube. It may be filled with water or spirit and the level line is sighted by looking over the surface levels of the liquid in the two uncovered upright limbs of the "U," ranging them against the measured markings on the staff, i.e., the white painted 6ft. or 8ft. rod with feet and inch divisions on it.

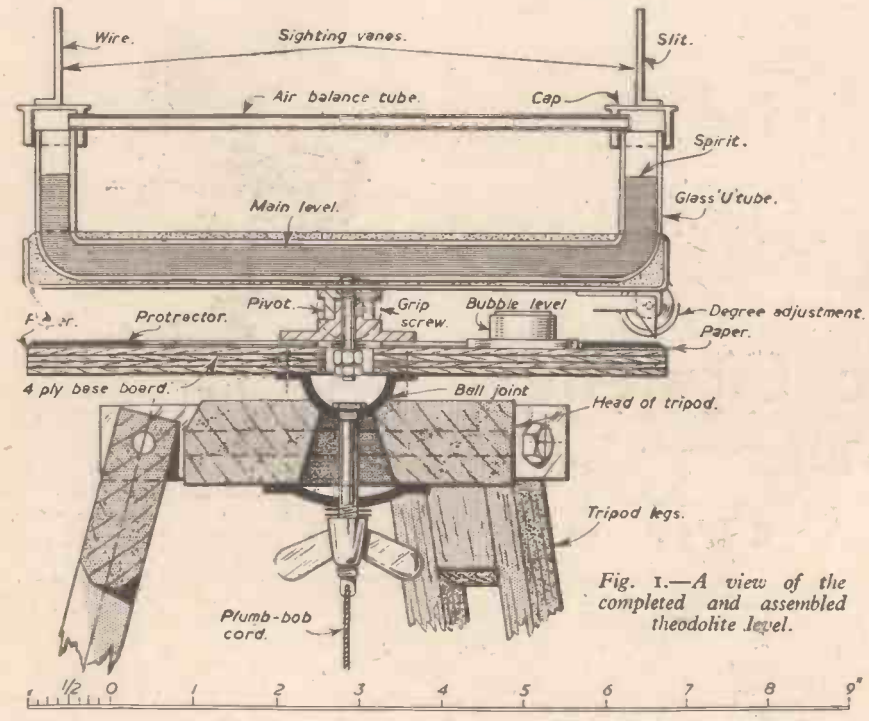


Fig. 1.—A view of the completed and assembled theodolite level.

On a reasonably clear day readings should be quite possible up to a range of 50ft. radius from the instrument.

The glass tube is bent, as shown in the general arrangement drawing, with two upright ends 2in. high. To protect the horizontal portion of the tube a trough of sheet metal is made up as detailed in Fig. 2, and after the centre pivot has been made and fitted, the level tube may be set in the trough in plaster of paris.

The Pivot

The centre pivot is made from brass bar, approximately as shown in Fig. 3, the upper portion being filed with a groove to fit the trough (which is soldered in) and tapped at the side for a brass clamping screw. The lower portion has a flanged base, and is turned to suit the upper portion as illustrated. The spigot and socket so formed should be a good working fit, the central bolt or stud holding the two parts together being quite slack in the hole drilled for it.

The double nuts on the latter are best locked up with spring washers intervening, as indicated in the general drawing. The flange of the lower unit is then drilled and wood-screwed down to the base board.

The Base Board

This portion of the instrument is intended to be made of hard wood 4-ply, about 5/16in. or ⅜in. in thickness. It may be circular, but if a turning lathe is not available there is no objection to a hexagonal shape, as shown in Fig. 4, the disc being about 8⅛in. diameter over the flats of the hexagon. This size is stipulated, as the larger the protractor is in diameter the more accurate will be the theodolite portion of the instrument, and 8in. diameter celluloid circular protractors, properly marked out, are readily obtainable.

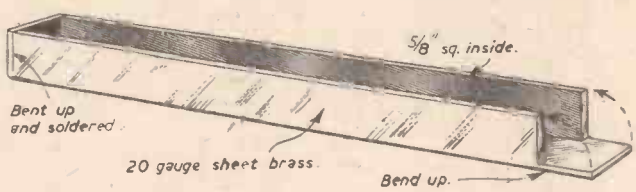


Fig. 2 (Above).—The metal trough to protect the horizontal portion of the tube.

Fig. 3 (Right).—The centre pivot.

The Bubble Level

The protractor referred to above should be set quite centrally on the base board, a line being scribed on its surface at the outset for that purpose. Then, in a convenient position on the surface of the base, a flanged centre bubble level, such as is used on cameras and other instruments for all directional levelling, may be screwed down to the wooden base. A great degree of accuracy is not really necessary, as the actual levelling is accomplished by the readings from the main "U" tube level.

The Ball Head

To obtain this all-round degree of levelness the underside of the base board is arranged to be fitted with a ball head (see Fig. 5), and a tightening screw to hold the whole of the working part of the instrument into a recess formed in the tripod head.

Any metal, dome-shaped object can be impressed into service for this, as long as it can be fitted with a flange or provided with other means of screwing it to the base board with a central screw-stud at least a ¼in. in diameter. The size of the ball head does not matter—within limits, of course. The central clamping down spindle should be fitted with a large domed washer, a couple of double spring washers and a fly nut. The spindle should also be long enough to be drilled for a plum-bob cord as indicated in the main drawing.

This latter is required when the instrument has to be set up directly over a peg in the ground when taking angles.

The Tripod Head

The head of the tripod is another hexagonal block of wood (see Fig. 6). It is best made up of three thicknesses of the same 5/16in. plywood as used for the base. These pieces should be screwed together and the whole planed up on the edges to shape.

The edge of the tripod head is shown sheathed with 1in. by ⅛in. metal strips arranged as shown in Fig. 6. These strips—

three in all—should be screwed on to the wood with about six round-headed screws in each. The soundness of the head construction is most important.

Setting Up for Levelling

To set up the instrument for levelling, spread the tripod legs as you would for a camera, seeing that they rest firmly on the ground and with the head roughly level. Unslack the main central fly nut and move the

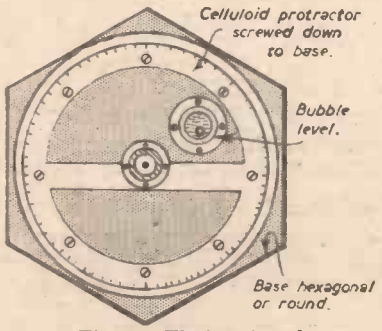


Fig. 4.—The base board.

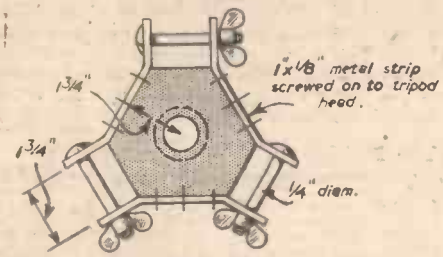


Fig. 6.—The hexagonal block of wood for the tripod head.

base about until the bubble level indicates that the base is level—i.e., when the bubble is as near the centre as possible. Tighten up, and the main "U" level can then be swung all round for levelling readings on the staff.

Fig. 5 (Above).—The ball head.

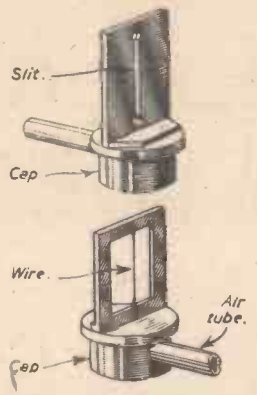


Fig. 7 (Right).—The back sight.

Theodolite Sights

To enable the instrument to be used as a surface theodolite to measure angles on the ground, for rough trigonometrical surveys, setting out buildings, etc., the top of the "U" level is best fitted with metal caps. On these are fixed the sight vanes. The foresight may be of the slit type, made by sawing a vertical slit not more than 1/16in. wide in a piece of stiff brass sheet. The slit should be filed to a knife edge, and also should be quite straight. A special tool-makes' Swiss file may be necessary for this work, but if any real difficulty is occasioned the vane may be made in two pieces soldered together, with a space between each forming the slit.

The back sight is simply a frame with a central vertical wire—a piece of flower wire—as illustrated in Fig. 7. Both the wire and the slit vane should be blackened in a flame.

The Liquid Level

As previously mentioned, methylated spirit may be used in the "U" tube instead of water. This liquid is less viscous, and the surface curve (due to what is known as the surface tension) is not so noticeable with spirit. To retain this liquid the caps which are fitted to the glass tube and carry the sight vanes may be cemented on. Plaster of paris may be used if there is a means provided for augmenting the supply of spirit, otherwise a cement may be employed.

Using the Theodolite

As the instrument, when it is used as a theodolite, must be placed over a peg or other mark in the ground, accuracy in this respect is provided for by the plumb-bob and cord. Otherwise, the instrument is set up as for levelling.

The level is then swung to range on a pole at the other end of the base line on the ground, and, when accurately sighted, the side clamping screw is used to hold it there. In such a position the pointer may not be exactly reading on to an adjacent degree mark on the protractor. Without swivelling the level off its ranged line, the adjusting screw of the pointer may be operated to bring it directly over one of the degree divisions, and save dealing with an initial fraction. You will know that you are commencing with an even figure, not a part of a degree. This is arranged by making the pointer of hard, springy brass sheet as shown, with an adjusting screw fitted into the other side.

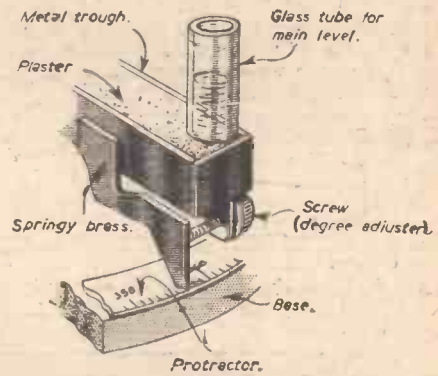


Fig. 8.—The liquid level.

An Automatic Cigarette Cabinet

IN the automatic cigarette cabinet shown in Figs. 1 and 2, there are two separate compartments. When the inner one is raised a cigarette is deposited on the receiving post, then, on the inner box being lowered, the cigarette is projected through the slot and remains on top ready for removal.

The boxes may be of white pine, mahogany, walnut, or other suitable wood. The sides should be ¼in. thick, and the top and bottom pieces about ⅜in.

The dimensions of the outer box are 3in. by 4in. and the inner 2⅜in. by 3⅜in. Near the bottom of the inner box are two wedge-shape pieces, one on each side, with a ½in. space between to provide the necessary clearance for the cigarette post.

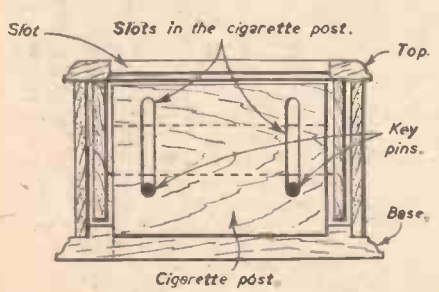


Fig. 1.—A front view of the cigarette cabinet.

This is placed in the centre of the outer box and extends nearly from end to end, the clearance being merely sufficient for the inner box to fit down between the ends of the post and sides of the outer box. The top of the post is cut slightly concave so that a cigarette will lay on top without rolling off and should be flush with the top of the cigarette box and of a similar colour, so that it is distinguishable only after close examination. Two slotted openings are cut through the cigarette post, one near each end, and two keys or stops—small sticks of wood—pass through the openings and are fastened to the sides of the inner box to prevent the box from being raised too high.

The keys and post are assembled before the inner box is placed within the outer one. Then place them in the outer box and invert the latter on the workbench so that the top of the cigarette post projects through the slotted opening of the top of the box and rests on the bench. Put on the bottom piece of the outer box and fasten to the cigarette post with screws.

The case can be carved, stencilled or decorated in any desired manner, according to individual taste.

In use, the inner box is raised until stopped by the keys. The cigarettes, which have

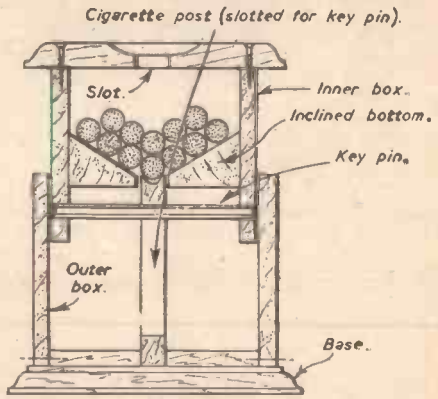
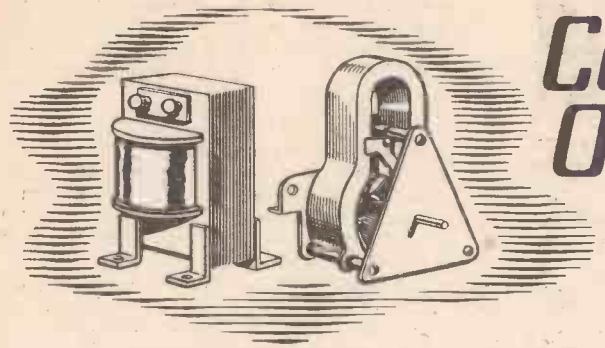


Fig. 2.—A section through the cabinet.

previously been introduced through the top opening, roll towards the centre, and as the box is lowered, all but one of the cigarettes roll off the post, and this cigarette projects through the top of the cover piece.



Control and Mains Operation of MODEL MOTORS

Circuits and Details for Using Mains Power to Replace Accumulators and Batteries

By F. G. RAYER

THE small motors which are primarily intended for operating from an accumulator or dry batteries may readily be driven from A.C. mains, which is much more economical. With dry batteries and small accumulators, replacement and re-charging are necessary quite frequently while anything approaching continuous operation of the model becomes impracticable. Mains operation completely overcomes these difficulties, and can be perfectly safe if a suitable circuit is used.

Such motors are usually of two types. One has a horseshoe-shaped permanent magnet for the field magnet —"permag" motors of this kind will only operate from direct current, but may be reversed by reversing the polarity of the supply. The second type has a wound field in addition to the armature windings, and will operate from either A.C. or D.C. supplies. As it cannot be reversed merely by reversing the polarity of the supply, this type of motor, though excellent for many models, is not usually employed in trains, where a permag motor is usual.

To drive a model motor from the mains, it will thus be necessary to reduce the mains voltage to a figure suitable for the motor, and to provide a D.C. or A.C. output, as the case may be. So that the motor, and connections to it, are safe, isolation from direct contact with the mains is required, while fuses may be added for additional protection.

Using A.C. Motors

These can be distinguished because the field (fixed) magnet assembly is not permanently magnetised, as mentioned. Instead, it will be of soft iron or similar material, laminated in the case of all but the cheapest motors. Current for such a motor may be drawn directly from a transformer, which can be connected as at "A" in Fig. 1. Here, current may be drawn from any wall socket or other outlet. As with all mains apparatus, mains connections should be of good flex, terminating with a proper adapter or plug, and all connections or joints should be so covered that no bare points can possibly be touched. These precautions include the primary of the transformer, but not the secondary. Provided the transformer is in good order, the secondary circuit (and hence the motor and leads) will be perfectly safe to handle, exactly as if a dry battery or accumulator were used.

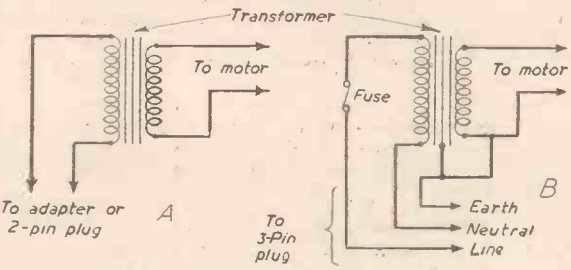


Fig. 1.—Circuits for A.C. type motors.

The transformer primary should be for the usual 200-250v. mains. Transformers cannot be used with D.C. mains. The secondary should be chosen to suit the motor. If the correct voltage for the latter is not known, the transformer secondary voltage can be the same as that of the batteries originally used. The current rating of the transformer must also be sufficient for the motor. With many of the better-class model motors the current consumption is indicated by the maker. If not, then it could be ascertained with a meter. Failing this, the transformer can be chosen with an adequate rating, when any current up to this figure can be drawn. Very small toy motors, designed to run from dry batteries, seldom consume more than 1 amp. Some small motors take less. The intermediate type of motor usually takes about 2 to 3 amps., while the larger type of model motor may take up to 4 amps., which figure is seldom exceeded.

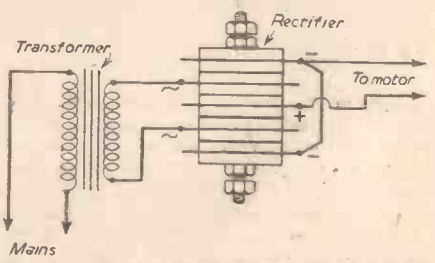


Fig. 2.—Circuit for A.C. operation of D.C. motors.

The voltage supplied by the transformer should not exceed that usually employed. But the current rating may be higher—this figure only means that the transformer *could* supply such a current, if wanted. A 6v. 4 amp. transformer could thus be used for any 6v. motor which did not take over 4 amps.

At "B" in Fig. 1 a circuit for operation from a 3-pin plug is shown. The transformer core and secondary are earthed. If a breakdown or any other fault causes a short between primary and secondary, this earthing prevents a dangerous voltage arising in the motor circuit; at the same time the fuse would blow, giving added protection. Though a fuse will be present in the house circuit, this will be of such high rating that it will not give full protection in the present case. The additional fuse may be of low rating—½ amp. is suitable, as the primary current is much lower than that in the secondary and motor. With such an arrangement, no switch or means of disconnecting should be placed in either neutral or earth wires. A switch, if used, is placed in the line conductor, in which any fuse is also situated.

The motor may be stopped by switching off the secondary circuit only, exactly as with a battery. Whether this is done, or the primary circuit switched, is a matter of convenience only.

Using D.C. Motors

These have a permanent magnet field, and are usually made in the smaller sizes, especially for trains. They are especially suitable for dry batteries, because their power output is greater, for a given current consumption, than that of the wound field motor.

Such a motor can be operated by adding

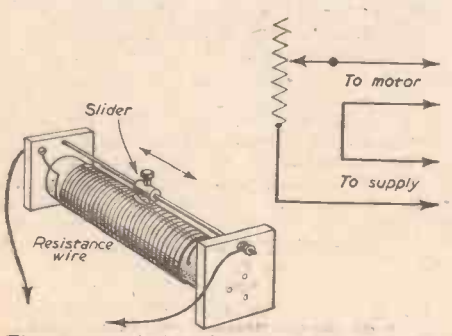


Fig. 3.—Typical resistance speed controller.

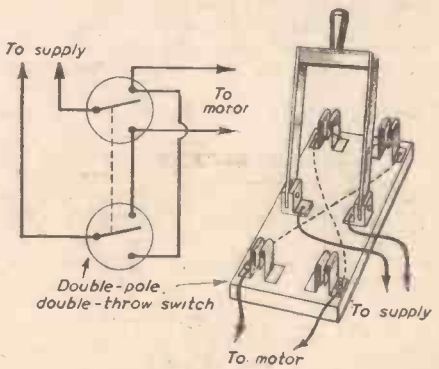


Fig. 4.—Reversing P.M. motor.

a rectifier to the transformer, as shown in Fig. 2. Half-wave rectifiers can be used, but the full-wave type is best. As such metal rectifiers are largely used in charging circuits, they can readily be obtained, at moderate cost, for any voltage between about four and 24. The voltage rating should be equal to or greater than, that of the motor to be driven. For example, a 6v. rectifier would do for motors normally run from 3v., 4.5v., or 6v. batteries. The current rating should

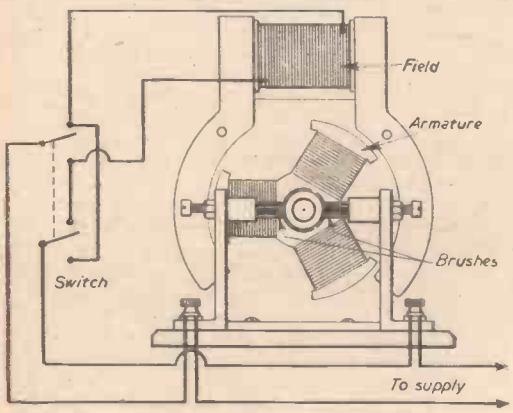


Fig. 5.—Reversing A.C. type motor.

similarly be equal to, or greater than, that of the motor. Very few permag motors consume more than 2 amps.

If working near its maximum rating, the rectifier should be mounted with fins vertical, and air permitted to reach them easily, to prevent heating. The "AC" tags must be taken to the transformer secondary. Many manufacturers mark these green, or with a sign such as shown. Positive and negative tags are frequently marked red and black respectively.

When maximum current is being drawn some voltage drop occurs. To compensate for this the secondary of the transformer may need to be of somewhat higher voltage than that required for the motor. Here, a transformer with tapped secondary is best, as a suitable output can then be chosen readily. Or an ample voltage can be provided and subsequently reduced to the level best for the motor by a wire-wound resistor or speed controller.

The Resistance Controller

Whether of A.C. or D.C. type, or operated from mains, rectifier or batteries, a motor may have its speed controlled by reducing the voltage with a variable resistor. This is of great advantage in many models, especially with railway layouts.

The resistance controller may consist of a number of loops or spirals of wire connected to studs contacted by a rotating arm. Or the wire may be wound on a circular or straight core of insulating material contacted by a slider. A simple controller of straight type is shown in Fig. 3. The wire may be wound upon a hardwood block about ½in. to ¾in. in diameter, the slider slipping along to contact turns. The gauge and length of wire will depend on the motor, but is in no way critical. If the motor still runs too fast, with all the wire in circuit, the resistance is too low. This can be overcome by using thinner wire or increasing the length. If control is very sudden, with the motor stopping, the resistance is too high. Thicker wire will overcome this, or the wire, if not too thin, may be spaced out on the former. For most motors iron or resistance wire of about 22 to 24 s.w.g. will be satisfactory. The turns may be secured to the wooden former by varnish. Very thin wires are best avoided because of their fragility and to avoid excessive heating. If nothing else is to hand, copper wire of about 30 s.w.g. can be pressed into service, the gauge being reduced to 34 s.w.g. or so for smaller motors. A few trials will show what to expect, and the wire can then be wound tightly on the controller.

Reversing

The permag motor can be reversed by reversing the polarity of supply, and this can be done with a double-pole double-throw switch wired as shown in Fig. 4. A simple knife switch is shown, but other types can be used. The switch can have an "off" position and may be placed anywhere between motor and supply, the latter being battery or rectifier. Such a switch, with speed controller, is particularly useful with model trains.

The wound-field type of motor, operated either from a mains transformer (A.C. supply) or battery (D.C. supply) may be reversed by changing the polarity to the field or armature (but not both). In this case the switch needs to be near the motor to avoid additional long connections. In many instances the field and armature will be in parallel, when the switch can be added as shown in Fig. 5. Here, connections to the field are reversed. Connections to the brushes could be reversed instead if these are easier to obtain. If the switch has an "off" position it must not be used, as only the field (or armature) part of the circuit would be interrupted.

If the motor has field and armature in series the switch can still be used. In this instance it will be in series with one battery lead, instead of in parallel with both, as in Fig. 5. In addition, if the switch has an "off" position this can be used.

Where field and armature are in parallel both will be of the same voltage, and it is usually in order to wire them in series to double the voltage rating of the motor if desired. For example, a 6v. motor would require 12v. when so modified. To suit a transformer or rectifier available it is often possible to change a series-connected motor to parallel operation and halve the voltage.

Charging an Accumulator

The use of mains for trickle-charging an accumulator should not be overlooked and is of very great advantage with mobile models or boats. The accumulator powering such a model will usually be quite small and a charging rate of 1 amp. is adequate. Mains transformer and rectifier may thus have maximum ratings of 1 amp. and the cost of such parts will be small.

A suitable circuit for this purpose is shown in Fig. 6. The meter is by no means essential, but indicates the rate of charge. If it is omitted, a meter should be connected externally when first trying the circuit, to assure operation is satisfactory. With free-acid cells charging may continue until a hydrometer reading shows the acid has reached a specific gravity of about 1.280. With "dry" accumulators the charging period will be found marked or with accompanying data. For example, "15 hours at 1 amp. or equivalent at lower rate." If so, it is only necessary to leave

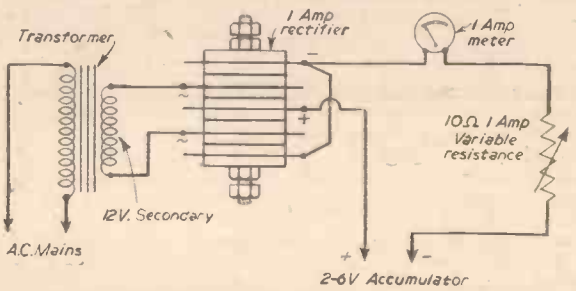


Fig. 6.—Circuits for charging accumulators.

the battery on charge for the required period —15 hours at 1 amp., 30 hours at ½ amp., or so on. Distilled water should be added when necessary.

A New Liquid Air Machine

Its Principle and Operation

THE Philips Research Laboratories have concluded a series of developments leading to the manufacture of an entirely new gas refrigerating machine that can be used to produce liquid air.

Philips Electrical Limited, in announcing the Liquid Air Installation PW7000, state that temperatures of minus 200 deg. Centigrade can be obtained quickly and simply. The plant also has distinct advantages over more orthodox compression refrigerators which, ordinarily, are unable to produce temperatures lower than between minus 60 deg. Centigrade and minus 80 deg. Centigrade.

Principle of the Machine

The principle of this machine may be compared with that of a heat engine. In a heat engine, energy in the form of heat is transformed into mechanical energy, but if no heat is applied and the machine is driven from an external source of power such as an electric motor, it can be made to function as a refrigerating machine.

The new liquid air machine is comparatively small and is considerably simpler in construction than the "cascade" type of machines usually employed to produce temperatures below minus 80 deg. Centigrade. It also compares favourably in efficiency and simplicity with conventional compression types of refrigerating machines which cannot produce such low temperatures. Because refrigeration takes place without compression, and since there are no expansion valves, the liquid air is pure and free of oil contamination, dust and dirt.

Low Working Temperature

A feature of the new installation is the short starting time required to reach the low working temperature; liquid air is produced within 15 minutes of switching on. The plant will produce 5 litres of liquid air per hour at an ambient temperature of 20 deg. Centigrade and will run continuously for 16 hours in air at a relative humidity of 50 per cent. After this working period, defrosting of the air intake head is necessary, where moisture and carbon-dioxide have been deposited as ice and "snow" respectively. De-frosting takes up to one hour including starting time for the next working cycle. Refrigerating capacity can be varied, both by changing the speed of rotation and by varying the gas pressure within the working space of the machine.

AN INTRODUCTION TO LINOCUTTING

Print Your Own Designs With Blocks Made From Linoleum

LINO printing is one of those hobbies that can be done without many tools, and it also offers a remarkable amount of scope even to the reader who cannot draw. It is a branch of the art of drawing and is a unique style of expression still used for book illustrations and Christmas cards. Linocuts were one of the first forms of printing block and there is still enough resemblance between the modern printing block and the linocut to see how one evolved from the other.

Type of Linoleum

There are several types of linoleum in use to-day, but the only suitable variety for lino-cutting is the expensive sort, plain and about ¼in. thick. The cheaper linoleum with a printed or glazed surface is likely to crumble either during cutting or when printing. Suitable scraps of lino may be found in the home or may perhaps be available from a furnisher specialising in linoleum laying. The best type of linoleum for cutting is also available from handicraft stores.

As in the modern line block, the parts of the lino surface which are cut away show up as white areas in printing and the parts which are left print the black part of the design. It is obvious, too, that the lino block will print in reverse, i.e., from left to right, so that the design will have to be cut the reverse way to that which the finished print is desired to be.

Materials Required

One of the prime needs is, of course, a set of cutting tools and there are many of these available. The one shown in Fig. 1 is a typical example. These blades may be interchangeable in a single handle and each shape of blade is designed to produce a particular type of cut. There are, however, no definite rules governing the selection of tools and many workers use individual instruments of their own devising. Other accessories required are a rubber squeegee roller, 4in. to 6in. wide, a sheet of glass, a paint brush, a tube of indian ink and some carbon paper.

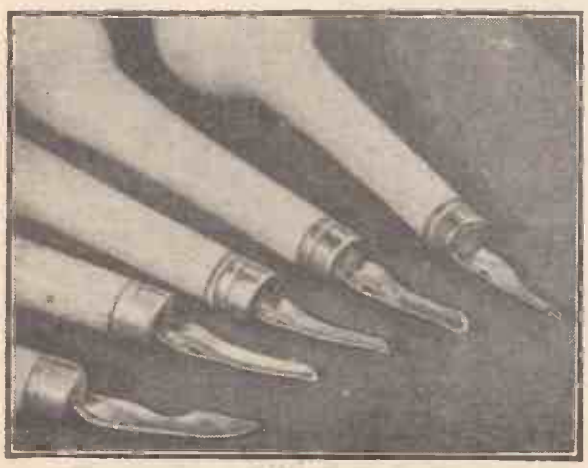


Fig. 1.—A typical set of linocutting tools.

Fig. 3.—A relatively simple linocut.

Practice Cuts

Before embarking on a proper design it is advisable to experiment with the tools and the medium, so that some degree of skill is acquired and the "feel" of the tools obtained. The practice pieces of lino should be mounted on wooden baseboards in the same way as will be the finished designs, so that the worker becomes accustomed to working with a thick block of material.

The work should be carried out on a firm table or bench and a good space should be cleared so that there are no obstacles. The lighting should be adequate and conveniently placed—an adjustable bench lamp is ideal.

The practice cuts should be made with every type of tool and should include all types of line; thin cuts, wide channels, curves and circles as well as straight lines. A far smoother circle or curve can be cut by holding the tool practically stationary and rotating the lino with the left hand so that the lino itself makes the cut.

A further point to remember is that the smaller the number of cuts the better and at this point some experiments should be made in cutting round a pencilled line. The shape of the cuts is important, too; the edges of all the cuts should be radiused as shown in B, Fig. 2. If they are cut as at A the unsupported angular walls of the grooves are liable to collapse when printing commences.

Mounting the Lino

Once the design has been selected, and a simple one of the type shown in Fig. 3 is advocated for the first attempt, the rectangle enclosing it should be drawn on the lino. This should be run over with a cutter, incising to about half the thickness of the material, then bent back along the lines, exposing the canvas backing which is then cut through and the surplus edges discarded. To keep the resulting rectangle firm and flat, it should be mounted on a plywood or an ordinary wood base. The wood used must be flat, otherwise the print will not be even. The surface of the wood and the back of the rectangle of lino are covered with glue and pressed together. A flat piece of wood is laid on top and a weight placed on it to ensure that it adheres evenly. Allow glue

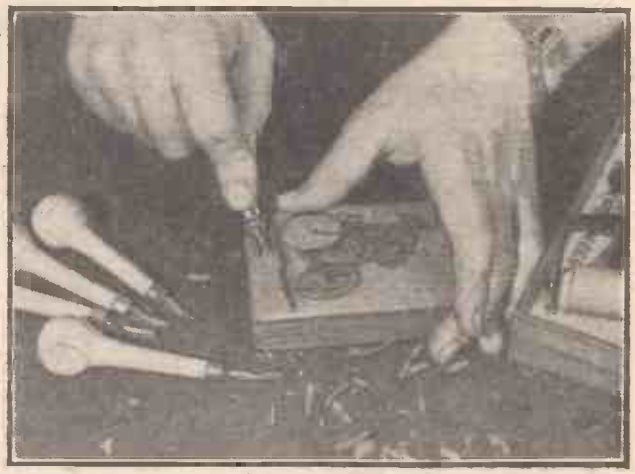


Fig. 4 (Right).—Linocutting in progress.

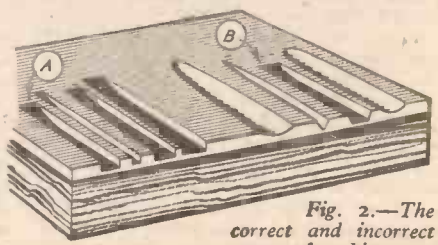


Fig. 2.—The correct and incorrect ways of making cuts.

to dry thoroughly before starting to transfer the design.

Transferring the Design

The method of doing this depends

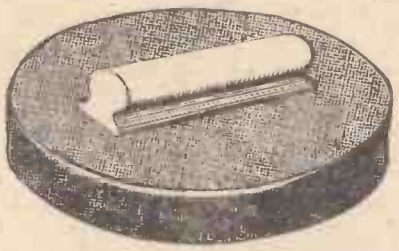


Fig. 5.—The pad for use in printing.

largely on the reader's artistic talent. Those with drawing ability will probably prefer to draw their own design straight on to the lino block—remembering, of course, to draw in reverse. Those who are not artists, however, will prefer to trace their designs and transfer them with carbon paper. Even those who evolve their own designs may find it preferable to draw it out separately and then transfer it to the lino block. The method of doing this is as follows: lay a sheet of carbon paper face upwards under the drawing and then pencil it over. This will result in a reverse copy being formed on the back of the original. Now lay the carbon paper face downwards on the lino block and on this the drawing reverse side up. Fix both paper and carbon paper securely to the block and trace over the lines of the design with a hard pencil. This will produce a reversed sketch on the linoleum. It may then be advisable to make the design more permanent by going over it with indian ink.

Cutting the Design

The first step is to go round the main outlines with a V gouge to separate the chief objects in the picture from the background, and then the main part of the background, up to the V grooves, is cut away with a wider U tool. When this has been done the finer detail work can be executed, the most fragile and delicate pieces being left to last so that they are in no danger of being broken while the easier part of the cutting is being carried out. Fig. 4 shows a linocut being made.

Fig. 6.—A more complicated design. This reproduction is of course much smaller than the original linocut.

Inking the Roller

Printing from linocuts is, of course, the final operation. On the sheet of glass mentioned earlier is poured a little indian ink and over this is passed the roller until the latter is evenly covered with ink. Be sure not to get too much ink either on the glass sheet or on the roller. A little practice will soon show the right quantity to use, but until experience in this direction is obtained it is advisable to make experimental prints, increasing the amount of ink until the right quantity is found. You can always increase the quantity of ink, but it is difficult to remove the excess.

Printing

There are two methods of making a print: one way is to place the block face uppermost on the table, pass the inked roller over it, depositing an even layer of ink on the black. Then turn the block over on to the clean sheet of paper and press it down firmly and evenly. Avoid lateral movement in the slightest degree as it is pressed down, and then remove it sharply to avoid blurring, and the print is made.

The other method of making the print is by laying the sheet of printing paper over the upturned face of the inked block, spreading it lightly with the hand to make it fast. To press the paper evenly over the design a pad is necessary. This can be formed from a piece of thick rigid felt, as shown in Fig. 5. The handle is fixed by screwing through the felt into the handle and another pad of felt glued underneath to cover the screw head and provide a flat, smooth rubbing surface. After rubbing over the block evenly, raise one corner of the paper to see if the printing is satisfactory; if not, replace the paper and rub over again with the pad. Then, when completed, strip off the print and leave to dry.

We have in this article dealt only with the basic techniques of linocutting, and although there are other more complicated methods of operation as well as colour-printing techniques it is felt that success depends more upon the skill of the worker. Fig. 6 shows a more advanced design—one which any person acquiring the necessary skill should be able to execute.

The Railway of the Future?

A New Idea for Fast Land Transport

By W. ZALEWSKI

THE idea shown in the sketch was drawn up as a suggestion for future railway transport. The sliding units (sliding bearings) replace the running wheels. These sliding units grip the rail in such a way that it creates a constant attachment between sliding units and rails through the lubricating system so that the moving wagons cannot be dislodged under any circumstances. The rails are laid in such a manner to secure them from being lifted up, loosened or otherwise upset by forces produced by moving wagons. The carrying surface of rails can have longitudinal channels for lubricant in which the sliding units float with similar effect to that of a moving hydroplane.

The sliding units could in certain cases be replaced by groups of rollers, the aim being to obtain high speeds.

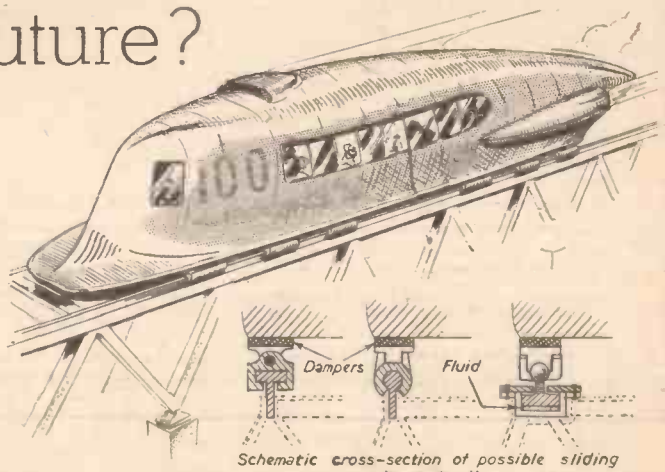
The reason why a railway on wheels cannot attain high speeds is perhaps some unevenness, some lack of balance of wheels and the varying elasticity of the rails. All these produce forces which can cause derailments.

In my idea, the rails would be very rigid and built some distance above the ground, on specially strong metal or concrete frames and would run in a straight line. The upper surface of the rails would be slightly concave grooved to retain the lubricant, which could be a cheap fluid of very light viscosity. Sliding bearings would grip the upper part of the rails and would, of course, be attached to the wagons by some system of dampers. In front of the sliding bearings would run a cleaning system also.

Of course, there is a great deal of work and calculations needed on the details and also on the construction of the sliding units, the wagons, the rails and the driving power.

The speed obtained would depend on the following factors:—

the lubricating system,
the cooling of sliding bearings,
the power plant.



Schematic cross-section of possible sliding units and rails.

An artist's impression of the "railway of the future" and some suggestions for wheel alternatives.

I believe such a method of transport would be as fast as air transport in the future but very much safer. It would also be a great deal safer than present rail transport, which was invented over 100 years ago for slow travel, and has not been brought to the limit of safety where speed is concerned.

Readers are invited to submit their views concerning the practicability or otherwise of the above, or to submit alternative schemes.

OUTDOOR 'O' GAUGE MODEL RAILWAYS

By E. W. TWINING

Concluding Details of the Garden Railway Layout Which Appeared Last Month

FIG. 9 is a section across through double track giving dimensions in a station, but the six-foot way can have its dimensions increased a little on the curves to ensure the clearance of one coach from another in passing trains. No station occurs on a curve in this layout so the platforms can all be as figured, viz., 1 3/16in. from the rail. In laying the curves it would be as well to test clearances by passing coaches and a Pacific engine around the two tracks to ensure that they do not foul each other.

The Station

There are two stations of which I have thought it advisable to give details or general drawings. These are included in Fig. 10, which includes all the buildings shown in the plan except the small country or wayside station; this can be of very simple form and consist of the usual self-contained building on each platform, each fitted as a booking office and waiting room. The main central station is a structure without an arched roof, for it is best to have every train in a garden railway out in the open and perfectly accessible.

The platforms for this and all stations can be modelled in concrete if preferred, and I suggest that a tool be made to fit on and between the rails and to be slid along to strike the height and edges of the platforms. By this method the long lengths can be made parallel with rails and be perfectly weatherproof. The tool is simply a piece of plywood cut to the required silhouette.

All buildings can be constructed in plywood or other hardwood and be made removable. They can be heavily painted with white lead and stone colour so that they may stand up to a sudden downpour of rain; but they are comparatively fragile and it would be better to ensure to them a long life than to permanently fix them out of doors. It would be possible to make all buildings of concrete, but their construction would involve the maker in a tremendous amount of work in the preparation of moulds. Plywood will be the best to build in and by this is meant the waterproof variety. Spare no expense, but use aircraft quality whenever plywood is called for.

All joints, where permanent joints are called for, must be made with inside square pieces to form rebates—either squares or right-angled triangular pieces, and these can be nailed on or screwed to the main walls with white-leaded paint joints—either paint or casein glue which is much more waterproof and stronger than Scotch glue. Whichever is used, white lead or casein, the joints should be screwed as well and when the building is complete it should be painted all over with three coats of white lead paint, the third coat having raw umber with a little yellow-green tube colour added to give it a stone colour.

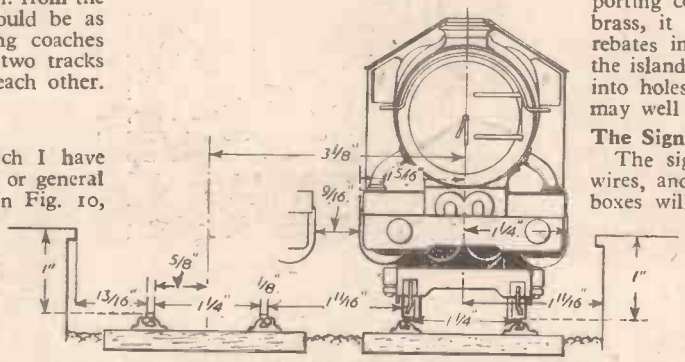


Fig. 9.—Details of track measurements for clearance purposes.

The roofs of the locomotive shed and the goods depot can be of tiles or slates, whichever colour is preferred. If of tiles use venetian red with black added. If slates are preferred, mix black and white lead and a little green until a green-grey slate tone is obtained.

All of the drawings in Fig. 10 are to a uniform scale, which scale has been added. From this it will be seen that the central station is a little more than 11ft. long and one section is a couple of inches over 6ft. in length. Make this of 9mm. plywood. The goods depot is 5ft. 9in. long and even the larger signal box has a length of 18in., so it will be seen that some good construction has to be put in to these buildings. The windows should all be cut through the walls, rebate strips inserted and either glass or perspex put in. If the canopies and their roofs over the platforms are made of glass, the most simple construction will be to make up the frames in metal and include the supporting columns in the metal. Using angle brass, it will be possible to provide simple rebates into which the glass will drop. On the island platform the columns should drop into holes, but on side platforms the frames may well be screwed to the building.

The Signals

The signals, the rigging of the operating wires, and the levers and gear in the signal boxes will be an important job. There are four types of signal called for; two of them on single masts. The "home" as at A, Fig. 11. The "distant" is at "B." The "home and distant," both on the same mast as at "C" and the bracket signal which is shown at "D." The bracket carries what are really starting signals, "S," in one case, but they are both home signals. One controls the points of the main line to the terminus and the central station and the other is the starter from the terminal station.

For distinction I have made all home signals to operate in the downward quadrant; for the all clear, and the distant, arms go to the upper quadrant to give same indication. In this drawing, B indicates black, W white, Y yellow, and G green. "Y or R" means that the glass is either yellow or ruby. V. means vermilion. All the ironwork is

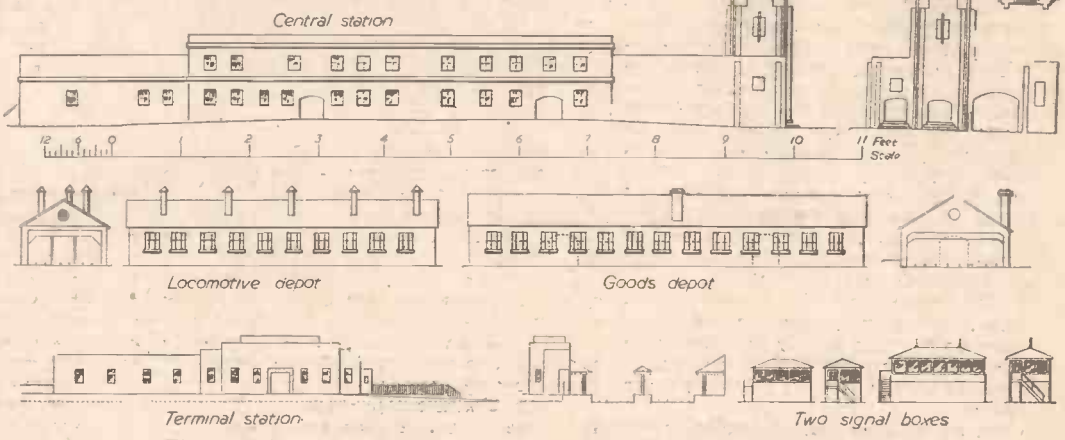


Fig. 10.—Elevations of buildings shown in the plan, which appeared last month.

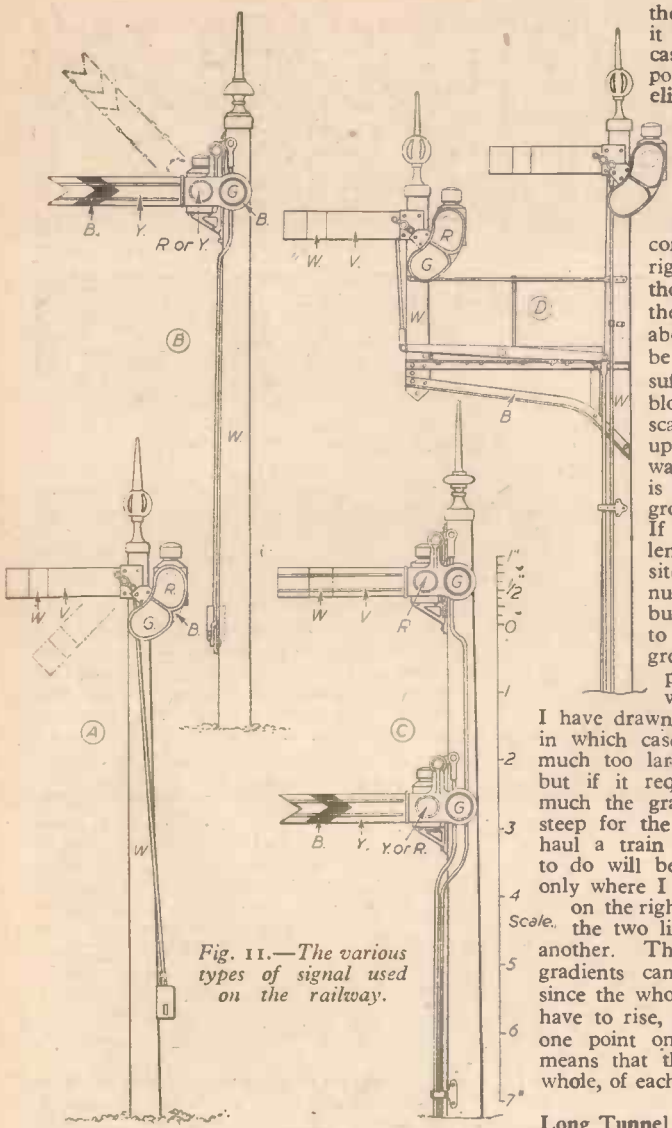


Fig. 11.—The various types of signal used on the railway.

painted black and all woodwork, except the arms, is white. All signal arms are white on their backs with a black band across, which band follows the shape and position of those on the front side.

Layout Modifications

The reader will probably wish to reduce the number of signals and it will be in nearly every case the single-armed posts which will be eliminated. It will merely mean that the blocks will be longer. There are certainly some which can, or could, be dispensed with. They are situated between the top left-hand corner and the bottom right-hand and include those at the crossover at the viaduct. A total of about seven or eight could be cut out and still leave sufficient lengths to the blocks to represent correct scale. Much depends upon what the reader wants, expects to get, and is able to get on the ground which is available. If he can quadruple the length and breadth of his site he can put in the full number of signals shown, but many will be unable to do so. In fact, the great majority will be hard pressed to get the railway within the limits in which I have drawn it, viz., 42ft. by 25ft., in which case they can, if it is not much too large, compress it a little, but if it requires compressing very much the gradients will become too steep for the engines to ascend and haul a train and so the only thing to do will be to have one crossover only where I have shown it and have on the right-hand side a junction of the two lines, not one line below another. This will mean that the gradients can be less than halved since the whole of the lines will only have to rise, or fall, 5in. and that at one point only: the viaduct, which means that the whole, or nearly the whole, of each circuit can be gradients.

Long Tunnel Alternative

It will seem a great pity to scrap the idea of the long tunnel but the best thing to be done, if the alteration is made, will be to have another short tunnel in the bottom right-hand corner of about 3ft. 6in. in length and let the junction be open. There will then be two junctions. If this is done I would point out that a three-armed bracket signal will be called for to deal with three roads. What the gradient would be would depend upon the size of the ground, but if it were done on ground of the size which I have drawn it would work out at about 1 in 235. I would rather have a fairly stiff grade at some point so that the engines have to work hard in getting their trains up to the summit.

Signal Boxes

There will be in each case, not only the levers and frames, but underneath them there will be the rods and bell cranks to the wires leading to points and signals. Then besides these and projecting at the backs of the levers and below the floor of the box there should be a locking frame of sliding bars, which will, when a lever is pulled over, lock all other signals and points, on the same track, in their " on " positions and so prevent two opposing signals or points being taken off at the same time. Whether the reader will make and fit such a locking frame will be for him to decide. Obviously it will have to be strong enough to actually lock the levers from being wrongfully moved ; in fact, that is what the frame is for. It is the levers which are locked by it, so it will have to be carefully thought out in the cases of both boxes. It will be placed fairly high up in each box and underneath the level of the levers, either at their backs or in front beneath the flooring. It would be better to get the whole railway finished and working, including all points and signals and then see, after working the levers for a time, whether a frame for locking is desirable or necessary.

Surrounding Scenery

As a finish to the railway and its surroundings grass must be set on all embankments and the central lawn. Now it will make quite a difference to the height of the land whether turf is laid or whether grass seed is set in the ground. My own preference would be to sow seed using a finely-screened earth, after sowing on a perfectly flat surface. Small trees may be set, especially those which can be purchased of Japanese varieties of conifers. Besides miniature trees, little bushes of box, tiny oak trees, etc., can be set amongst the grass, whilst acorns may be pushed into the ground in places. Hart's-tongue ferns, Lady ferns and Buckler ferns may be set. There are many flowers, both wild and cultivated, which can add beauty and charm to your railway and there is much to be said for ivy on surrounding walls.

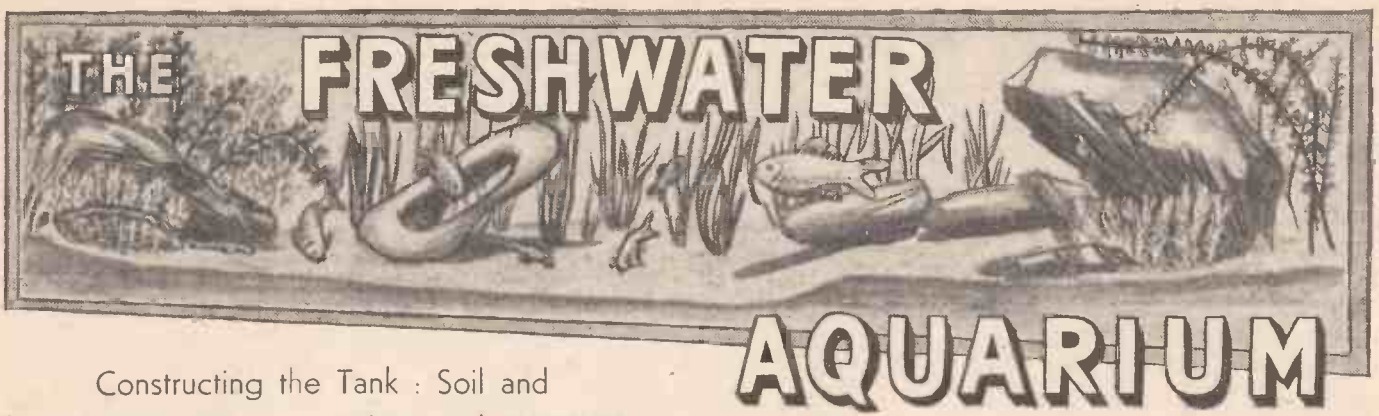
Japanese Miniature Trees

How to Grow the Decorative Plants Mentioned in the Previous Article

THE plants may be raised from seed, cuttings, grafts or layers. When they are a few inches high they are transferred from the nursery to pots and the shaping of the trunk begins. Copper wire is bound loosely round the trunk and limbs, and these are now gently persuaded to take any shape desired. As the trunk develops, the wire must be carefully removed and replaced by fresh, more loosely wound to allow for growth. This process is repeated year after year until the wood hardens, when it will retain the pose permanently without the need of wire.

Each spring the young trees are repotted in fresh compost and the roots are quite drastically pruned. All woody roots are cut away and the fibre roots clipped round. The head is then pruned till it is in perfect proportion to the roots which are to maintain it. This matter of adjusting the size of the roots to the size of the head and vice versa is one of the most important points to be considered. The roots of pines are never cut, as excessive wastage of resinous sap may cost the tree its life. These roots are sometimes tied in a loose knot or are folded over and over the base of the trunk. The result of this treatment is that a certain number die, leaving sufficient to support life but not to make growth. These trees are kept under the closest supervision, wiring and training being carried on throughout the year. A weak fertiliser is given weekly during spring and summer and great care is exercised in watering, for they must never be allowed to get dry. For nine months of the year they are allowed to stand in full sun, but in winter they should be protected from the frost and kept under somewhat cooler conditions than in summer.

Fully established specimens must be repotted and have their roots trimmed every spring, the larger trees should be similarly treated at least every second year. A suitable compost consists of two parts heavy loam or clay rubbed down till it is of granular consistency, two parts coarse river sand and one part old leafmould. A cold greenhouse is, of course, the ideal place in which to grow the trees, but they are also useful for room decoration. They will not tolerate gas ; however, coal and electric fires are less harmful, but even so, plenty of fresh air is essential. They should be removed from the room when the windows are closed and the fire is alight. In summer, leaving them out of doors overnight will go a long way towards preserving them, especially if given an occasional day out of doors when it is raining. Watering is very important and a thorough soaking in a basin once a week is desirable, and moderate watering in addition whenever necessary. Spray the foliage frequently to counteract the dry atmosphere of the house. During spring and summer, dried blood at half the normal strength will help if given once a fortnight.



THE FRESHWATER AQUARIUM

Constructing the Tank : Soil and Water Plants : Stocking with Pond Life

By ERIC N. SIMONS

THE modern fashion is, of course, the electrically heated, ornamental aquarium containing a variety of tropical fish; but while this calls for a minimum of effort and attention and is a soothing and decorative addition to the home, there is far more interest and excitement to be had from the freshwater aquarium. This contains indigenous pond life, but if desired a few goldfish may be introduced, though, as will

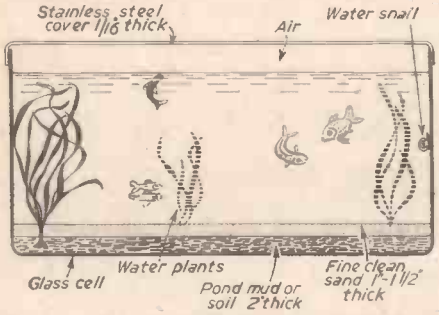


Fig. 1.—The disposition of soil, sand and water in the tank.

be seen, they are liable to cause troublesome complications.

The Tank

It is possible to buy a suitable tank, equipped with slate sides on three sides, with clear glass on the fourth side for purposes of observation. These are, however, somewhat expensive, and it is possible to achieve the same result much more cheaply and with equal efficiency by other means. The first requirement is a large electric battery glass cell, of such size as the prospective owner considers he needs or for which he has room. Such cells are readily obtainable, have a horizontal rectangular form (the vertical smaller cells are not so suitable), are made of transparent glass, are open on the top, and are cheaper than the specially made tank.

Reducing Light

The next step is to cover three sides of the tank with black paper or paper black on one side. The object of this is to reduce the amount of light coming into the tank. It is not sufficiently realised that fish, even goldfish, do not like bright light, and for this reason it is considered cruel to keep them in perfectly open glass bowls or jars. It must be remembered that what we are endeavouring to do with our aquarium is to reproduce in the home the conditions of pond life. Observation of any outdoor natural pond will show that bright light coming in on all sides is never found. Consequently, we darken the tank as much as possible for the sake of the inmates, while retaining one clear glass wall through which to see what is happening inside.

Soil and Sand

There are two schools of thought regarding the next stage. In some aquaria the first step is to introduce a layer of soil, or, better still, pond mud about 2in. deep at the bottom of the tank. The object of this is to provide adequate reception for the water plants which are essential to the pond. These are planted in the soil. Over the top of this layer is placed an inch or so of fine sand, which prevents the water of the tank from becoming unduly muddied by the soil and enables the fish, etc., to detect readily the particles of food that sink to the bottom, and consume them.

Avoid Pebbles

The second school considers that sand alone should be used, and on top of this a layer of pebbles. In the writer's experience the pebbles should be avoided. They make the tank look attractive to the eye, but they form pockets into which odd particles of food fall and become inaccessible. In due course these decay and are liable to pollute the water. Moreover, if, as occasionally happens, some inmate of the tank dies, its body may fall between pebbles and be hidden to the observer. The body is not seen, therefore, and again corrupts the water as it decomposes. This is particularly likely to happen with water snails, which in their black shells themselves resemble pebbles when they lie dead among the stones.

Water Plants

The water plants should not be introduced into the tank until the mud and sand or sand alone have been put down. Such plants are essential because they provide the oxygen which keeps the water sweet. It must always be borne in mind that the true freshwater aquarium has no artificial apparatus for oxygenating the water. The water is kept sweet by the oxygen given off by the water plants, and it is therefore absolutely essential that no more life should be introduced into the tank than can be supported. Otherwise there will be insufficient oxygen to enable the fish to breathe, and the distressing sight will be seen of their rising to the top and gulping air, or dying (as do the smaller fish) with great rapidity.

The aim should be to achieve a true balance of nature, just as in a natural pond in the open air, and this is not by any means so easy to achieve as it sounds. In fact the beginner will in all probability have many failures before he finally achieves success.

Reducing Evaporation

The owner having bedded down the plants in their soil, water is introduced into the tank, but 1in. or 1½in. should be left unfilled. Evaporation of water from the surface of the tank is a continuous process, and it is a nuisance, especially if one is liable to be absent from home for several days at a time, to have to keep adding water to compensate for the loss. The best remedy is to obtain a sheet of flat, unpolished stainless steel large enough to cover the top of the tank completely, and about 1/16in. thick or whatever may be available. This is readily slid off sufficiently to enable water to be added if desired or taken right off for work done inside the tank. Additions of water will, however, be needed but rarely, because most of the evaporated liquid will condense on the colder steel, and form drops that return to the tank.

A front view of a typical domestic freshwater aquarium.

Establishing the Plants

The enthusiastic owner must not at once introduce his livestock. The plants need time to establish themselves before they begin to give out oxygen in sufficient quantity. Algae need time to develop and form, and such algae play an important part in the life of the aquarium. It is, therefore, essential to leave the tank for from two to three weeks before introducing fish, etc.

Washing the Sand

The sand used for the bottom of the aquarium should, for preference, be fine sea-

sand or silica sand, clean and free from impurity. Where such sand is not readily obtainable it is possible to use builder's sand, but this must be carefully washed before it is introduced, to remove organic matter liable to contaminate the water. Many such washings may be necessary, and as long as the washing water comes off muddy or dark, the washing must continue, until only a residue of pure sand is left.

Types of Aquarium Plants

One of the best water plants to be used is the arrowhead (sagittaria sagittifolia), which has arrow-shaped leaves, leafless stems, and flowers from July to September. Pondweeds may be used, and duckweeds, while other plants are the water speedwell, water milfoil, and water soldier. Roots of these plants can usually be bought from a dealer, but it is much more interesting to find one's own plants from local ponds. Such plants, being those best suited to the particular climate and surroundings, are likely to do better than plants brought from other districts.

Water Snails

The next requirement is a number of water snails, which act as scavengers. They steadily move up and down the sides of the tank, feeding on the algae that give the glass a brownish coating which makes observation difficult, and therefore keep the inside clean and the glass clear. They also move across the floor of the tank removing the inevitable debris, such as the excreta of the fish. What is more, at the due season they lay numerous eggs, which they deposit in jelly-like blobs on the side of the tank, and these make a highly satisfactory and nutritious addition to the diet of the fish, which eat them greedily. The snails, however, like the other living creatures, should not be introduced until the tank has settled down, i.e., after about three weeks, as there will be no algae for them to feed upon.

Stocking the Tank

We now come to the stocking of the tank, and here a warning must be given. Nowhere is nature more "red in tooth and claw" than within the restricted space of an aquarium. There are some species that are the natural prey of others, so that to keep them in the same tank is to ensure their certain death. Thus, goldfish devour water-shrimps, sticklebacks, and most fish smaller than themselves. Beetle-larvæ catch tadpoles in their curved prongs and suck them dry. It is much better, if one wishes to study the habits of certain forms of pond life, to have a number of supplementary smaller aquaria devoted exclusively to a particular species, which may then live and develop without fear of extinction. Sticklebacks are a case in point, because one of the most fascinating things is to see these little creatures actually build a nest for themselves and their offspring at the right time of year. The minnow is also fascinating because of its beautiful colours at the mating season, when it is almost a darting rainbow.

Goldfish

Goldfish are attractive from the ornamental point of view, but they are not in their habits particularly interesting, and are a menace to most of the other species put into the tank with them. They consume a good deal of oxygen and need a considerable amount of food. Moreover, they are liable

Another view of the freshwater aquarium.

to a fungus disease which makes itself visible by silvery patches on their golden scales. If this is observed, the fish must be removed at once, the white patch removed by delicate rubbing with cotton wool, and the fish kept apart until it is certain that it has recovered. Otherwise it will infect the other goldfish.

Fish Food

There is no need to buy expensive ants eggs to feed these fish. Sago in the dry state is equally nourishing and much less expensive. Care must be taken not to give the fish more than they can or will consume at a time. Otherwise, the particles tend to fall to the bottom instead of floating on the surface, and there, almost inevitably, some of them may fail to be eaten and begin to decompose.

Preserving the Balance

If the correct balance is maintained, the plants will give out oxygen, the fish and other living things will produce carbonic acid for the plants, the snails will do the cleaning work, and the aquarium will be self-perpetuating. Despite all care, however, the precarious balance is liable to be upset by some accident. For example, goldfish are liable to nibble the leaves of the water plants and kill them, which promptly reduces the balance of oxygen. Should the sliding off of the tank cover produce a sour or offensive smell from the water within, it is a sign that the balance is wrong and the water is turning bad. There is then no remedy but to remove the fish temporarily with a fish net, taking care not to place them in water at a lower temperature than that of the tank. Siphon out the water with a glass or rubber tube or a combination of the two, clean out the tank, removing any decomposing matter, and begin all over again.

Avoid Rockwork

Many owners of freshwater aquaria like to insert artificial rockwork, imitation grottos and lighthouses, etc., in their tanks, but in the writer's view these are inartistic and to be avoided. They do not add to the charm or interest of the tank; they tend to cause complications of the type referred to in connection with pebbles and they all have to be removed when it becomes necessary to clean out or make new plantings.

The Tank for Scientific Study

The tanks with slate slabs, bolted or screwed together, which as earlier stated can be bought, are not always satisfactory, because not only are they expensive but also they are heavy and brittle. If the aquarium is desired less as an interesting hobby than as a means of genuine scientific study, then it is advisable to cover all four sides of the glass to render them opaque, and light from the top only, as only in this way can true pond conditions be simulated. It is found that even a single transparent side of the aquarium causes restlessness in fish which they do not show in more normal conditions, and such restlessness is liable to shorten their lives. Where this method is adopted, however, the stainless steel top cannot be used, and this has the drawback that a coating of dust, etc., is liable to form on the surface of the water.

Circulation of Water

To obviate this dust settlement which is liable to have bad effects, such as reducing oxygenation of the water, it may be essential to have some form of circulation, either intermittent or continuous, but slight.

Hungarian Bentonite Exports

THE big export possibilities of Hungarian bentonite are to be exploited. Hungary is rich in this mineral, which is of great importance as a binding agent in many industries, including iron-founding, ceramics, constructional engineering, rubber and linoleum making, dyeing, manufacturing fire-resistant materials, and for soil improvement.

Bentonite has been found particularly suitable for making granular fuller's earth, which is valuable for cleansing oils and for filtering air and gas. Successful experiments have also been made in clarifying wines and fruit juices, and there is a big future for bentonite in the improvement of sandy soils.

Working Model of an Atomic Pile

THE United Kingdom Atomic Energy Authority has lent to the Science Museum a large working model showing the "B.E.P.O." Atomic Pile, the larger of the two pioneer atomic piles set up at Harwell. This pile went into operation in July, 1948, and is used for research purposes and for "cooking" the radioactive isotopes which are now so widely used in medical research and treatment, in agricultural research and in industry. The model goes through a complete cycle of operations in five minutes.

New British Gravity Survey

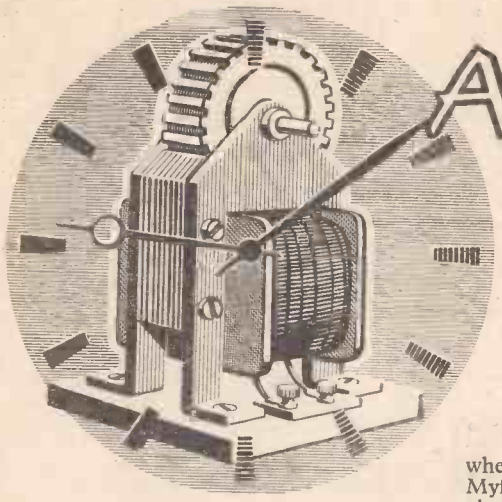
OBSERVATIONS intended to increase scientific knowledge of the earth's crust under the South Atlantic and Indian Ocean are to be made from a submarine.

Such gravity surveys depend essentially upon the variations in the swinging period of a pendulum. Differences in the composition of the earth's crust produce differences in the effect of gravitational pull, and therefore can be detected by pendulum readings.

Gravity surveys of that portion of the earth's crust which is below the ocean can only be made from submarines which, when submerged, are not subject to wave motion.

Electronic Passenger Counter

BIRMINGHAM CITY TRANSPORT DEPARTMENT is to give practical tests to some new equipment. An indicator unit, mounted by the rear platform of the bus, comprises a small panel containing an electro-magnetic counter having an illuminated numeral behind an aperture in the front panel. The numeral changes each time a passenger enters or leaves the upper deck. When the top deck is empty the indicator shows the full number of vacant seats. As soon as all the available seats are filled, the indicator registers nought and a "Full" sign is illuminated. The indicator is controlled by an electronic device which utilises a beam of light across the stairway.



A Synchronous ELECTRIC CLOCK

Adapting an Existing Clockwork Movement to Operate from a Synchro-motor

By T. S. JONES

THE clock to be described is of the synchronous type, that is, it depends for its working on the fluctuations or cycles of the alternating current. The clock will *not* work from direct current. It consists essentially of two separate units, the motor and the movement. Since there is only one simple lever connection between both units, and the lever may be of any length, the motor need not be in close proximity to the clock itself. This means that this device is ideal for converting existing clocks to synchronous operation. My most successful model is at work in the case of a grandfather clock which was virtually beyond repair.

The reader is advised to obtain an old clockwork movement as the basis of his clock; these can often be obtained for a few shillings at sales, and the larger the better should be the rule. Old clocks have the advantage that they are robust, both in the case and in the gear wheels. Another advantage in using an old clock is that the reduction gears for the hour hand are already in place and need no alteration.

Materials

These are simple and are readily obtained. The following are the main items required:

A 50-tooth cast-iron change wheel from a lathe.
Transformer iron.
4-6oz. copper enamelled wire. (38 s.w.g.).
Sheet brass about 18 s.w.g.
An old clockwork movement.
Sundry nuts and bolts and bits from the junk box.

The wire may be obtained from Post Radio Supplies, 33, Bourne Gardens, London, E.4.

The Motor

This is of conventional design and is similar in some respects to the one described in the February issue of PRACTICAL MECHANICS although it is considerably more robust and has remarkable power. It is not recommended for driving models as it works best under continuous steady load. Its speed is absolutely constant and the builder has no control over this, the final speed being dependent on the number of teeth on the rotor. The wheel will move two teeth onward for every cycle of the A.C. mains. Thus on 50-cycle mains the wheel will move on 100 teeth per second. If there are 50 teeth on the wheel the final speed will be two revolutions per second. This gives a steady time sequence which is the basis of the clock. The wheel may have 100 teeth, but this makes a very large motor with far more power than is necessary.

Construction begins with the preparation of the rotor. This is made from a change wheel from a lathe. The original was a Myford lathe wheel of 50 teeth. Having obtained a suitable wheel, treat it in the following manner. Remove from the teeth about half their thickness, that is, reduce the diameter of the wheel by half the depth of the teeth. This gives a flat profile. Then, with a fine warding file, clear out the lands between the teeth until they are of square section. Plug the hole through the middle with a brass plug shrunk in and drill out to take a ¼in. silver steel shaft. This job must be done very carefully. If no lathe is available do the plugging first and the trimming of the teeth afterwards. The wheel must revolve dead true.

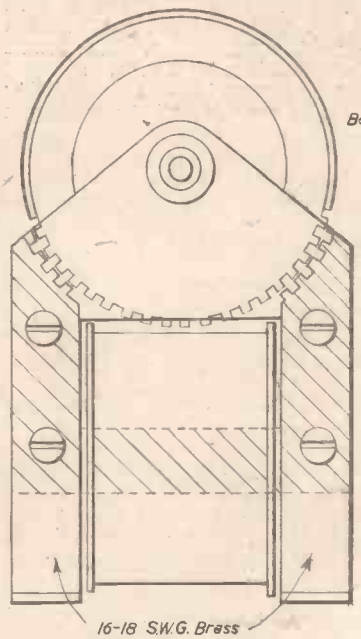


Fig. 1.—Side view of motor showing shape of laminations.

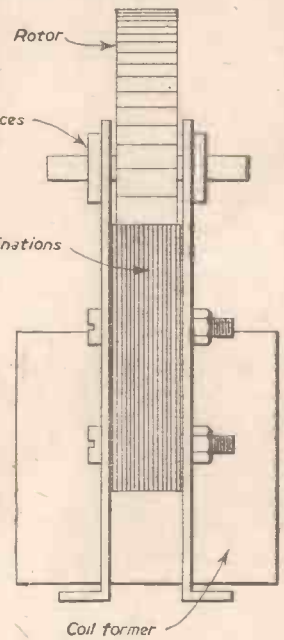


Fig. 2.—End view of the motor.

The Field Magnet

The laminations are made up from transformer iron and it will be a great help if an old transformer can be split up to provide these. E shaped laminations are ideal and these should have the centre limb removed. Do this carefully whilst the laminations are held firmly in the vice to prevent their being distorted.

Keep the laminations intact if possible, and it is a great help if they are drilled through with a 1/16in. drill and riveted together with brass wire. The shaded portion of Fig. 1 shows the exact shape to be cut.

The teeth are cut to be an exact match with those on the rotor. The sketch shows four teeth on each pole, but this is not essential; five could be provided.

If a larger wheel (100) is used, then a centre limb should be provided and the coil arranged to fit over the centre limb. The shape illustrated, whilst complicating the winding of the coil, allows much more space for winding than the centre limb method. This allows for mains current to be passed through the coil. No dimensions are given for the motor as it is clear that these are entirely dependent on the size of the rotor wheel. All that is required is a field magnet with poles cut with teeth to match exactly those on the wheel. Size is not important. The thickness of the laminations should be the same as that of the rotor. Whilst cutting the laminations cut two extra from sheet brass or aluminium. These act as distance pieces.

The Side Pieces

These are cut from stiff brass sheet and should conform to the shape shown in Fig. 1, except that a cutaway must be provided in the side pieces for the coil former. The side pieces should be cut together and the bearing hole matched carefully so that the wheel will revolve true. The writer sweats ball races on to the side frames to support the rotor. As this is the only point of wear the advantages are obvious. It is impossible to give dimensions as these depend on the materials available.

The laminations now have to be slung in the side frames so that they are as near as possible to the wheel. Drill through the

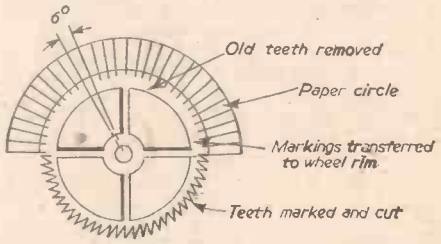


Fig. 3.—Marking and cutting the ratchet wheels.

frames and laminations, having positioned the latter as nearly as possible. Now remove the laminations and slightly enlarge the hole through which they are to be fastened. Reassemble the frames and tighten up gently. It will now be possible to jiggle the laminations slightly to close up any gap. This gap *must* be as small as possible.

The Coil

This is built up directly on to the laminations. First of all cut two end pieces

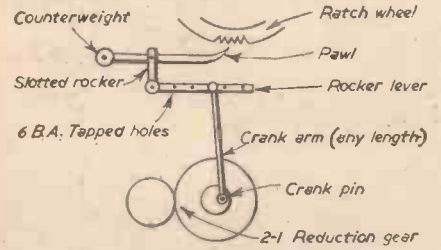


Fig. 4.—Drive to second hand.

for the former as large as possible to fit over the magnet without fouling the wheel. These should be cut from stiff strawboard soaked with shellac and allowed to dry. These are then slipped over the laminations. Mitreing one corner will assist this. Cut a strip of stiff paper as wide as the centre limb, and wind this round until a good layer is obtained. Cement the end pieces on to this paper, and give a good coating of shellac or melted paraffin wax. The coil is now ready to be wound.

The winding is best done in a lathe. Cut two pieces of wood and slot them to take the laminations. These are slipped over the end and mounted between the centres. The centre limb of the U should be in line with the centres. Bore a small hole in one end piece to admit the wire and feed in a few inches of 20 s.w.g. wire. Make one or two turns. Solder on to the end of this the end of a reel of 36-38 s.w.g. enamelled copper wire. The reel should be supported in such a position that it is free to revolve. The lathe is started on slow speed and the wire carefully fed on to the coil with the fingers. Take time with this to see that the windings are smooth and even. Stop frequently to paint the windings with shellac, or better still separate each layer with shellac-painted cigarette paper. Continue winding until at least 6oz. of wire have been wound on or the coil former is full. Finish off with a few turns of 20 s.w.g. wire as before. Then wrap the coil with linen tape and paint liberally with shellac. Leave overnight to dry out in a warm atmosphere.

Final Assembly and Testing

If the required amount of wire has been wound on the coil, it should stand mains current without overheating. The frame of the motor should be earthed before testing. Assemble the laminations as before, with the coil now in position and the laminations adjusted to give the smallest possible gap between them and the rotor wheel. The screws should then be tightened fully and the motor mounted on to a temporary base. As a precaution the writer assembled a small bayonet-capped socket in series with the motor, and carried out the first tests with S.B.C. lamps in series. This was finally incorporated in the finished job as the motor was far too powerful for the job in hand. It will stand mains current easily, but the powerful force acting on the rotor causes needless wear on the bearings. Finally a 15-watt miniature lamp was used and this gave just the necessary reduction so that the motor worked beautifully with no trace of noise. A suitable resistance, of course, could also be used.

When starting the motor it is necessary to spin it by hand at approximately the correct speed.

Once started it should be allowed to run itself in for several hours. This does not appear in theory to be necessary, but in practice has been found so. The motor should make no noise except possibly for a very faint humming and it can revolve in either direction. If it does prove to be noisy tighten up the screws holding the laminations or mount the motor on small rubber feet. A hollow base should not be used as it acts as a sounding board.

The Clock Movement

Assuming that an old clock has been obtained, remove all the works except for the hand assembly and 12-1 drive for the hour hand. This is left intact. Also, of course, the original dial may be used. The movement is extremely simple. It consists essentially of two ratchet wheels actuated by pawls moved by rocking gears and eccentric drives. First, the ratchet wheels; these are cut from the existing gears in the clock. One should already be found on the driving spindle to the minute hand, and this one should be used. The other one may be fitted in any convenient position where a second hand, if fitted, will go. This second gear is the one driven by the motor.

Both gears are treated in an exactly similar way. Start by removing all the gear teeth until a smooth wheel is left. Sixty ratchet-shaped teeth are cut in this as shown in Fig. 3. This is not so difficult as it sounds.

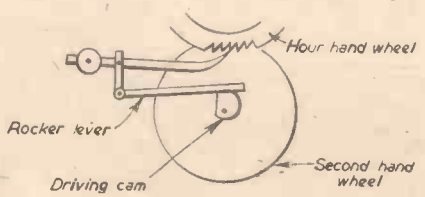


Fig. 5.—Drive to hour hand.

From a piece of paper cut a circle a little larger than the wheel and mark off on this 60 radii at equal intervals of 6 degrees. Now push this paper circle over the spindle until it rests against the wheel and then carefully mark off these intervals on the rim of the wheel. Now, using a suitable needle file, cut the teeth into the wheel. A rough drawing of the final layout should be made so that the maker will be able to decide the disposition of the rockers to ensure that the teeth are cut in the right direction.

The 2-1 Reduction Gear

The drive to the first wheel is taken from the motor. Note that if a rotor wheel of 50 teeth has been used it will be necessary to fit a 2-1 reduction gear as shown in Fig. 4. From the larger wheel of this reduction gear the drive is taken by a simple crank as shown in Fig. 4, actuating a rocker. The rocker bearing consists of a tube soldered on to the side frame through which the spindle passes. Thus one end of the drive is outside the clock frame and the other end inside. A rocking lever is fitted to the outside and this has a number of holes drilled along its length and tapped 6 B.A. These holes allow for adjustment of the throw of the rocker. Fig. 4 makes this arrangement clear. On to the inside of the spindle a short length of rod is fitted. This rod should have the end slotted and drilled to accommodate the pawl as in Fig. 4.

When the motor is started this pawl should move forward and backward sufficiently to move the ratchet wheel one tooth forward. Adjustment should be made to achieve this on the rocker lever. If the spindle of the ratchet wheel is very free in its bearing the pawl will draw the tooth back again. To prevent this either tighten up the bearings (if these are adjustable) or fit a small springy piece of metal to bear gently against the wheel rim. This wheel should now revolve once per minute at intervals of one second.

The second wheel attached to the minute hand spindle is driven in a slightly different manner. A simple crank is not possible due to the fact that the drive is not taken from the end of the spindle. However, the solution is quite simple. The drive is taken from a specially shaped cam attached to the driving spindle. This cam operates a rocker device very similar to the previous one. The lever this time rests on the face of the cam, which should be provided with side pieces to prevent the lever sliding off. Fig. 5 shows how this is achieved. This wheel should revolve at once per hour at intervals of once per minute. The reason for the special shape of the cam is that if a simple cam were to be used, the full movement to register one minute would occupy only about 20 seconds. The backward movement of the pawl would result in an idle period on the minute hand. The clock is now ready for final assembly and testing. A faint ticking should be heard from the second hand wheel as the counterbalanced pawl moves across the wheel. Apart from this, the clock should be virtually silent.

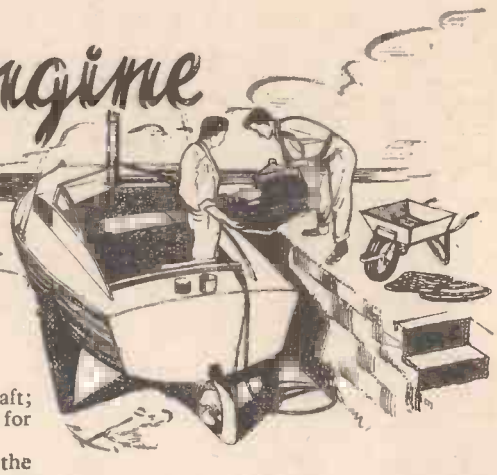
General Notes

The foregoing description is of necessity somewhat lacking in detail; so much depends on the particular wishes of the modeller that it is difficult to give hard and fast dimensions, and a number of details can only be worked out on the actual model. The writer is of the opinion that it is much better to convert an existing clock than to create an entirely new model. This is of course quite possible, but the extra work involved, especially in the finger gear assembly with its hollow shaft and compound gear trains, is hardly justified by the results obtained.

The clock is readily adaptable and could be adapted to the master and slave type by a very simple conversion. Instead of a direct drive to the rocker from the motor a make and break device is fitted to the reduction gear of the motor and an electromagnetic relay operates the rocker. This one motor could of course operate any number of movements. This system would be valuable where a motor of lower power was constructed to work from a low voltage transformer.

Another interesting fact is that in most cases the striking mechanism of clocks is usually actuated by the finger assembly and this would remain unaltered. It would still have to be hand wound. The writer is experimenting with the possibility of using a small motor through a powerful gear train to wind up the striking weight. This could be operated by a contact brought into operation when the weight reached the bottom of its travel and thrown out when the weight was returned to its normal position. Thus the present electric grandfather clock would be fully electric even to the date recorder.

Installing a Ford Engine in a Boat



Details for Converting and Fitting a Ford Motor Engine in an Inshore Fishing Boat

By M. F. LEVETT

BEFORE commencing to install the engine in the boat, convert it to run on T.V.O., either employing a proprietary conversion set, or the method set out in PRACTICAL MECHANICS for November, 1954.

Whilst no hard and fast rules can be laid down regarding the fitting of the engine into the boat, the recommended method is to fit the engine and gear box in a steel frame using the standard mounting points. This frame can then be bolted to the boat. Care must be taken that the weight of the engine and gear box is spread over a fairly large area, otherwise the combined weight and torque will damage the hull. In the interests

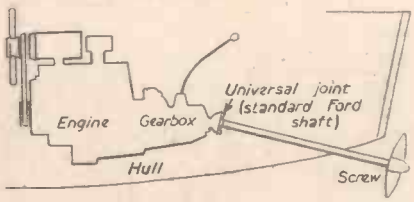


Fig. 1.—Screw shaft with one universal joint.

of stability, mount the assembly as low in the boat as possible, leaving just enough room to enable the starting handle to be operated. The starting handle will require shortening, and two suitable brackets to guide the handle in the starting dog must be fixed to the steel frame, which can be extended to accommodate these.

The normal Ford engine is designed to operate with the top of the cylinder block parallel—in all directions—with the ground, or, in this case, the surface of the sea. Depending on the shape of the boat, so must the supporting framework be designed to allow this.

The clutch may be retained, either as it exists, or the pedal can be removed, and a suitable lever substituted—this may be more convenient. The gear change lever can be shortened to fit in with the general layout, or bent to a more convenient shape. Take care to fill the gear box with the right quantity (one pint) of the correct oil, such as "Castrol" ST gear oil; drain and refill every 400 working hours.

The Shaft

The drive from the rear end of the gear box will be angled, requiring one, or two, universal joints. If the screw shaft can project from the hull at an angle, one universal joint will suffice (Fig. 1). If as in Fig. 2, then two joints will be required. Where the single joint drive is used, it may be possible to employ the standard Ford universal joint and torque tube. This will require modifying slightly, probably in the overall length. Remove the outer casing and pass the driving shaft through the hole cut in the rear of the boat, and with the engine unit mounted in the usual position, viz., one-third of the distance from the stern to bow up the boat, measure the length of shaft; allow sufficient to project beyond the hull for attachment of the screw.

The method of fixing the propeller to the drive shaft will depend on the type of propeller used; a method that has proved satisfactory is to reduce the shaft diameter to suit the propeller boss and running a fine thread on the end of the shaft, securing the propeller with a shaped nut (Fig. 3). A pin or woodruff key should be fitted to transmit the drive without danger of slipping.

Where it is not possible to employ the Ford shaft, Messrs. Hardy Spicer, of Witton, Birmingham, will no doubt be able to supply a suitable item from their range of agricultural shafts; it would be advisable to get into touch with them.

The Waterproof Bearing

The rear bearing (Fig. 4) has three functions to perform, viz., transmit the propeller thrust to the boat, support the shaft, and keep the water out. This type of bearing is cast in two pieces, with fixing lugs to suit

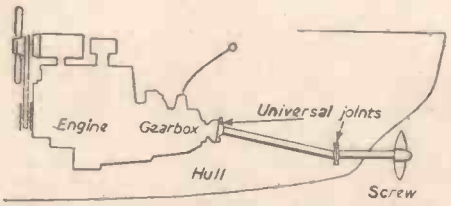


Fig. 2.—The screw shaft with two universal joints.

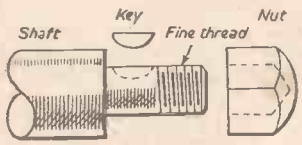


Fig. 3 (Left). —A method of fixing the propeller.

the shape of the hull at the rear. Phosphor-bronze is suitable for this application, and, the longer the bearing—within reasonable limits—the better. For the lubrication two screw-down lubricators are satisfactory; use a high melting point waterproof grease, such as "Mobil" hub grease. Give each greaser one half turn every operating hour.

Propeller Size

As so many variable factors enter into the calculation of propeller sizes, trial and error is the best way of finding the particular size and type of screw to use. An approximate idea may be obtained by comparing boat sizes, taking note of the engine and screw sizes; a simple calculation will give a size to start with. For example, if a particular boat has a 20 h.p. engine driving a 12in. screw, then a 10 h.p. engine can be expected to operate successfully with a 6in. screw, assuming the pitch remains the same.

Having decided on the approximate size of screw, experiment on the water, the plan being to obtain a reasonable speed with about half throttle, and the engine running easily. If these experiments are carried out using second speed on the gear box, first and third gears will give a wide selection of speeds. Reverse gear, being only used for manœuvring, need not enter into the question, unless it is desired to have a fast reverse; in such a case, conduct the experiments in bottom gear.

A small control panel will be required. On this mount the ammeter, fuel gauge, water temperature gauge, starter motor pull, choke control and ignition switch.

The battery and ignition coil require placing in a dry and accessible position.

Cooling Pump

For sea-water cooling, fit a small centrifugal pump between the cylinder block water inlet and the sea-water inlet in the boat's side, driving the pump by Vee belt in conjunction with the dynamo, making a triangulated drive. The pump speed may be varied by using different sized pulleys, this again will require some experiment. The cooling water outlet (top of cylinder block) leads directly to the sea, above the water-line. Depending on the position of the pump in relation to the water-line, provision for priming may be required.

To obtain control of the engine speed, a motor cycle type of handle bar control level is advised—the B.S.A. ignition control lever is ideal for this purpose. Couple to the throttle arm by a Bowden cable, using a suitable cable stop and throttle return spring.

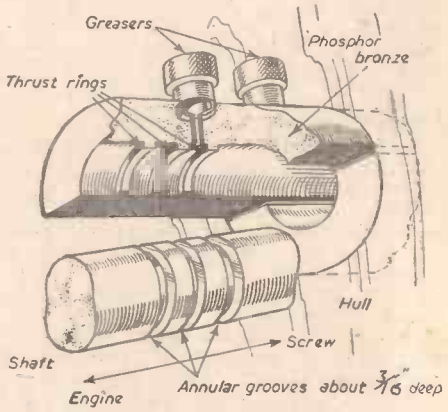


Fig. 4.—The propeller shaft and its waterproof rear bearing.

Finally, cover the entire assembly with well-ventilated, easily detached coverings, but leave the sump as open as possible, to keep the engine oil temperature to a safe figure.

Front view of the puppet theatre. The wing spacer is not shown.

Making a GLOV

Full Constructional Details Including Curtains and Backcloths, and Deta

By E. J. V

THE art of puppetry can be traced far back into history and was certainly practised by the ancient Egyptians. Hand or glove puppets are the simplest form of puppets, and consist of a solid head, hollowed to give access to the index finger, and a garment which covers the hand, attached to the neck. The thumb and middle finger are inserted into two "arms," which form part of the garment or glove, and by manipulating the two fingers and thumb, movement of a limited degree is possible. Glove puppets have neither the mobility nor grace of marionettes, but are well suited to witty dialogue and slapstick comedy; their simplicity of control and ease of construction make them ideal for use by children. Puppets are used in some schools, for they not only help considerably to make children conscious of their speech, but also give great scope in the exercise of the imagination when developing small plays. In addition, the making of fresh puppet characters and backcloths to suit new plays enables children to apply their knowledge of needle and cardboard work and painting to some practical purpose.

The puppet theatre is constructed in two sections and bolted together with four coach bolts. This system was adopted to facilitate transport. If any reader so wishes, the upper section only may be made and used mounted on a suitable table which has been draped so as to conceal the operator's legs. Provision would have to be made for an "elbow shelf," which in the complete unit is a part of the lower section, as without it any prolonged performance would become a strain.

Framework

Softwood ⅞in. square for the upper and 1in. square for the lower section was used. All essential measurements are shown in Fig. 1, though these need not be rigidly adhered to, providing the stage is at such a height above the floor that the operator can sit comfortably while manipulating the puppets.

The foot of the lower section is sufficient to prevent any tendency to tilt forward. The three uprights are let in to the foot as shown and four L-brackets fitted at "x" to give added stability.

All joints other than on the foot are halving joints. One woodscrew in the centre of each joint is sufficient to hold the frames secure, and if care is taken to drive these in on the one side they are later covered and hidden from view.

The wings shown in Fig. 1 are made to fold back so that the theatre will pack away into as small a space as possible and when opened are set at an angle of about 45 degrees to the front. They are secured to their respective sections by stout brass hinges, two to each wing, which are fitted across the back, there being no necessity for sinking them flush with the framework.

Two 8in. lengths of 1in. square softwood are attached by woodscrews to the lower section as shown at "y" in Fig. 1. These carry the "elbow shelf" described in a later paragraph.

When the wings are fitted, the upper should be clamped to the lower portion and holes drilled where shown by dotted lines in Fig. 1, to take four ¼in. coach bolts. The holes in the top section are then enlarged slightly with a round file so that location of the bolts (held by their squared shanks in the bottom section) is made easier. The typical square nut supplied with such bolts is sufficient to hold the assembled framework quite rigid when taken to finger tightness. Washers should be placed under the nuts.

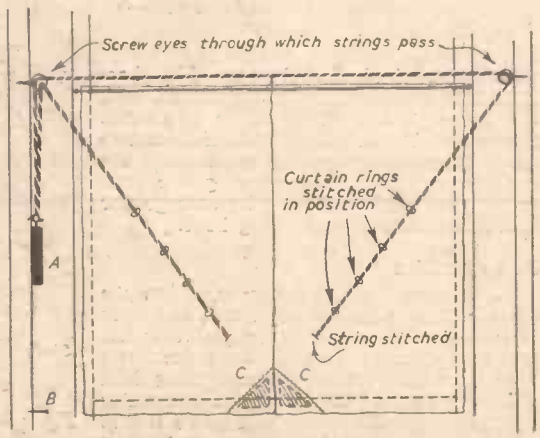


Fig. 4.—The curtains. When the handle "A" is drawn down, the curtains are raised diagonally. The screw eye, by which the operating strings are attached to "A," is slipped over the pin "B" to keep the curtains open. The weights "C," held behind cloth patches, ensure the curtains returning to the closed position.

Wing Brace

A 3ft. 7in. length of ¾in. x ½in. softwood is laid across the top of the wings (when opened to their correct position) near the back and marked off and cut so that its ends finish neatly at the same angle as the sides of the wings. Cut the heads off two ¾in. woodscrews and with a hacksaw make a screwdriver slot in the shank of each. These are then driven into the ends of the brace so as to act as pins which will coincide with corresponding holes drilled to take them in the top of the wings. The brace also acts as a support for the backcloths on which various scenes are painted.

Stage Shelf

A shelf is required to project in front of the proscenium so that any objects used by the puppets in their acts can, if desired, be put down in view of the audience. A 3in. strip of 3-ply, cut to the width of the stage aperture, is of ample strength. A rim of ½in. half-round or quadrant moulding is necessary along the front edge and ends to prevent any objects rolling off. Before fastening down the moulding with panel pins, a hole should be drilled and countersunk in each front corner and two ¼in. BA bolts inserted and fastened from underneath with nuts. The moulding then conceals the heads of the bolts. The bolts themselves are to carry two

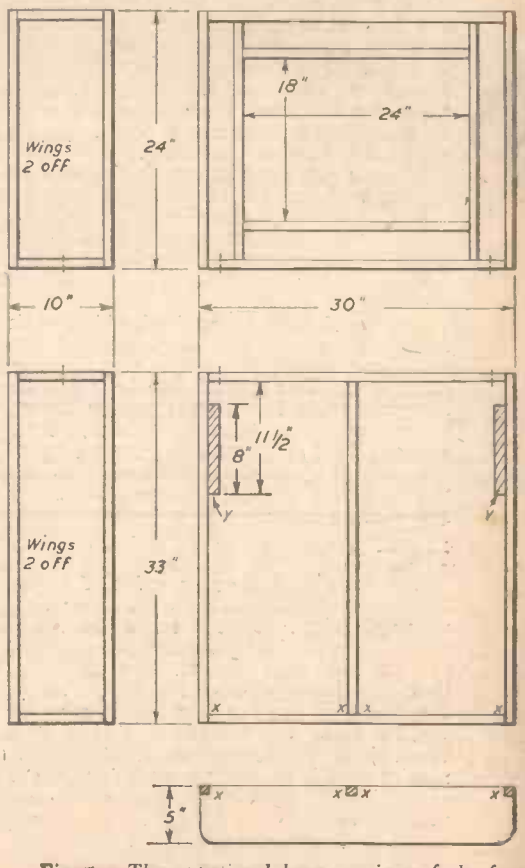


Fig. 1.—The upper and lower sections of the fram

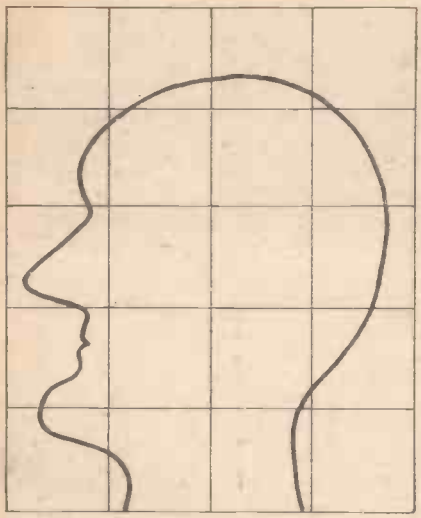


Fig. 5.—Head pattern—scale approximately half size.

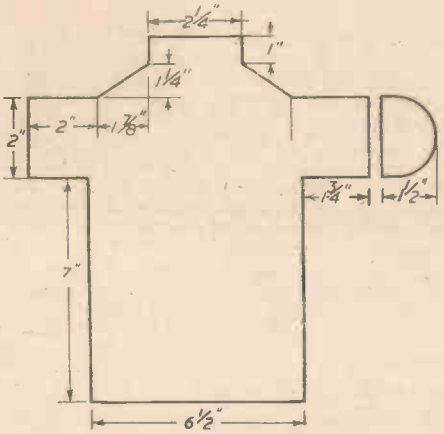


Fig. 6.—Glove pattern.

PUPPET THEATRE

ils for Making Puppets

WILKINSON

footlights. The shelf is drilled and countersunk at each end and centre along the back edge so that it can be attached to the bottom edge of the stage with woodscrews.

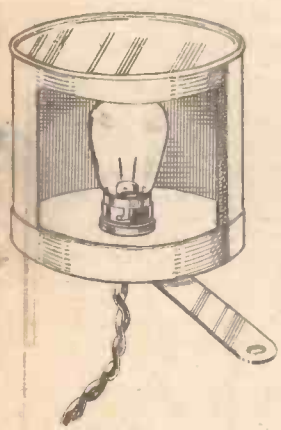


Fig. 2 (Above). —Footlight for attaching to stage shelf.

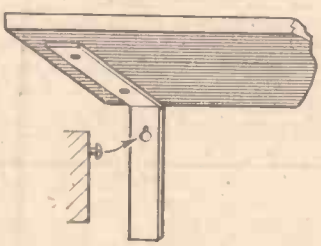


Fig. 3 (Right). — Elbow shelf bracket.

The Footlights

To keep these a reasonable size two 15-watt sewing machine bulbs were used, connected in parallel. The interested reader may wish to construct his own reflectors from sheet metal, though for the original two tins were utilised and served well. Fig. 2 gives a good idea of how the tins were treated. The completed reflectors are held in place at the corners of the stage shelf by 3in. strips of metal, for which purpose the two B.A. bolts were fitted to the stage shelf. A more convenient form of attachment for the lamps, however, might be to bolt a spring paper clip of suitable size to the underside of each reflector.

Elbow Shelf

This enables the operator to rest the elbows while the puppets are performing and must consequently be adjusted to a level which suits the individual. It must also be easily removed so as to allow the folding of the theatre when it is not in use. The shelf measures 2ft. 3½in. by 3½in. by ½in., to the underside of which is to be fastened two 3in. by 3in. iron "L" brackets. Each bracket should have two holes in one leg for securing to the shelf by woodscrews, and one in the other leg large enough to pass freely over a roundhead woodscrew (about 1in. from the angle) with a slot the width of the screw shank filed out towards the bend (Fig. 3). With the two roundheads screwed into the blocks "y" in Fig. 1 the shelf can then be easily attached and detached; 7in. from the stage to the top of the elbow shelf was found to be the best height, but by simply altering the positions of the two woodscrews in the blocks "y" the height can easily be varied to suit anyone—young or old!

Covering the Frame

To cover the framework, stout cardboard was used, it having the advantage of lightness compared with other types of sheeting. The actual material was taken from two large cartons in which two bookcases had been packed, and served admirably.

At this stage it is best to remove the wings and stage shelf and separate the two sections. After placing each frame on to a sheet of cardboard and marking round, the panels can be easily cut and tacked with brass shoe rivets to the woodwork. The only panel which calls for individual shaping is that which lies across the top of the proscenium. It is made to project a matter of 2in. or 3in. past the lower top bar and can then be cut out to any pattern which suits.

As cardboard was used (plywood or hardboard could be used though to the detriment of weight and cost) it was decided to decorate the theatre by wall-papering, and a most attractive finish was produced. To ordinary cold-water paste was added a lacing of glue-size (which had been dissolved in hot water) to improve its adhesive quality. The paper was cut with a generous overlap so that it could be turned over the edge of the framework and then neatly trimmed off with scissors. To enhance the proscenium two shades of paper and a matching border—all "left-overs"—were employed. The reader will no doubt choose a finish to suit the covering material he adopts. The foot, wing spacer, projecting shelf and attached footlights were enamelled to suit the general colour scheme.

Curtains

To complete the actual theatre there only remains the fitting of curtains. These are made of any suitable material, with a turnover at the top edge to take the wire on which they are hung, and sewn together at the centre top. A short length of old curtain spring is ideal and can be held in place by the usual hooks and screw eyes. The arrangement by which the curtains are operated is shown in Fig. 4.

Photograph of the rear of the puppet theatre. The wing spacer is not shown.

Backcloths

These consist of rectangles of butter muslin 2ft. 9in. by 2ft. (or any thin material) and are fastened by their 2ft. 9in. edges by drawing pins to the wing-spacer. The operator sits behind these suspended cloths, with the arms in front, elbows on the shelf, and hands and wrists (wearing puppets) protruding above the stage. The puppets are visible to the operator through the muslin while, with three or four thicknesses of material, he or she is concealed from the view of the audience. Powder paint, mixed to a creamy consistency, is admirably suitable for the painting of scenes on the cloths. Put plenty of old newspaper underneath the muslin before painting!

Making Glove Puppets

Glove puppets can be purchased, but they are rather expensive and are made in only a limited number of characters. With materials costing a few shillings plus the usual oddments found in any housewife's sewing-box —and, of course, a little patience—an entire "cast" of puppets can be made and any desired character produced.

Marking Out Puppet Heads

From a piece of thin cardboard 8in. x 2½in. (cereal packets are fine for the job) roll a tube which will fit comfortably over the index finger. A couple of paper clips and an elastic band will hold the tube together while the glue is drying.

The actual heads are produced from stocking tops (i.e., the stockinet type of material at the leg top of silk and rayon stockings) and wood shavings. Fig. 5 will give a good idea of the pattern size to be used when marking out the stocking top material, which should be doubled. The profile of the pattern can be varied to suit the desired character, and it is worth noting that nose and chin should be slightly exaggerated when marking out, for it will be found that these two features lose some of their prominence during the making process. Sew the two pieces of material together along the edge of the pattern and then cut away the surplus cloth. The base of the neck will naturally have been left open and the head-shaped bag can be turned inside out. Press small wads of cotton wool into the nose and chin until they are reasonably firm and then stuff the head with fine wood shavings no wider than ¼in. (the narrower the better). The neck should not be filled.

Stuffing with Shavings

With the top of the puppet head resting in the palm of one hand the wood shavings can be pressed aside down the centre of the head so that the previously prepared tube can be pushed well in. The neck material should then be glued to the lower end of the tube.

The head at this stage does not look very lifelike, but the addition of hair and painted features such as eyes and mouth will make an enormous difference. For male characters the lighter-coloured stocking tops may be deemed suitable without further colouring the head, but for females painting will be necessary.

Painting

First prepare a stand so that the head being worked upon can be kept upright while drying; a short length of dowel rod let into a flat base will serve admirably. Now the pores of the material must be filled and for this gum arabic may be used. Apply a liberal coating and allow to dry (the oven will speed up all drying processes). For colouring, poster paints are recommended and should be mixed to a creamy consistency. Paint the entire head and neck with successive coats until a satisfactory finish is obtained. Remember that the puppets are not viewed at close quarters by the audience and therefore an immaculate "skin" is not necessary.

The Wigs

By far the best substance for the wig is crêpe hair; this is the material used by actors for modelling beards and moustaches.

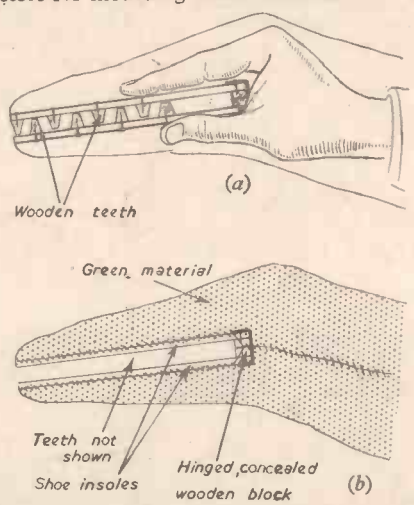


Fig. 7.—Crocodile's jaws and method of holding; covering the jaws.

(Top left).—Toby the dog. (Top right).—Crikey the Croc.

(Above).—Red Riding Hood.

(Right).—The magician.

A group of puppet characters.

It is sold in plaited lengths of various colours and can be purchased at any theatrical make-up counter. Half a yard, costing 1s. 6d., will serve about six puppets.

Unplait the hair for a distance of about 3in. or 4in. and frizz out. By holding the plait in one hand and the ends of the loosened hair in the other, and by drawing the hands apart in a series of sharp jerks, tufts of hair can be separated from the whole. These tufts will look rather "thin," but when put in position will be most realistic. Gum (glue is too dark and will show through the lighter coloured hairs) should now be applied to the head and back of the neck and the crêpe hair pressed into position, working from front top centre down one side to the back of the head and neck, and then repeating on the other side. Baldish patches can be touched up by the addition of more gum and small tufts of hair. Similar treatment makes ideal beards and moustaches. All that is then required is a trim with scissors—unless a shaggy, unkempt appearance is required.

The painted features require little comment. Lips, cheeks, eyes and eyebrows are simply added with poster colours and the desired shapes can always be worked out on paper first.

The Gloves

The pattern shown in Fig 6 should be cut out of paper and pinned to a double thickness of material, and when complete the glove will be large enough for the average adult hand. (Allow ¼in. for turning.)

When making a human doll, hands of a suitable colour must be added: any piece of pink material will do. Four of the hand shapes shown in Fig. 6 should be cut out and each stitched to an arm before the glove is sewn up. When an animal is in production, for example a dog, the arms of the glove are simply continued into the hand shape in the same material. Sewing up can now be undertaken, leaving the bottom and top of the neck open. Finally turn inside out.

Assembling Head and Glove

All that need be done here is to turn in the neck of the glove, push the neck of the completed head into the garment and secure on the inside with an elastic band.

Two or three coloured buttons can be added to the front of the glove, while bonnets, cloaks, jackets, cardboard hats, etc., are easily conjured up to add diversity to the members of the cast. If these extra clothes are made detachable, one character can perform two or more parts; for example, "Red Riding Hood" can discard her red cape and bonnet and appear as "Dolly Daydreams," or by replacing with a little finery and a crown can take the part of "Princess Rosebud."

Making a Crocodile

An enormous amount of fun can be added to a show by the addition of a crocodile to the cast.

The basis of "Crikey the Croc." is a pair of men's cork insoles (the type having a felted upper surface). These should have the heels cut off square across the instep. If red insoles are obtainable all the better, otherwise the white ones can be coloured by damping and then brushing on red ink.

While these are drying, a dozen teeth can be cut out of wood and black poster colour applied. These are simply attached with ⅜in. shoe rivets pressed through the insoles and into the bases of the teeth, which have been previously pierced with a pricker. A coating of glue on each tooth before attaching will make them more secure. The teeth of one jaw should be so spaced as to fall between those of the other when the two jaws are closed (see Fig. 7a).

A piece of softwood as thick as a tooth is long and as long as the width of the insole at the instep end should be stained red and the two jaws attached to it.

Covering the completed jaws is the trickiest part of the job: Fig. 7a shows how the crocodile is operated by placing the four fingers over the upper and the thumb under the lower jaws. The actual glove or covering must allow room for the hand, but at the same time should not be slack. Only constant trial as the stitching proceeds is a true guide. Two pieces of green material 14in. by 6in. are required. Start at the nose of the upper jaw, turn in the material step by step to suit the curve and stitch to the insole, finishing off just before the block of wood at the rear of the jaws is reached. Place the hand in position as if operating the crocodile, lay the material over the hand and place upside down on the table. Get a member of the family to mark the material along the unstitched edge of the jaw. With the line as a guide, cut away the surplus material leaving enough for turning in and stitch as before. This process is repeated with the lower jaw. Now the edges of the two lengths of material can be brought together as shown in Fig. 7b so that the ends of the wood block are in the main concealed and stitched down their length. All that remains to be done is to sew two glass buttons over circular patches of red cloth to serve as eyes.

"Crikey the Croc." is a great favourite with children.

Additional Characters

One or two useful characters can be made in the following way. Purchase a solid rubber mouse and press into its underneath side a 4in. length of stout wire turned at one end into a loop. By holding this handle below the edge of the stage the mouse can be freely manœuvred.

A large spider is simply made with soft wire, fullness being given to head and body by wrapping around with narrow strips of cloth until the desired shape is produced. Finish off by binding with a suitably coloured wool and stitching in the eyes with embroidery silk. A handle should be provided as with the mouse.

As a final tip, sew a small loop of tape to the bottom back of each glove (the wire handles have loops) and provide a series of small cup hooks along the framework of the puppet theatre wings so that all the puppets can hang ready for instant use.

The foregoing article should serve as a useful guide to those who have never tackled such a subject before, and many readers will be able to work out interesting and amusing variations for themselves.

Science and Observation

By Prof. A. M. LOW

A Good Question

Someone asked me the other day how it was that when an express train comes down the line and a trail of steam comes from the safety valve this white cloud seems to be cut off sharply at the last carriage.

It is that steam is invisible. The white cloud is chiefly tiny particles of moisture and when it reaches the rear of the train where there is a slight vacuum the pressure is reduced and the water particles evaporate again into invisible steam before they are totally dispersed.

Smaller drops of water are very interesting. The pressure in a tiny drop may easily reach 20 lb. per sq. inch or more because of the surface tension of the "electrical particles" in the mosaic from which all matter is constructed. It is rather imaginary, but one might almost say that it is the release of these vast forces which gives the "atomic" bomb its power.

Small drops may be made to coagulate if they are electrified. Sir Oliver Lodge made some interesting tests in this way, having as their ultimate object the dispersal of fog. I wish such a plan could be applied to London, but until we can obtain electrical energy more cheaply the expense would be far too great on any worth-while scale.

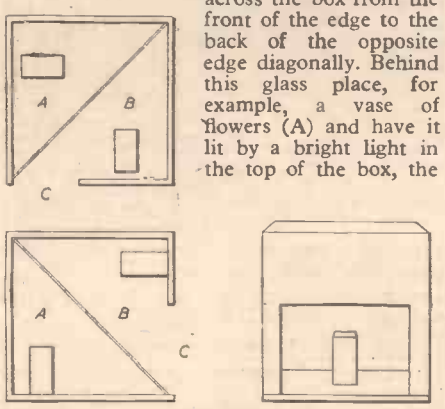
Many experiments have been made to produce rainstorms or their equivalent dispersal by dropping electrified particles of sand from aircraft or by firing vortex rings into the clouds and here again it is a question of scale, for at present we have not the vast power available to interfere appreciably with nature. Atomic energy might easily change this and one foresees the time when bitter complaints come from the Continent because England has secured fine weather at the expense of Juan les Pins.

See the Ghost

There are, of course, many ways of producing "ghosts" effectively. One of the most amusing is to draw in Vaseline the picture of a skull on the back of your coat. Only a little Vaseline is necessary and it will easily clean off afterwards.

Now obtain a small "black-light" ultra violet bulb, such as is used for sunshine treatment, only smaller. You can sit with your back to the lamp, turn out the lights in the room and get someone to put on the ultra-violet, which can be thoroughly screened so that its visible light is nil. The Vaseline "ghost" glows brightly in a terrifying manner, but if someone switches on the ordinary room lighting nothing is seen at all so, of course, there *can* be no trickery.

An interesting little apparatus can be made by a very much simpler plan on the style of the old-fashioned Pepper's Ghost. To make it you require a box, say, about 14in. cube. In it place a sheet of glass across the box from the front of the edge to the back of the opposite edge diagonally. Behind this glass place, for example, a vase of flowers (A) and have it lit by a bright light in the top of the box, the light being concealed so as not to be visible from the front.



Two versions of the well-known Pepper's Ghost. The top sketch is of a box divided diagonally, while underneath are two views of a box divided vertically. C is the space through which the audience views the objects inside.

In the other space place the model of, shall we say, a doll (B) with a similar light concealed in the top of the box. If this apparatus is placed at some distance from the audience, the inside of the box being painted dead black, you will see the flowers when the bulb over the flowers is on, but if you switch off this bulb and simultaneously put on the bulb over the doll in the other box, you will see a reflection of the doll from the 45 deg. diagonal glass. The flowers were, of course, seen through this glass which does not show if lighting is carefully arranged.

There are many variations. If the box is stood on a table your friend can put his head up into one half, while the other contains a model of a donkey's nose and face. Any simple combination of this kind will doubtless suggest itself to you in a moment and if you like to be very technical you can arrange a resistance so that as one light dies out slowly the other comes on with equal strength.

Blushing

On the subject of this strange but now rare faculty of blushing, I have a friend who has equipped his dining-room with an extraordinary picture. When someone tells an after-dinner story which is a little suggestive, he points to this oil painting of an old-fashioned and charming woman and says, "You are making my aunt blush." The face is of a pale delicate cream, and it is a fine painting, but as his fascinated guests look up, a brilliant blush suffuses the aristocratic cheeks.

The method by which this is achieved is interesting. Among the oxides of mercury and other metals are several compounds which suffer what is known as temperature change. At varying temperatures the material changes colour. This characteristic is used in practice for indicating temperature changes such as occur during the hardening of steel, when more accurate electrical methods are not available. It is used in sealing some kinds of electric light bulbs, so that the operator can tell when the approximate temperature of the seal has been reached.

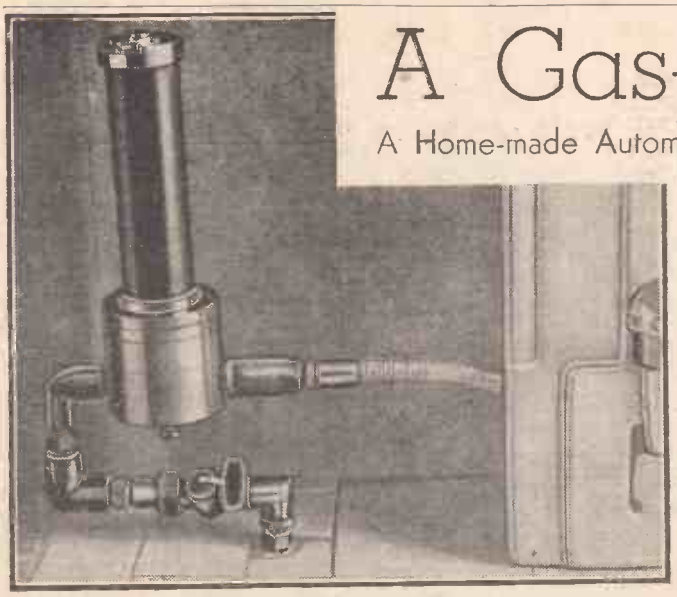
Mixed with the paint used in the aunt's picture is some of this substance, and behind the canvas is a small heater resistance such as one sees in the cigarette lighter of a motor-car. A button is touched under the table, the resistance becomes hot and on comes a blush of which any ingénue might be proud.

Do not confuse this temperature change with the alteration in crystalline form which takes place when certain salts of copper are wet or dry. It is these which are employed to give a rough indication of the amount of moisture in the atmosphere by impregnating, for example, the dress of a doll.

A Gas-fire Thermostat

A Home-made Automatic-control Unit

By J. KAY



The completed thermostat.

AIR temperature thermostats for the control of gas space-heating appliances consist usually of a wall-mounted thermal element connected by thin copper tube to a control valve situated in the feed pipe of the appliance to be controlled.

As a user of radiant-flued gas fires for domestic space-heating the writer was interested in thermal control but objected to the unsightly appearance of such an arrangement. Unaware that a combined unit could be obtained (a fact also very little known in the gas industry) it was decided to make a combined unit. This is shown mounted in the feed pipe of a seven-radiant fire in the accompanying photograph. The thermal element is a thin-walled brass cylinder, 5in. long, with an invar rod down the centre. The top end of the rod is terminated by a differential screw adjustment giving a range of 45 deg. to 75 deg. F. for rather more than a half turn of the top flange. The lower end of the rod rests on a spring-loaded flap valve which is closed when the air temperature is above the set point on the scale.

The lower part of the device consists of two chambers separated by a leather diaphragm. The lower chamber passes the gas consumed by the fire and the pressure drop across the valve induces a slight flow through a small orifice into the chamber above the diaphragm which also contains the flap valve.

If the air temperature is higher than the scale setting the flap valve is closed and gas cannot pass through the upper chamber back to the outlet side. In these circumstances, pressure in upper and lower chambers is the same and the diaphragm falls by gravity and reduces the gas rate to the minimum set by the adjustment screw projecting through the bottom of the valve. Reduction of air temperature causes a sufficient contraction of the brass tube to slightly open the flap valve permitting gas in the upper chamber to leak through to the outlet side. The consequent loss of pressure allows the diaphragm to rise under mains pressure in the lower chamber and full gas rate is restored.

By choosing the size of the orifice connecting upper and lower chambers the valve can be made to give a sharp cut-off at set point or to hold any intermediate rate between maximum and minimum.

Doubts were entertained as to whether there would be sufficient air movement at near floor level to operate such a device but results have proved very satisfactory and appreciable gas economy effected without loss of heat comfort.

There are no sealing glands and gas is not admitted to the thermal element; in fact the invar rod can be completely withdrawn if so desired without turning off the appliance. The only small point of criticism is a slight susceptibility to air humidity. If the moisture contained is above normal the point where control commences will be a little higher than scale setting.

BOOKS Received

Making and Showing Your Own Films. By G. H. Sewell, F.R.P.S. 320 pages. 21s. net. Published by George Newnes, Ltd.

THIS book is intended to act as an introduction and guide to the general principles of narrow-gauge film making and presentation. It endeavours to provide the answers to the problems encountered by the amateur film maker as regards equipment and processing and actual filming techniques and projection. The author has been concerned with making films for a quarter of a century both as an amateur and a professional. The book contains some 150 illustrations, mostly photographs and has, in addition to a list of contents, a comprehensive index.

"Mine Legislation," by W. H. Prothero, C.C.M., A.M.I.Min.E., and J. Worthington, C.C.M., A.M.I.Min.E. 112 pages. Price 10s. 6d. Published by George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

THIS book has been specially written to meet the requirements of mining students and colliery officials intending to sit for the Mine Deputies Examination, the Colliery Under-managers Examination or the Colliery Managers Examination, for certificates of competency issued under the authority of the Mines Qualifications Board.

It comprises a selection of questions, together with answers, which have been set at past Mines Qualifications Board Examinations. These questions have been chosen by the authors as being those most likely to be unaffected by the contents of the new Mines and Quarries Act, which will, of course, contain some new material and new General Regulations, and which, it is expected, will be in operation at some future date not earlier than 1956. For the guidance of students and mine officials, relevant information from the Coal Mines Act, 1911, and the general Regulations made under that Act, have been given in the answers.

Such subjects as mine administration and the duties of mine officials, storage and the use of explosives, winding and hauling equipments and roof supports, ventilation, safety measures and first aid, mine access and transport, as well as illumination, safety lamps and electricity, are included.

Taking Care of a Car. By E. P. Willoughby. 55 pages. 2s. net. Published by Temple Press, Ltd.

THIS handy little book is the second in a series of five and is concerned, not with the curing of troubles, but with the things a motorist should do to avoid those troubles. It is designed to meet the requirements of the ordinary motorist. It contains an index and is well illustrated.

The Shipmodeller's Workshop. By R. K. Battson. 81 pages. Price 3s. 6d. Published by Percival Marshall.

THE information contained in this book is primarily on workshop practice relating to the building of ship models. The principal components of a ship are described in alphabetical order, information with sketches being given regarding both materials and construction technique.

Jet Engine Manual. By E. Mangham and A. Peace. 133 pages. 10s. 6d. net. Published by George Newnes, Ltd.

AS the title suggests, this little book will be of special interest to those engaged in the operation and maintenance of turbine aero-engines. It is in "question and answer" form and contains some useful photographs and diagrams. Chapter 1 deals with the constructional, mechanical and functional details of turbo-jet and turbo-prop engines and there is a chapter explaining nearly 100 terms and abbreviations. There are sections on fuel systems, lubrication and starting systems, controls and operation, and engine testing, also a chapter on installation. The final chapters deal with fault diagnosis and component inspection and useful facts and figures.

Practical Armature Winding. By A. H. Avery. 100 pages. Price 3s. 6d. Published by Percival Marshall.

THIS book, dealing with the practical side of the subject will appeal to those interested in designing small generators and fractional h.p. motors. It sets out to help the reader to avoid pitfalls and to obviate expensive trial and error methods. Diagrams and photographs are included.

Articles required

THE Editor is prepared to consider articles submitted on the subjects listed below. Each article should be not more than 2,000 words in length and be accompanied by a list of materials, sources of supply, clear rough sketches, and photographs where possible. Articles should be clearly written or typewritten on one side of the paper only, with 1in. lines and adequate spacing between the lines for sub-editorial marks and corrections.

Articles must be original and all materials must be readily available.

Articles are required on:—

Radio-controlled models.
Aquarium fitments and accessories.
Power-driven model aircraft.
Full-size Boat Construction.
An underwater Camera.
Making A Sun-ray Lamp.
Home Workshop Equipment.
Household Equipment.
Photographic Equipment.

Frequency and Phase Converters

The Use of Synchronous Induction and Static Frequency Converters and the Phase Converter

By J. L. WATTS

FREQUENCY converters are sometimes required in order to provide a particular frequency for some special purpose, such as to supply high-frequency motors, or in order to link together two systems which operate at different frequencies. Such a change of frequency can, of course, be effected by using an A.C. motor, which operates on one frequency, to drive an alternator which generates A.C. of the required frequency.

Synchronous Frequency Converters

A synchronous motor could be used as the driving unit, since the speed of such a motor is directly proportional to the frequency of its supply. The speed of a synchronous motor, in r.p.s., is equal to $\frac{f}{P}$ where f is the frequency of the supply, in cycles per sec., and P is the number of pairs of poles for which the machine is wound. The frequency of the voltage generated in an alternator is equal to P x N, where N is the speed in revs. per sec. at which the alternator is driven. Thus, if there is a slight change of frequency of one of two systems which are linked by means of a synchronous motor-alternator there will be a corresponding change in the frequency of the other system.

This direct relationship limits the possible changes of frequency which can be made by means of a synchronous motor-alternator of this type, since the two machines are directly connected together.

TABLE 1

Change of Frequency	Speeds (r.p.m.)
25 to 40	300 : 150 : 100
25 to 50	1,500 : 750 ; 500
25 to 60	300 : 150 : 100
40 to 50	600 : 300 : 200
40 to 60	1,200 : 600 : 400
50 to 60	600 : 300 : 200

Table 1 (above) shows the possible changes of frequency which can be effected with directly-coupled machines at the various speeds. A synchronous motor can be used as an alternator, consequently two such coupled machines can be used to transfer power from an A.C. power system operating at one frequency to another power system operating at another frequency in either direction. Electrical power is then drawn from one system and converted into mechanical power in the synchronous motor, which mechanical power is converted into electrical power in the alternator. Losses at both stages of the conversion tend to make this type of converter rather inefficient.

When a synchronous motor is run on load the voltage applied to its terminals leads the component of voltage required to overcome the generated e.m.f. on load, largely due

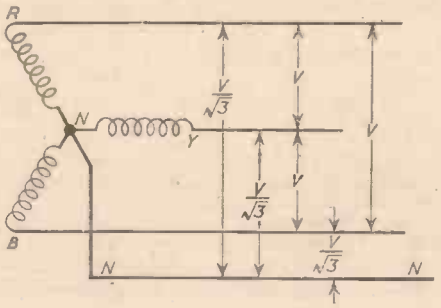


Fig. 2.—Three-phase and single-phase voltages.

to the inductance of the windings, the angle of phase difference depending on the load. On the other hand, the generated e.m.f. of a loaded alternator leads the terminal voltage. Since the phase of the generated e.m.f. in a machine depends on the position of the armature windings with respect to the field poles at a given instant, it follows that if two such synchronous machines of a frequency-converter set are directly coupled together, the corresponding armature conductors of the two machines should not pass the magnetic centres of the poles simultaneously. This can be arranged by coupling two rotors of the frequency converter by means of a rigid coupling having a certain angle of displacement between the rotors.

Load Control of a Synchronous Frequency Converter

With such an arrangement, however, the coupling would only have the correct angular displacement for one particular value of load, and the set could only transfer power from one particular system to the other. One way of overcoming this drawback is by arranging that the stator of one machine can be turned through a small angle by means of a rack and pinion. By turning the stationary armature of one synchronous machine forward in the direction of the revolving field magnets a given armature conductor is acted upon by the field a little later than before, thus retarding the phase of the generated e.m.f. In this way the machine can be made to operate as the motor of the frequency converter, increased displacement increasing the load.

If the stator is racked in the opposite direction to that of the revolving field magnets the phase of the generated e.m.f. will be advanced, and the machine will act as an alternator. With a given relative setting of the stators of the two coupled machines both can also be made to function as synchronous motors, fed from the respective power systems, the machines taking from the busbars just sufficient power to run them unloaded. Load can thus be transferred from one power system to the other by turning the stator of one machine in one direction or the other.

We may consider the case of a 1,200 r.p.m. synchronous frequency converter used to link together two power supply systems having frequencies of 40 and 60 cycles per second respectively. The machine connected to the 40-cycle supply will be wound for 4 poles, whilst the machine connected to the 60-cycle mains will be wound for 6 poles to give the same speed. We will assume that the phase angle between the generated e.m.f. and the terminal voltage of the alternator on load is 12 (electrical) degrees, with 15 (electrical) degrees angle of lag of the generated voltage of the synchronous motor. The number of geometrical degrees of displacement to provide a given displacement of D electrical degrees is equal to $\frac{D}{P}$ where P is the number of pairs of poles in the machine.

Thus, if the 40-cycle machine is motoring the stator displacement of this machine will be $\frac{15}{2}=7.5$ geometrical degrees, whilst the stator displacement of the alternator must be $\frac{12}{3}=4$ geometrical degrees, giving a total displacement of 11.5 geometrical degrees between the stators. Thus, for reversal of power with the same terminal displacement the stator displacement of the 60-cycle machine, which will then be motoring, will be $\frac{15}{3}=5$ degrees. The stator displacement of the 40-cycle (alternator) will then require to be $\frac{12}{2}=6$ geometrical degrees, giving a total displacement of 11 degrees in the opposite direction. Thus the stator settings for transfer of power in opposite directions are not equidistantly spaced about the neutral position.

Two power supply systems which are connected together by means of a synchronous frequency-converter must have a constant ratio of frequencies. If the load on one system increases considerably there will be a tendency for the frequency of that system to fall slightly. A considerable amount of power will then pass through the frequency-converter from the other system to allow the alternators on the heavily-loaded system to accelerate slightly to raise the frequency of this system. It is, therefore, important that the rating of a synchronous frequency-converter shall be

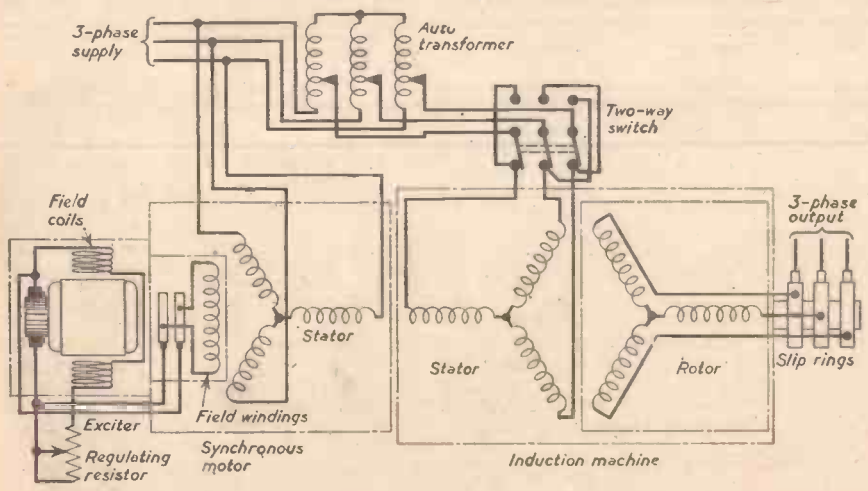


Fig. 1.—Connections of a synchronous-induction frequency converter.

sufficiently high to deal with such a transfer of power without damage. The rating of such a frequency converter should not be less than one-fifth of the rating of the smaller system. Such a set may be started from either system by methods common to other synchronous motors, i.e., auxiliary motor, auxiliary winding, etc.

Induction Frequency Converters

Induction motors can also be used as frequency converters. If a definite ratio of input to output frequency is required the frequency converter may consist of a synchronous motor coupled to an induction machine such as a slip-ring induction motor. For instance, if it is required to obtain a 133.3 cycle supply from 50 cycle three-phase A.C. mains, a 50 cycle synchronous motor would be used, which might have six poles to run at 1,000 r.p.m., i.e., $\frac{1000}{60}$ r.p.s. If the stator winding of the induction frequency converter is fed from the same frequency as the synchronous driving motor, i.e., 50 cycles per second, a magnetic flux will be created in the induction machine which will rotate round the stator at $\frac{50}{P}$ r.p.s., where P is the number of pairs of poles for which this machine is wound. Thus, if the induction machine is wound for 10 poles the flux will rotate round the machine at 10 r.p.s.

If the synchronous motor drives the rotor of the induction machine in the same direction as the rotating flux at $\frac{1000}{60}$ r.p.s., the rotor conductors will cut the rotating flux at $\left(\frac{1000}{60}-10\right)$ r.p.s. E.m.f. will be generated in the rotor conductors at a frequency which is equal to the product of the rotor speed (r.p.s.) with respect to the flux, and the number of pairs of poles. Thus the rotor e.m.f. will be at $5\left(\frac{1000}{60}-10\right)$ cycles per second, or 33.3 cycles per second. On the other hand, if the rotation of the flux of the induction machine is reversed by reversal of the connections to two of the stator terminals, as indicated in Fig. 1, the rotor conductors will then cut the rotating flux at $\left(\frac{1000}{60}+10\right)$ r.p.s. The generated e.m.f. of the rotor windings will then be equal to $5\left(\frac{1000}{60}+10\right)$ or 133.3 cycles. By using a machine having a suitable number of poles power can thus be drawn from the rotor windings of the induction machine by means of slip rings and brushes. The voltage may be controlled by varying the current input to the stator windings of the induction machine. With this converter set there is a definite ratio between the input and output frequencies for each direction of flux rotation.

Where a definite relation between the input and output frequencies is not essential, as when a high-frequency output is required for one or more high-frequency motors, the driving motor may be an induction motor, such as a squirrel-cage motor. The output frequency will then fall slightly on increased load due to the inherent "slip" of the induction motor. Such converters were described in the article on "Polyphase Induction Motors" in *Practical Engineering* dated January 8th, 1954. Commutator frequency-converters are also available, as described in the article on "Polyphase A.C. Commutator Machines" in *Practical Engineering* dated August 7th, 1953, and September 4th, 1953.

Static Frequency Converters

Mention may also be made of a static frequency-converter which consists essentially of a specially designed transformer. A transformer depends for its action upon the alternating magnetic flux produced in its core by alternating current through its primary windings. This varying flux is linked with the secondary windings on the core and induces an alternating voltage in the secondary windings, the ratio of primary to secondary voltages being approximately proportional to the number of turns in the respective windings. Normally, a transformer is designed so that the core does not become saturated with magnetism, thus the flux is

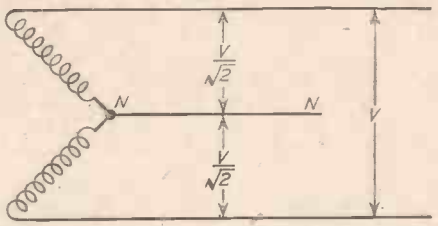
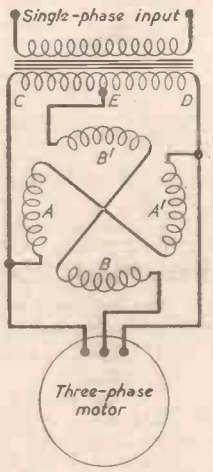


Fig. 3.—Two-phase and single-phase voltages.

approximately proportional to the primary voltage, as is also the secondary voltage. The frequency of the output voltage will then be the same as that of the input voltage.

However, in a static frequency-converter both an A.C. and a D.C. supply are used to produce the magnetic flux. By suitable



Transformer

Phase converter

Fig. 4 (Left).—Connections of one type of phase converter.

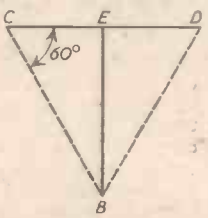


Fig. 5 (Below).—Vector diagram relating to phase converer.

design the magnetic flux can be made to vary between a certain maximum value and zero, instead of between equal values of opposite magnetic polarity as in a normal transformer. The core is designed so that it becomes saturated with magnetism as the A.C. voltage reaches peak value in one direction. The voltage induced in the secondary windings depends on the rate of change of the flux linked with these windings, whilst the polarity of this voltage depends on whether the flux is increasing or decreasing. As the flux rises from zero to its saturation value voltage is induced in the secondary windings in one direction. When the core becomes saturated the flux will become constant and no voltage will be induced in the secondary winding. As the primary voltage and flux fall voltage will be induced in the secondary windings in the opposite direction. Thus the secondary voltage passes through one cycle in half a cycle of the A.C. input, giving an output at twice the input frequency. An additional winding is used to neutralise harmonics which tend to distort the wave form from sinusoidal, the output of this converter being at twice the input frequency. These static converters have little application in practice, however.

Phase Conversion

It is sometimes required to convert the number of phases of an A.C. supply. A three-phase supply of voltage V between the phases can, of course, be used to supply single-phase loads of the same voltage which are connected between phases of the supply, as indicated in Fig. 2. If the neutral point of the three-phase supply is available single-phase loads at a voltage of $\frac{V}{\sqrt{3}}$ can also be supplied between the phases and the neutral. Similarly single-phase loads can be fed from the outers of a two-phase supply at a voltage V, or at $\frac{V}{\sqrt{2}}$ between the outers and neutral, as shown in Fig. 3.

It is sometimes desirable to obtain a fairly high single-phase current, as for arc welding, from a three-phase supply in such a way that the load is drawn from all three phases rather than from single-phase. For this purpose a three-phase to single-phase static transformer is occasionally used, although this does not place a balanced load on the supply. A transformer may also be used to convert three-phase to two-phase or vice versa, or three-phase to six-phase, etc. However, in this article we are mainly concerned with electro-mechanical conversion devices rather than with purely electrical ones.

The Phase Converter

Phase conversion can, of course, be effected by using a motor having the same number of phases as the A.C. supply to drive an alternator having the required voltage at the required number of phases. Single-phase can also be converted to three-phase, three-phase to two-phase or vice versa, etc., by means of a rotating machine called a phase converter. The operation of this machine depends on the fact that if one phase of a polyphase motor is supplied with single-phase voltage after its rotor has been brought up to speed, electromagnetic action in the motor will produce a magnetic flux which revolves round the stator at synchronous speed. This flux will induce voltages in the stator windings of exactly the same phase relationships, and almost the same value, as if the windings had been fed with polyphase voltages. In this way a three-phase induction motor can be used as a single-phase to three-phase converter, as in the article on Polyphase Induction Motors in *Practical Engineering*, April 9th, 1954. Similarly if one phase of a two-phase induction motor is fed with single-phase voltage, and the rotor is run up to speed in some way, the voltage induced in the open phase of the stator windings will differ by a quarter of a cycle from that applied to the other phase of the windings.

A Single-phase to Three-phase Converter

Fig. 4 shows the general arrangement of a phase converter used to supply a three-phase motor from a single-phase supply. A single-phase transformer is used with a tapping E from approximately the centre point of the secondary winding. One stator winding A-A¹ of the two-phase converter is connected across the secondary winding of the transformer; whilst the other stator winding B-B¹ is connected between the mid-point of the secondary winding and the third terminal of the three-phase motor. When the phase converter is running the voltage induced in the winding B-B¹ is a quarter of a cycle (90 electrical degrees) out of phase with the voltage at the secondary terminals C-D of the transformer. The number of turns in the winding B-B¹ can be made such that the voltage induced in this phase is $\frac{\sqrt{3}}{2}$ of the voltage between the terminals C-D, to give three-phase voltages at the motor as indicated in the vector diagram Fig. 5. In practice auxiliary connections are made to compensate for the inductance effects of phase A-A¹ and, in order to maintain balanced three-phase voltages when the motor is loaded, the tapping may be shifted slightly from the mid point E.

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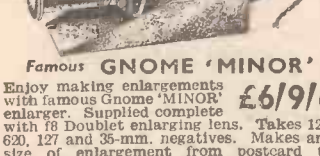

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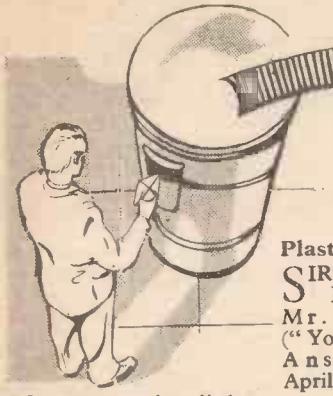
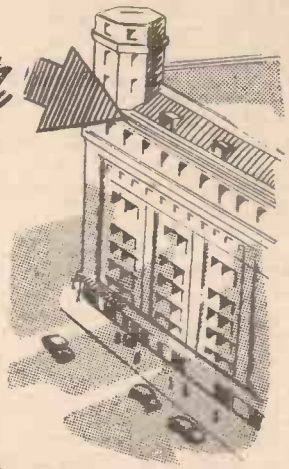


Letters to the Editor



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

Plaster Casting

SIR,—Perhaps I can help Mr. G. Neal ("Your Queries Answered," April), and amplify your remarks a little.

You are right in pointing out the trade's aversion to giving away their secrets. This, I think, is very reasonable, as 5 per cent. of the work is very highly skilled, but the other 95 per cent. is unskilled, plus a great deal of secret "know-how." Workers do not mind anyone knowing the skilful part (making the masters and moulds), but they do try to avoid the outsider knowing about the unskilled part.

One secret concerns the flexible mould. This seems a gift from the gods; but is it? It is heavy and it sags with its own weight and the weight of the plaster. It also shrinks. Thus it is impossible to get a replica of the original master or pattern, *unless* one knows how to give the mould the support it requires. Stitches, pins and rigid outer cases (boxes) are only some of the ways to get real replicas; but if true replicas are not required the flexible mould is very good.

A drying room is absolutely necessary. A solid lump of plaster 3in. thick will take four to six days to dry out in ordinary room temperature. The fact that some casts dried and not others is his fault. The mixing was probably too long or too thin. If one is long in the mixing the set can be killed. A drying room can be any place where the heat can be controlled, according to the size required, from a cupboard to a large room. The heat should be from 100 deg. F. to 120 deg. F. But any baked plaster is brittle on the surface. Size added to the water will slow the set and give a longer working time. It makes a stronger finished job but takes longer to dry. This does not matter if there is a drying room, but it does if one has only ordinary room temperature. I have some plasters that take equal parts plaster and water, and others that take 2½ parts plaster to 1 part water. If I have a new plaster, I try it with 1½ to 1. This is a good average.

Bubbles always have been a great trouble. They can be avoided with a vibrator, but this is rather expensive. A simple and cheap method is to get an electric motor and fix on the shaft an unequal cam. This will set up quite a lot of vibration if placed on the table where the pouring is done. But if there are any air traps in the design it does not help. If the positions of these air traps are known, tipping the mould during casting is the only way to avoid them.

Plaster moulds never last long, unless they are very carefully prepared, and obviously you cannot have the slightest undercut.

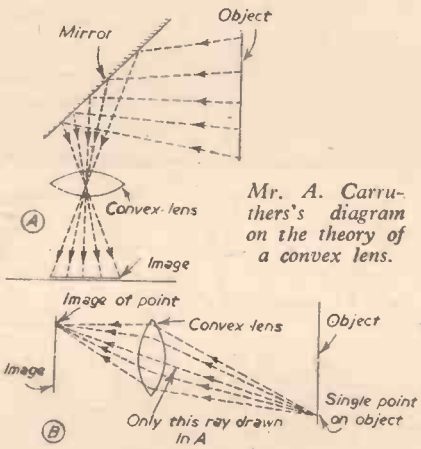
Asbestos dust will make the plaster more difficult to mix, and does affect the detail very slightly, but in a large casting it would be negligible.—C. V. THOMPSON (London, W.4).

Optical Copying Device

SIR,—Re the letter from L/Cpl. Holford in your April, 1955, issue concerning a copying device mentioned in the December, 1954, issue it is essential that a convex lens is used to obtain a sharp image of the object; with a single concave lens no image could possibly be produced.

If the dotted lines in the diagrams are meant to represent actual rays of light, L/Cpl. Holford's drawings are both misleading, as is your drawing in the December issue. The top drawing in the sketch is more correct.

The theory behind this is as follows. Ignoring the mirror for the moment, rays of light coming from any one point on the drawing to be copied are diverging and these rays must be brought to a point again on the image for it to be clearly in focus; this happens in the lower diagram. The convex lens produces a point image of each separate point on the object, the whole building up into an exact copy of the object. Thus each dotted line in the top sketch represents the central ray of the group (as drawn in the lower one) for each point on the object.



Mr. A. Carruthers's diagram on the theory of a convex lens.

The only difficulties are that the image is (a) inverted, and (b) reversed from left to right; (a) is corrected by turning the object upside down and (b) by using a mirror (note printing seen in a mirror is reversed).—A. CARRUTHERS, B.Sc. (Manchester, 20).

Radioactive Electricity

SIR,—We feel that we must allay any fears that may have been aroused in your readers' minds by the recent letter published on radioactive electricity.

Considerable research has gone into the solving of problems associated with radioactive electricity, and as a result filters have been developed on the well-known neutron absorbtion principle (i.e., the electricity passes from the pile to the grid system via an absorbtion column made up of alternate layers of graphite and titanium surrounded by a powerful electromagnetic field).

Tests have shown that the amount of radioactivity which could be introduced into any household, using the new electricity, in a lifetime is less than that introduced by one member of any such household having an "X-Ray."—A. KING and P. HAWKINS (Staffs).

SIR,—Re the letter on radioactive electricity, PRACTICAL MECHANICS, April, Mr. Hough seems to think that you have to "plug-in" to an atomic pile to get electricity and that the "virus" would be carried along by the alternating current pulses. This is not so! Ultra-high-frequency waves (the "virus"), of the type emitted from radioactive elements, travel in a straight line through space and are restricted to very short distances, through matter, depending on the power of emission. In an atomic bomb, the total energy released occurs in less than 1-100,000th of a second, giving a tremendous explosion, but in the atomic pile the emission is controlled by a modulator, resulting in a continuous source of heat, and this is used to generate steam, which drives a turbo-generator. So Mr. H. can rest assured that he will come to no harm from the product of an atomic power station (unless he walks into the reaction chamber of said pile). The fishermen he mentions came into *direct* contact with the radioactive dust, probably inhaling some. The radiations from the dust would certainly attack the flesh, breaking the tissues down, until weakened to such a state that they would offer no resistance to the virus which was *already* in their bodies. The answer is control, and our scientists can be trusted to keep the radiations in their proper place.—R. MOORE (South Shields).

Chemical Removal of Tree Stumps—Correction

SIR,—In the May edition of PRACTICAL MECHANICS, among the Readers' Queries, was an answer to a correspondent with regard to the destruction of a tree stump by chemical means.

The reply mentioned the use of sodium *chloride* for this purpose, and went on to say that caution should be used, since it was toxic. Sodium *chloride* is the chemical name for common salt. It would appear that a typographical error had occurred, and I take it that the substance should have been sodium *chlorate*, which is commonly used as a weedkiller for gravel paths, etc. This chemical should be stored and handled with care, since compression might cause a conflagration, especially near combustible material.—DAVID R. JANES, M.P.S., Ph.C. (Dunstable).

An Appreciation

SIR,—I am a keen amateur photographer, and I feel I must write and thank you for the very fine articles that deal with photography in PRACTICAL MECHANICS from time to time; the April issue was outstanding. The article "Adjustable Masking Frame" was a "gift."—E. W. KEFURT (London, N.W.1).

Encouraging Originality

SIR,—I am most interested in your Editorial in the April issue of PRACTICAL MECHANICS regarding Provisional Protection and Patent Law generally, as my own personal observations and experience indicate that the poor inventor is usually frustrated, gets a very raw deal and stands little chance of reaping any reward for his initiative and ingenuity. Just recently I have seen an instance of a really good, satisfactory and simple device in which the impecunious inventor during his period of provisional protection was "led up the garden" by high praise and impressive promises from a a large and well-known supply company only to be completely "let down" in the last few weeks to find

that the company were putting on the market, through one of their own men, an inferior version of the device which my friend had previously considered and discarded as being too cumbersome and unsatisfactory.

In any case it is usually extremely difficult to find an English manufacturer who will take up a private individual's idea even though it is fully protected. So long as they can continue to sell their own products they seem satisfied and unprogressive.

Under these circumstances do you not think there is a very real need and ample prospects for the formation of a limited company specifically to assist poor inventors ? I suggest that the company should consider, in confidence, any provisionally protected or *un*protected ideas submitted by private individuals without making any charge. Any frivolous ideas could be rejected, but on those showing commercial possibilities the company should pay all development expenses and patent fees, find a manufacturer, and take perhaps 95 per cent. of the profits resulting until all initial expenses had been repaid. The inventor, who could not afford any outlay beyond his skill and ability, would be only too pleased to receive the balance of 5 per cent. instead of having to let his invention rot in obscurity, while the company could dictate its own terms for the future distribution of further profits and thus ensure its own prosperity as well as an increased rate of return for the inventor from any resulting continuance of sales.—E. F. WACE (Harpenden).

"Imperia" Knitting Machine

SIR,—With reference to the query about the "Imperia" knitting machine in "Information Sought," April issue, the makers went out of business just after I had mine 25 years ago. The Harrison Knitting and Textile Machinery Co., Ltd., 54, Goodge Street, London, W.1, wrote me at the time saying they had taken over the firm and all accessories could be obtained from them. I have dealt with them since then for wools and spares and am able to get everything. It is advisable to send a needle as a pattern as some are rather thicker than others.—Mrs. M. H. COLES (Wirral).

Acetylene Generator

SIR,—With regard to your article describing an Acetylene Generator by your contributor K. H. Flint in the April edition of PRACTICAL MECHANICS I would advise any of your readers making this article not to use copper in the construction owing to the possibility of the formation of copper acetylide.

This chemical is explosive when dry, and has been used for fuse composition.—NEIL S. HEMINGWAY (Rochdale).

Dyeing Lambskins

SIR,—With regard to the directions for dyeing white lambskins given to Mr. Royston in Your Queries Answered: as these skins are white they are almost certainly of alum or formaldehyde tannage and will be ruined if heated when wet to temperatures anywhere near the boil. It is only possible to dye this type of leather at about 100 deg. F. and I suggest that the skins are placed in the dye solution at this temperature, which should be maintained for about two hours. I am bound to say that it is very difficult to dye woolskins to a full and level shade, even with the specialised equipment of a modern tannery, and Mr. Royston should not expect too much.—N. W. PALMER (Yeovil).

Casting in Aluminium

SIR,—Re Your Queries Answered on page 318 of your April issue, where a query appeared regarding the melting and casting of pure aluminium. As I work in an aluminium foundry I can offer a few useful suggestions to Mr. R. Latham.

I would suggest that he uses sand moulds in which to cast his work. He will have to use a suitable pattern—usually made from wood, this being simple to use. I can only suggest he tries for the sand at a local non-ferrous foundry; generally the best sand used for aluminium is that of the fine natural Mansfield variety.

The procedure for making a sand mould is first to place a frame around it to contain the sand (this can be made up from suitable lengths of wood and need be no larger than 18in. × 18in. × 4in.). A pair of these are required to complete one mould. The sand that is to be used must not be too wet. An easy test is to take a handful of sand and press it into the palm of the hand. If it leaves the palm fairly clean afterwards, then it is just about right, but if it sticks, then it is too damp. The right percentage should be 5-6 per cent.

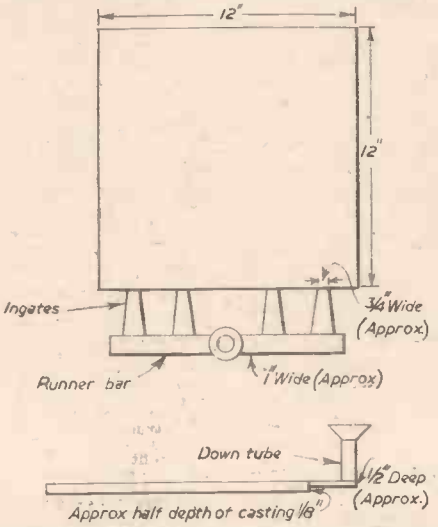


Fig. 1.—Details of a sand mould for casting aluminium.

If Mr. Latham requires a good surface finish on his castings, then I would advise him to sieve a small quantity of sand over the pattern just to cover the surface, an ¼in. mesh sieve will serve the purpose. Fill the frame up with sand loosely, and then use a rammer of some description to pack the sand firmly round the pattern. If the handle of the shovel is not too big, then this will suit the purpose. Add more sand and using the flat of the shovel pat the sand flat. During the ramming up of the mould it is essential to ram the sand firmly but not too hard. Scrape the excess sand off down to the level of the frame, and turn the half mould over.

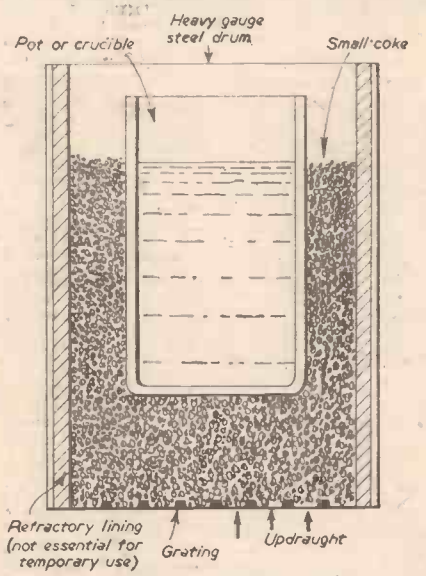


Fig. 2.—Method of melting aluminium.

After making sure that the sand has been rammed firmly round the pattern, the pattern can then be rapped lightly to loosen it from the sand and then it is removed carefully with the aid of a spike of some description.

The other half of the mould can be made quite easily by ramming sand into the other frame off the same flat surface.

An old spoon would be very useful to cut out the channels through which the metal can pass into the mould cavity. These can be arranged as shown in Fig. 1. A tube with an approximate diameter of 1in. can then be pushed through the top part of the mould to match up with the running system. When doing this it is essential that the mould is lying down flat.

To finish off, open the top part of the tube hole out a little to receive the molten metal, blow the mould free from loose sand, and place the top part on the bottom. Before casting, a weight of some sort must be put on the mould as the pressure exerted by a flat casting is enough to lift the top part of the mould off so releasing the metal through the side of the mould.

The simplest method of melting aluminium is shown in Fig. 2. To speed the process of melting a forced draught can be utilised. The procedure for melting is given in detail in the Editor's answer.—B. F. A. SAUNDERS (London, S.W.15).

Electric Drier and Airer

SIR,—The attention of the Royal Society for the Prevention of Accidents has been drawn to an article describing the construction of an electric drier and airer, which appears on page 290 of your April issue.

It has been pointed out that the illustration shows an electric plug point within reach of the bath and immediately under the hand-basin, that flexible cord is trailing on the bathroom floor, that the metal framed appliance does not appear to be earthed and that there appears to be a possible fire risk connected with the apparatus, since if it were enclosed with towels above a certain thickness the rate of heat dissipation could be less than the heat supplied by the lamps, so that the whole apparatus could become dangerously heated.—For HOME SAFETY DEPARTMENT (Royal Society for the Prevention of Accidents).

SIR,—Looking through my April PRACTICAL MECHANICS I saw that the illustration on page 290 at the head of the article Electrical Drier and Airer depicts a socket outlet in a bathroom.

As a qualified electrician and an employee of the London Electricity Board in contact with the general public, and advising them on such matters, I would like to point out that (a) such an installation is contrary to the I.E.E. regulations; (b) any electrician who installs a point in a bathroom is not worthy of the name; and (c) if such a point was installed no Area Electricity Board would connect it to the meter.

I am well aware that many such installations do exist all over the country, but that does not lessen their potential danger, and the Boards are constantly advising consumers to have them disconnected and alternative arrangements made.

Unfortunately, however, the matter does not end there. There are many types of installation whereby it is possible to fix a socket in a bathroom and connect it, via the dis. board or switch fuse, to the supply without the supply authority being aware of the additional load. From there it is but a simple step to the use of all kinds of appliances while the user is in contact with water, and can result in severe burns and probable death.—T. H. C. SMITH (London, S.E.9).

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

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FRAMED original Oil Painting, 8in. x 6in.; seascape or landscape, 10/-, 2 17/6; beautiful present; post paid; c.w.o. Hall, 18, Roa Island, Barrow-in-Fur., Lancs.

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MAIL ORDER ONLY. Brand New Tools. Bargain price, post free. Lathe Chuck Specialist, Independent, 4in., 60/-; Burnerd, 3½in., 67/6; 4½in., 75/-; 6in., £6/4/6. Burnerd self-centring 3-jaw, 2½in., £6/15/-; 3½in., £7/16/9; 4in., £7/16/9; 5in., £9/17/3; 6in., £11/8/9; 9in., £17/1/3. Micrometer, 1in., 10/-. Angle plate, 3in., 5/3. Vee block, 3in., 5/3; 4in., 6/6; 3 lathe carrier, ½in., ¾in., 1in., 11/6. Burnerd tool post for 3½in. lathe, £7/5/-; 4½in.-5in. lathes, £9/6/-; Machine vice, 18/6. Union hand bench drilling, ½in. machine, £5/6/6. Steel dieholder, 13/16in., 2/9; 1in., 6/-; 1 5/16in., 10/-. Carb. wheel, 4in. x ½in., 4/-; 3½in. x ¾in., 4/-; 7in. x ½in., 7/6, all ¾in. hole. Expansive bit, ½in. to 1½in., 19/8; ½in. to 3in., 26/8. Ratchet brace, 10in. sweep, 16/6. Twist drill grinding jig to ½in., 24/-. Emery wheel, 2in. x 1/16in., 1/2; 3in. x 1/16in., 1/6. Precision drill chucks, ½in., 38/-. Arbors for same, No. 1 M.T., 5/6; 2, 6/-. Drill stands, 1-60, 1/16in.-½in., A-Z, 3/9 each. Dies 13/16in. dia., 40 T.P.I., 5/32in., 3/16in., 7/32in., ½in., each 2/9. B.A. 0-1-2-3-4-5-6, 2/2; 7-8, 2/9; 9-10, 3/6. Silver steel round 13in. lengths, 12 different sizes, 1/32in. to 9/16in., 10/-. H.S. centre drills, size 1, 2/-; 2, 2/3; 3, 2/9; 4, 3/-. Dividers, 5in., 5/-. Abrafiles, 8d. Links, 2, 4d. Hacksaws, 10in., 3d.; 12in., 3½d. Tailstock dieholder 13/16in., No. 1 M.T., 13/6. H.S. Twist drills, 1-2, 2/6 each; 3-6, 2/5; 7-11, 2/1; 12-16, 1/11; 17-19, 1/10; 20-24, 1/9; 25-29, 1/8; 30-32, 1/8; 33-42, 1/4; 43-48, 1/3; 49-52, 1/2; 53-70, 1/-; 71-75, 1/6; 76-80, 1/11; 1/16in., 1/2; ½in., 1/5; 5/32in., 1/10; 3/16in., 2/-; 7/32in., 2/6; ¼in., 3/1; 9/32in., 3/10; 5/16in., 4/6. Adjustable spanners, 9in., 6/3; 11½in., 7/8. H.S. tool bits, square, ½in., 1/9; 5/16in., 2/7; ¾in., 5/6; ½in., 8/6. Lathe centres, No. 1 MT, 4/3; No. 2, 5/-. Tap, 40 T.P.I., 5/32in., 3/16in., 7/32in., ½in., 1/9 each. 32 T.P.I., 5/16in., 2/4; ¾in., 2/7; B.A. 0-1-2-3-4-5-6, 1/1; 7-8, 1/3; 9-10, 1/9. 26 T.P.I., 5/16in., 1/7; Whit., 1/16in., 1/8; 3/22in., 1/8; ½in., 1/2; ¾in., 11d.; 5/16in., 1/3. B.S.F., ½in., 11d.; 5/16in., 1/3. Your address block letters. S. Grimshaw, 7, Hall Street, Gorton, Manchester, 18.

ENLARGER CASTINGS.—Set of 8 top quality Aluminium Castings for 35mm., 2¼in. sq., 2¼in. x 3¼in.; exceptional value; 30/-, including bellows. V. J. Cottle, 84a, Chaplin Road, Easton, Bristol, 5.

CHEAP GOVERNMENT WIRE ! ! ! Ideal for training fruit trees, peas, beans, roses, arches, greenhouses, tomatoes, raspberries, tying, etc. Strong, flexible, steel-stranded and waterproof covered. Several thicknesses. Postcard to-day for free samples. Greens Government Stores, 183, Albert Street, Lytham.

HOSEPIPE VALUE ! ! ! Compare free samples. Green plastic, 60ft. ½in. bore, 24/-, carriage paid. Longer lengths available. Also others. Highest quality. Returnable unless delighted. Greens, 184, Albert Street, Lytham.

ENGINEERS' OPPORTUNITY. — Workshop contents for sale; lot £460; comprising 10 machines, about 200 small tools, benches, material. Seen working. Motors extra if required. (No accommodation.) London. Phone CANonbury 2485.)

HOBBIES

MONEY-MAKING HOBBIES with our Comprehensive Handicraft Catalogue (price 1/-), for Jewelcraft, Marquetry, Basketry, Shellcraft, etc.; world-wide postal service. Rawson's (Dept./m), 3, Westcombe Hill, London, S.E.10.

RUBBER MOULDS from unique designs. Sample Mould and list 3/11. Goodwins (Dept. N1), 26, Bird Street, Bolton, Lancs.

PROFITABLE HOBBY—Chromium Plating. Complete outfits, 10/- each. Details and plated sample 4½d. stamps. A. Dutch, 51, Monkhams Lane, Woodford Green, Essex.

TOY & GAME MANUFACTURE. The world's first journal specifically devoted to the manufacture of toys, games, sports equipment and amusement novelties. Annual subscription £1/10/-. Specimen copy 2/6. Techniview Publications Ltd., 125, Oxford Street, London, W.1.

MAKING YOUR OWN ? Telescopes, Enlargers, Binoculars, Microscopes, projectors, or, in fact, anything that needs lenses. Then get our booklets "How to Use ex-Gov. Lenses and Prisms," Nos. 1 and 2, price 2/6 ea. Also our Stereo Book "3D Without Viewers," price 7/6. Comprehensive lists of Lenses, Optical, Radio and Scientific Gear, free for s.a.e. H. W. English, Rayleigh Road, Hutton, Brentwood, Essex.

SHIPS IN BOTTLES.—The constructional kit that tells you how to make them; build for pleasure or for profit; kits 6/- each from Hobbies Ltd., and model shops. Cooper Craft, Ltd., The Bridewell, Norwich.

READY TO ASSEMBLE FURNITURE. —Contemporary, etc., Coffee Tables, Television, Radio Tables, etc. Picture Frame Mouldings. Stamp for lists. Hughes's Woodworkers, Lynchford Road, Farnborough, Hants.

HANDICRAFTS

MUSICAL MECHANISMS. Swiss made for fitting in cigarette boxes, etc., 18/- each. Send s.a.e. for complete list of handicraft materials. Metwood Accessories, 65, Church Street, Wolverton, Bucks.

MAKE YOUR OWN MUSICAL BOX, Swiss-made movements, 22/6. S.A.E. list of tunes. Best make only. Albert's Music Shop, 45, Heath Road, Twickenham.

LEATHER for all Leatherwork. Send 2½d. stamp for list and 25 to 30 cuttings. Bowell Agencies, 39, Sandringham Avenue, Leicester.

BOOKS

10,000 FORMULAS and Manufacturing Secrets. Finest book ever published for the man interested in saving money, earning money, or simply "making things." Send s.a.e. for details. Frobisher Co., Dept. P., 10, Lune Street, Preston, Lancs.

HOW TO REWIND and Service Electric Motors. Generators. Complete Practical Book only 3/-, p.pd. Below:—

LATHE HANDBOOK, 3 books in one, 5/-, p.pd.; wood-turning, metal turning, metal spinning, jigs, attachments, special operations; 200 illustrations; outstanding, practical "how-to-do-it" material throughout. Below:—

ARC AND SPOT WELDERS For The small Shop. Easily, cheaply made. Full plans, 3/-, p.pd. Below:—

SOLDERING AND BRAZING Simplified. Outstanding American book, 3/-. Below:—

MIDGET CAR AND SCOOTER Contruction, 3/-, p.pd. Below:—

CAR BODY REPAIRING. Complete A B C course; illustrated; 7/6, p.pd.; lists free. American Publishers Service (P.M.), Sedgeford, Norfolk.

PHOTOGRAPHY

ENLARGER and Camera Bellows supplied; also fitted. Beers, St. Cuthbert's Road, Derby.

MODEL DEALERS

HOBBIES LTD. have over 50 years' experience of catering for the needs of modellers, handymen and home craftsmen. Branches at 78a, New Oxford Street, London, and in Birmingham, Glasgow, Manchester, Leeds, Sheffield, Hull, Southampton and Bristol. Head Office, Dereham, Norfolk.

WOODWORKING

WOODWORKING MACHINE for £5; includes 3ft. lathe, 8inch circular saw, rise and fall table, sanding disc and table, tool-holder and screw-in tailstock. Make this useful machine from scrap material and steel-piping. Send 3/9 P.O. for plans. Evans, 64, Brooklands Park, Blackheath, S.E.3.

ALL HARDWOODS for woodturners and woodcarvers; dry, selected oak squares, 19in. x 3in. x 3in., 4/-. We sell thousands of discs per month to satisfied customers. S.A.E. for price list. Beautywoods, Redlynch, Salisbury.

PLYWOOD, 36 x 12 x 3/16, 13/- doz.; 24 x 12 x 31/6, 9/6 doz.; c.p.; s.a.e. for list. Parmount (Dept. P.M.), Burnley Road, Rawtenstall.

WOOD LATHES, Attachments, Motors and Control Gear, Circular Saw Blades, Spindles or Benches, Turning Tools, etc.; interested? Then send 6d. for illustrated literature, price list and H.P. terms. D. Arundel & Co., Mills Drive, Farndon Road, Newark, Notts.

ARE YOU LOOKING FOR A RELIABLE FIRM for Timber Plywood, Wallboards, Veneered Plywood; call at our warehouse or send s.a.e. for price lists. N. Gerver, 2/10, Mare Street, London, E.8 (near Cambridge Heath (E.R.) station). (AMHerst 5887.)

WOODWORKING MACHINES, all cast-iron constructed. Complete Saw Benches, 7in., £4/15/-; 8in., £5/10/-; 10in., complete, motorised, £30. Planers, 5in., £12; Bowl Turning Heads, £4; with 8in. Saw Tables, £7/10/-. Lathes, £7/10/-; Combination Lathes, £10/10/-. Motors, Pulleys, Belts, etc. 12 months' written and money refund guarantee. 4d. stamp for illustrated booklet. James Inns (Engineers), Marshall St., Nottingham.

SAWBENCHES, all sizes from £10; motorised, £20; petrol portable, £32. Spindle Assemblies, from 27/6 for saws up to 36in. Motors, Engines, Bearings, Pulleys, Belts. Deferred terms. Send 1/4 for handbook-catalogue. Price list free. Beverley Products, Sturton-le-Steeple, 17, Notts.

ELECTRICAL

NIFE BATTERIES, new, 10 volt cases, 25 A.H., 50/-. Rectifiers, new selenium, F.W., 12 volt, 3 amps., 9/6; s.a.e. list. L. Unwin, Bousley Rise, Ottershaw.

CABLE CHEAPER in small coils (25-49yds.). Prices per 100yd. lots (less supplied add 5%), twin rubber or plastic, 1/044 50/-, 3/029 64/6. 3/029. earthed, 78/6, 7/029 earthed, 135/-. Request lists, all cables, accessories. P.M., 591, Green Lanes, London, N.8.

AMAZINGLY powerful miniature Electric Motors. MiniMo: 3-6 D.C. volts, .1-.3 amps., speed 4/5,000, weight 1½oz., size 1½in. x 1½in.; drives boat propellers 1in. dia., aeroplane propellers 5in. dia., price 9/-. MaxiMo: 3-9 D.C. volts, .2-.75 amps., speed 4/5,000, weight 1½oz., size 1¼in. x 1 3/16in., drives boat propellers 1¼in. dia., aeroplane propellers 8in. dia., price 12/6. Maximum power, minimum consumption, for all models. "Friclub" Lubricant for above and all light mechanisms 1/6 per tube; all post paid. Etna Products Ltd., Dept. P.M., "Highland," Alkrington Green, Middleton, Manchester.

BRAND NEW CABLES: TRS twin, 1/044 42/-, 3/029 62/-; twin and earth, 3/029 73/-, 7/029 125/-; PVC twin 1/044 49/-, 3/029 63/-; all per 100 yards. Lampholders 6/6. Switches 16/3 doz. All electrical goods, including Fluorescent fittings, at bargain prices. List. Jaylow Supplies, 93, Fairholt Road, London, N.16.

WATCHMAKERS

WATCH REPAIRERS, Hobbyists, etc., send s.a.e. for list of Watches, Movements, etc., priced from 9d. each. Loader Bros., Dept. P.M., 36, Milestone Rd., Carterton, Oxford.

WATCH AND CLOCK PARTS, large stocks of all spares, Balance Staffs, Winding Stems, Hair Springs, Complete Balances, etc.; return postal service. Send for latest free lists. H. S. Walsh, 27/28, Anerley Station Road, London, S.E.20.

(Continued on next page)

(Continued from previous page)

HOLIDAY ACCOMMODATION

TOURING HOLIDAYS. "Bed and Breakfast in South & South-West England." Superb Illustrated Guide describing recommended Inns, Farms, Guest Houses, Hotels, etc., 2/9, post free. Herald Handbooks, 3, Teevan Road, Croydon.

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order 1952.

A.M.I.Mech.E., A.M.Brit.I.R.E., City & Guilds, etc., on "No Pass—No Fee" terms. Over 95% successes. For details of Exams. and courses in all branches of Engineering, Building, etc., write for 144-page Handbook—Free. B.I.E.T. (Dept. 967B), 29, Wright's Lane, London, W.8.

TECHNICAL INFORMATION SEARCHER. Chartered Patent Agents in Central London have vacancy for a man with an engineering background, preferably to National Certificate level. General education to Matriculation standard. An office job with a 5-day week and short hours. Applicants for interview should state age and give details of education, examinations passed, and experience (if any). Write Box 253, Reynells, 44, Chancery Lane, W.C.2.

EDUCATIONAL

I.P.R.E. TECHNICAL PUBLICATIONS. 5,500 Alignment Peaks for superheterodynes, 5/9. Data for constructing TV aerial Strength Meter, 7/6; sample copy "The Practical Radio Engineer," quarterly publication of the Institute, 2/-; membership and examination data, 1/-. Syllabus of 7 postal courses free and post free. Sec., I.P.R.E., 20, Fairfield Road, London, N.8.

LEARN IT AS YOU DO IT.—We provide practical equipment combined with instruction in Radio, Television, Electricity, Mechanics, Chemistry, Photography, etc. Write for full details to E.M.I. Institutes, Dept. P.M.47, London, W.4.

MERCHANT NAVY Radio Officer Cadet Training School. World travel and adventure overseas. Brooks' Bar, Manchester.

INVENTIONS

INVENTORS.—Send s.a.e. for particulars of our Service for profitably developing and marketing your Invention. Kelsey & Partners, Woodlands, Stroud, Glos.

CELLULOSE

ENTHUSIASTIC POPULARITY ! ! Cellulose Veneers, washable, flexible; white, black, pearl, glitter; 1,001 uses; all crafts; mixed parcels, 3/6, 6/6, 12/6, p.p. Jackson (Dept. P.M.), "Ouseburn," Woodmansey, E. Yorks.

MISCELLANEOUS

TAKE A TIP! It may be "Wimet." Grind with "Diadisc" from Millett! 1¼in. diamond lap, ¼in. taper bore, 25/9. W. J. Millett, C.M.B.H.I., St. Ives, Huntingdon.

BUILD YOUR OWN REFRIGERATOR, all components available at reasonable prices. Frigidaire flowing cold units £5; small units, Kelvinator, etc., £4; ¼ h.p. heavy duty Motors, £3; Chrome Cabinet fittings, new, £1; money back guarantee; s.a.e. for list and schematic diagram. Wheelhouse, 1, The Grove, Isleworth, Middx. (Phone: Hounslow 7558.)

COMPRESSOR EQUIPMENT. Miscellaneous Items; catalogue 1½d.-Pryce, 157, Malden Road, Cheam.

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

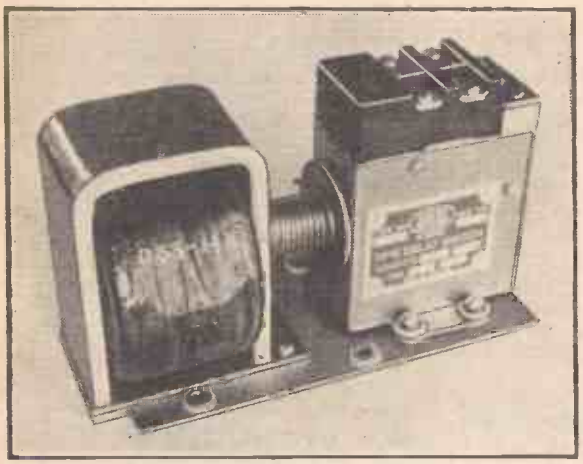
EVERY conceivable item of workshop equipment readily available under our Personal Hire-purchase Plan. Write for details to-day to Garners, 6-8, Primrose Hill, Barnsley.

"PRACTICAL MECHANICS," 120 copies, 1944-1954, almost complete. What offers? 130, Nightingale Road, Carshalton, Surrey.

Trade Notes

D.C. Pneumatic Time Delay Relay

ELECTRO METHODS, LTD., Caxton Way, Stevenage, Herts, have produced a D.C. pneumatic time delay relay, which is a single-pole change-over switch in which "make" or "break" timing can be set to operate over the range of 1/6th to 180 seconds. It comprises a compact pneumatic system and a robust D.C. solenoid and can be supplied mounted in a fully tropicalised cast-aluminium case.



The D.C. pneumatic time delay relay.

Its many uses include controlling accelerating-contactors to D.C. motors; timing the opening and closing of valves in refrigeration plant; controlling sequential process operations in which accuracy and reliability are essential; for the delayed starting of loop-circuit equipment and for the delayed starting of stand-by equipment. The specification and any further information is available from the above address.

Revultex Cold Casting Process

MESSRS. REVERTEX LIMITED, 51-55, Strand, London, W.C.2, have sent us details of their cold casting process for the production of hollow-moulded rubber articles. Neither elaborate machinery nor expensive metal moulds are required and a wide range of goods such as toys, hot water bottles, rubber balls, bulbs, imitation pottery and display ware can be made simply and economically.

Broadly the process consists of filling a porous mould with a liquid Revultex compound, allowing the mould to absorb part of the water and so deposit a wall of rubber on the mould surface. Afterwards the excess of Revultex compound is poured out and collected for future use. Finally the deposited rubber article is dried and removed. Further information may be obtained from the above address.

Wolf Cub Equipment

NEWCOMERS to the Wolf range of tools are the heavy-duty high-speed angle grinders which are designed to perform heavy weld dressing work, foundry grinding, cutting off risers, etc. These machines are the first electric tools expressly designed to operate the new depressed centre reinforced grinding discs at correct and maintained speeds under heavy duty conditions.

Also introduced for the home handyman are two new accessories in the "Cub" range, a high speed bench planer and a bench sander. They are part of the range built around the Cub drill, which provides also a bench saw, lathe, drill press, sander, polisher and bench grinder, etc.

Continual demonstrations of all Wolf Cub equipment were a special feature on the Wolf stand at the B.I.F.

Model Accessories

FROM Messrs. Bassett Lowke Ltd., Kingswell Street, Northampton, we have received details of some of their current lines. These include clockwork and electric boat motors, brass propellers and shafts and other boat building accessories. There are details of track, etc., for outdoor model railways and finally a section dealing with a small rotary pump suitable for such jobs as pumping water or oil, use in miniature fountains and waterfalls, for free lubrication of machinery, for feeding suds on to machine tools or for fluid circulation for cooling and heating. Approximate dimensions are height 1¾in. x 1in. x 2⅛in. All queries should be sent to Bassett Lowke, Ltd.

Below (Right).— Wolf combined mortiser and drill.

Multicore Solder Thermometer

A LAST minute exhibit on the Multicore Solder Stand at the Radio Components Show, held in April, was a solder thermometer. This simple form of pyrometer is to enable users of soldering irons and solder baths to determine quickly the temperature of the solder on the iron or in the bath. The instrument is completely self-contained and comprises a meter movement which is connected to a thermocouple mounted at the end of a tube attached to the meter. A scale is graduated in degrees Centigrade and Fahrenheit and the maximum temperature to which the instrument should be subjected is 400 deg. C. (752 deg. F.). The solder thermometer will be supplied direct by Multicore to factories already using Multicore solder at a net price of £6 12s. 6d. Delivery is approximately two months.

The Multicore solder thermometer.

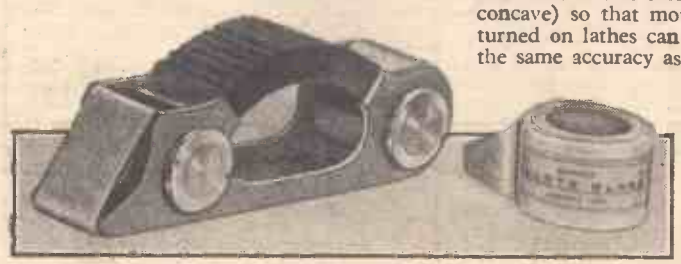
Bawsco Abrasive Coil Surfacing Tool

THIS tool has been specifically designed as a completely self-contained hand tool to be included in any handyman's kit. It will produce any desired finish on wood, metal and other materials without the inconvenience of obstructive electric cables or having to work in a room with a power supply. It also does away with the time wasting and material wasting practice of using cork and wood blocks and torn strips of sandpaper.

Instead, this entirely new hand tool employs the use of any one of 25 different twill abrasive coils varying in length from 4ft. to 9ft. (coarse to superfine in five different abrasives), which is simply inserted in the tool onto slotted tubes.

When the abrasive under the base wears a simple turn of the winders will roll up the used portion on to a tube at one end of the tool and at the same time, bring forward a fresh surface under the base from the tube at the other end. This is then locked in position by two friction screw tube locks. When the whole of this coil has been used, it can easily be pulled out and a fresh coil inserted. These coils are also entirely interchangeable for use on different materials.

The tool is precision built from solid duralumin; it will not rust and it is perfectly balanced with the hand-grip centrally placed to ensure even pressure and to keep the fingers clear of the surface being worked. The ends of this tool are curved (convex and concave) so that mouldings and work being turned on lathes can be evenly finished with the same accuracy as flat work. For smaller curved surfaces such as tubes and rods, etc., a series of clip-on plates in various shapes are available and these are simply snapped over the concave end of the tool.



The Bawsco abrasive coil surfacing tool.

Further details of this useful tool, which costs 29s. 6d. complete with fitted abrasive coil may be had on application to the British Abrasive Wheel Co. Ltd., 85, Bourneside Road, Addlestone, Weybridge, Surrey.

The prices of twill abrasive coils range from 1s. 6d. upwards.

Your Queries Answered

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.

Obtaining Fine Silver and Gold

PLEASE tell me the process for turning scrap 9ct. gold and sterling silver into their pure fine state, suitable for electroplating purposes.—J. D. White (Pemb.)

THE recovery of pure or " fine " gold is not a very easy matter unless you are experienced in chemical theory and manipulation.

To obtain pure gold from the 9ct. metal proceed as follows : —

Dissolve the gold in *aqua regia* (i.e., a mixture of 2 parts strong hydrochloric acid and 1 part strong nitric acid). The aqua regia should be gently warmed during the solution process. A strong yellow solution will be obtained. This solution must be very carefully evaporated to dryness on a water bath and then redissolved in distilled water. Next, dissolve 1 part of ferrous sulphate in 3-4 parts of distilled water, and acidify the solution by adding to it a few drops of strong sulphuric acid. Allow both this solution and the solution of gold to cool to normal temperatures. Then add the ferrous sulphate solution very slowly to the gold solution with constant stirring. All the gold will be precipitated as a dark red-brown powder which consists of pure metallic gold. This should be filtered off, washed in cold water and dissolved in aqua regia. The resulting solution must then be evaporated to dryness on a water bath and the residue redissolved in distilled water. This will give a solution of gold chloride which, in conjunction with potassium cyanide, comprises the usual gold-plating bath.

To obtain fine silver from sterling silver, dissolve the latter in warm dilute nitric acid (1 in 4). You will, in this way, obtain a solution of silver nitrate contaminated with copper and other metals. Because of its copper content the solution will be tinged green. The liquid will contain various insoluble impurities which should be filtered off. Evaporate the filtered liquid to dryness over the water bath and heat the residue more strongly. Red fumes will be evolved and a black-looking solid will be obtained. This should be dissolved in distilled water and the solution filtered. Add to the solution a dilute hydrochloric acid (1 in 4) until no further white precipitate of silver chloride is obtained. Stir up the liquid and filter off the silver chloride, wash the precipitate with cold water on the filter paper. Mix the silver chloride with double its weight of " fusion " mixture (a mixture of sodium and potassium carbonate). Place the mass in a suitable crucible and heat it strongly to red heat. The silver chloride will be converted into metallic silver which will fall to the bottom of the crucible. After cooling, the crucible should be immersed in boiling water, which will dissolve out the remains of the fusion mixture and will disclose a " button " of metallic silver which will represent the metal in its pure or " fine " form. This is dissolved in dilute nitric acid (1 in 4), the resulting solution then being carefully evaporated to dryness. The white mass of silver nitrate which remains may be collected in the solid state or redissolved in distilled water.

Bleaching Mahogany

I HAVE a mahogany mantelpiece and surround and wish to bleach it to a light colour. Can you tell me what to use and the method ?—B. J. Mooney (Harrow).

IT is not easy actually to bleach mahogany, since this is a pinkish wood which, with the passage of time, tends to become darker in shade. Naturally, of course, you will have to begin by removing the whole of the surface polish from the woodwork. This is best done by patiently scraping it all away with the edge of a copper coin held between the fingers, taking care not to scratch the wood itself. After this, go over the woodwork with a rag charged with warm methylated spirit.

Now grind up into a paste chloride of lime and water. Thin the paste out a little to the consistency of cream. Thus brush it over the bared woodwork. Let it dry on. Then brush on to the woodwork dilute acetic acid (1 in 4). Have the windows open during this operation, and take all pictures out of the room, for chlorine gas will be generated. This has a powerful bleaching effect and it might affect pictures, fabrics and wall hangings. If the wood is not whitened sufficiently as a result of this operation, repeat the whole process until you get the wood down to the colour you require. Finally, this is important, wash away every trace of the bleach and acid, using cold water rinses and then hot water and soap scrubbing. Let the woodwork dry out slowly, otherwise it may tend to twist. Do not have a fire in the room until the woodwork is thoroughly dry. The wood surface will require a final sandpapering, and it will then require some type of re-polishing. In place of acetic acid above recommended, hydrochloride acid dilute (1 in 4) can be used. This, indeed, is more potent, but it is rather dangerous to use, since it might attack the wood and soften it. It is better, in our experience, to use the more expensive acetic acid for decorative bleaching of this nature.

Readers are asked to note that we have discontinued our electrical query service. Replies that appear in these pages from time to time are old ones and are published as being of general interest. Will readers requiring information on other subjects please be as brief as possible with their enquiries.

Non-drying Adhesive

WILL you be good enough to supply me with the formula for making a " non-drying " adhesive such as that on the back of " self-adhesive " letters and pay packets. Can such an adhesive be obtained ready prepared ?—F. Fitton (Lancs.).

THE making of an effective " non-drying " or " self-sticking " adhesive such as you require is a very exacting task, requiring a number of materials which are difficult to obtain. For instance, here is a typical formula for such an adhesive :—

Nitro cotton	5	parts (by wt.).
Ethyl acetate	4	,,
Teluana	2	,,

To the above solution, add the following :—

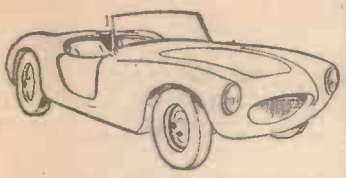
Estet Gum	4-5	parts (by wt.)
Castor Oil	3	,,
Butyl phthalate	3	,,
Ethyl acetate	2	,,
Teluana	2	,,

An alternative " self-sticking " adhesive consists of equal parts of fine mica powder and rubber latex.

Unfortunately, too, these special " self-sticking " adhesives are not at present marketed in small amounts, although there is undeniably a definite call for them. I.C.I., Ltd., North-Western Branch Office, Ship Canal House, King Street, Manchester, 2, supply a very excellent adhesive of this nature consisting of a solution of a synthetic low-polymerisation resin in xylene, but we very much doubt whether you would be able to obtain small amounts of this as a private individual. You may, however, be able to obtain some

(*Continued on page* 416)

FIBREGLASS !!!



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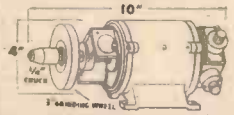

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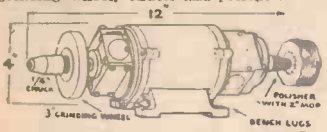

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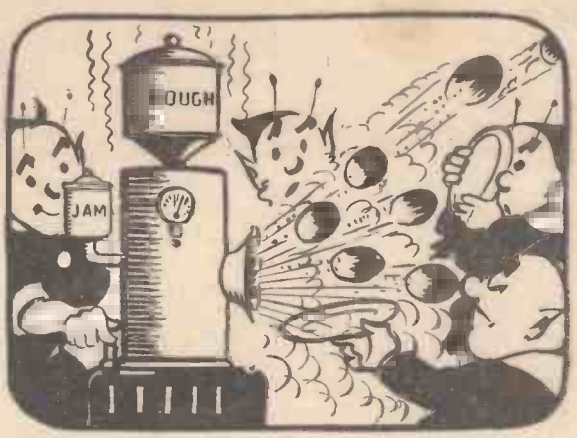

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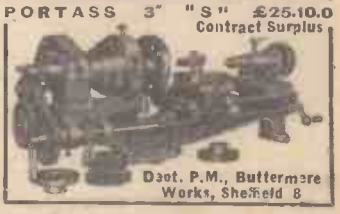


Dept. P.M., Buttermere Works, Sheffield 8

similar adhesive in small amounts from either Plastics Ltd., 11, Whitworth Street, Manchester, 1, or Messrs. Greenwood, 13-17, Victoria Street, Huddersfield, Yorks. You may, also, be able to procure a similar "self-sticking" adhesive from Portland Plastics, Ltd., Wear Bay Road, Folkestone, Kent.

Silica Gel

CAN you please answer the following :— What is silica gel ? What are its applications ? When does it require reactivation and how is it reactivated ?—G. B. Maskery (Brighton).

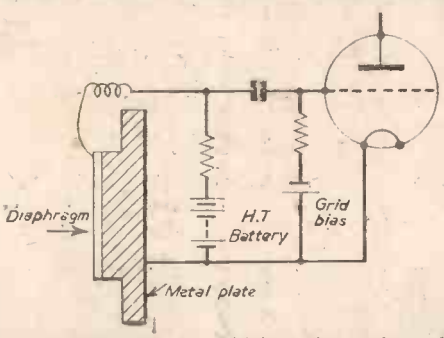
SILICA gel is an amorphous form of hydrated silica. It is produced by the electrolysis of sodium silicate solution or by the treatment of such solution with acid. In this water, a colloidal form of hydrated silica is obtained, which latter polymerises to give a "gel" or a jelly-like substance. This is the "silica gel." When freshly prepared, it appears as a gelatinous mass but, on standing, it sets to a solid mass which (when it contains less than 75 per cent. of water) is very friable or powderable and can thus readily be ground or pulverised. Usually the material is carefully heat-treated in order to dehydrate it completely. It is then pulverised and graded according to its particle size.

The uses of silica gel follow from its extraordinary activity as an absorbing agent. The gel will not only absorb fumes and gases, but it will also absorb impurities from liquids. Still more, it will rapidly absorb moisture from air and other substances. It has been estimated that one part of silica gel will often absorb about 300 parts of moisture or other contaminating impurity from its surroundings. When the gel has acquired its full complement of absorbed material it must be "reactivated." This, in some cases, is effected by dissolving out the impurities, but, more ordinarily, and especially in the case of absorbed moisture, the reactivation of the gel is carried out merely by heating it so as to drive the moisture off.

Making a Hydrophone

I WISH to construct a hydrophone suitable for use at approximately 50ft. depth. I understand that the microphone is built inside a heavy steel container but have no other details. What type of microphone would you recommend and what power from the amplifier ?—G. L. Doughty (Malpas).

YOU could use a heavy steel container for the microphone, the case being provided with a flexible diaphragm in order to allow vibrations to be transmitted to the microphone. You could use a condenser microphone (Marconi's Wireless Telegraph Co., Ltd.) consisting of a very thin metal diaphragm stretched close to, but insulated from, a solid flat metal disc to form an air



dielectric condenser which is kept charged through a resistor of at least 20 megohms. We advise you to use at least one stage of amplification in the hydrophone. Other stages can be used at the receiver, depending on the volume of sound required.

Draught Elimination and Fire Efficiency

WHEN the fire in our living-room is alight, it draws in a lot of air through defects in door and window, and even up through the floor boards where not covered. This creates a considerable draught in the room. If I stop up all this unwanted ventilation, will it stop the fire drawing, or will sufficient air be fed to it down the chimney ?—J. B. Lucas (Ireland).

IF you stop up all the chinks and crannies in your room so as to eliminate all the possible sources of draughts, it is probable that your chimney will smoke very badly. Under these conditions, when the door is closed (particularly if it is closed suddenly) there will be a down-draught of smoke from the chimney, and even if the fire is not actually smoking at the time, there will be a down-draught into the room of fumes from the fire. This will be because, by stopping up all the chinks, you will have taken away air currents in the room which would otherwise have entered the chimney space and have acted by compelling the smoke and fire fumes to rise in the chimney.

We quite agree, of course, with your idea of trying to get rid of the room draughts. But if you do this completely, we fear that you will have trouble in the above direction. We think, therefore, that you will have to aim at a suitable compromise. Stop up as many sources of draught as you can without making the fire smoke. Hence, you see, you will have to do this work little by little. You can stop up the whole of the floor-board defects, but, after that, go very carefully, testing each stage of your stopping-up until you arrive at a stage at which the fire begins to smoke. The entire question of just how far you can go in this matter depends entirely on the design of the fireplace and the chimney.

Information Sought

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

Mr. E. Ball (Batley) asks : "I am interested in the construction of what I may call 'an underground water pipe tracer.' The idea is to have some sort of vibrator feeding a transformer, which in turn is coupled to the underground pipe (one lead to the stop tap, usually in the roadway, and the other to the tap inside the house). The other part consists of a triangled frame aerial with an earphone connected across it. The pulsations are picked up in the earphone from the vibrator through the ground from the pipe, making it possible to trace the run of the water pipe between the two given points. I have managed to construct this arrangement, but the signals are too weak for the device to be of any value. Could you or any of your readers give me any information on this apparatus ?"

Mr. T. Kirne's problem is set out in the following letter : "I should like to build a boat suitable for inland lakes.

"The boat is to be propelled by two water-wheels—one on each side—and the two passengers seated inside use their feet to put the wheels in motion. Can you give me any information ?"

J. Thompson (Bradford) writes : "I wish to build a home-sunray lamp of the mercury vapour tube type and wonder if you could furnish me with a circuit to give a reasonably powerful output ? I am hoping to buy Government surplus components. An alternative circuit for infra-red rays would also be appreciated."

L. F. Moss (New Zealand) writes : "I wish to make some arrows for an archery club. I have a wood lathe on which to turn the shafts, but fixing the feathers has me stumped !

"Would you please give me some information on this ?—and some general instructions for making arrows would be very welcome. Can you advise me as to any books published on archery ?"

From Mr. A. M. George (Hornchurch) comes the following : "I have recently purchased an electric carbon welding set of the type wherein the carbon electrode produces heat on contact with the metal surface to be welded (as opposed to the carbon arc principle). Results with this machine have been unsatisfactory and I would therefore be very grateful if you could give me some advice on using this machine, the type of flux, rods, etc., and tell me of a book.

"The set is, I believe, ex W.D., for it bears no maker's name, and the only information I have is that it is A.C. working and has a maximum output of 150 amps. The main work which I wish to do is lap-jointing 22 gauge mild steel."

From Mr. A. Fern (Derby) comes the following : "I have a four shaft table loom, but find the work both slow and laborious. I would be glad, therefore, if you could send me details of a shedding device which would lift the shafts automatically and in any given sequence. I already have Theodore Jennings's 'Jack-in-a-box' in detail and wonder if it could be adapted for my purpose."

The following query is from S. C. Stanley (Walton-on-Thames) : "Could you suggest a means of measuring, or at least comparing, the emission of ultra-violet rays from electric arcs ?

"I do not wish to assess the output in units, but merely to compare that from one arc to that of another in proportional terms."

Mr. R. Cosgrove (Liverpool) writes : "On a recent visit to a beer bottling works I saw two filling machines ; one was C/02 gas-top pressure and the other unit was air-top pressure. I was unable to understand the function and working of these and would be obliged if you could give me an explanation. Could you also tell me how the level of beer in the bottle is controlled, and if there is any reading matter available on this subject ?"

From Harrogate Mr. E. Hartley writes : "I would like to convert either a Hipp or a mains synchronous type of movement into a perpetual calendar. Could you give me any details of the train work for the different months, also the extra day involved in leap year ?"

The following was received from R. Sanderson of Devizes : "I am contemplating making my camera suitable for underwater photography. I would be much obliged if you can give me any information as to how this may be done."

Mr. G. H. Powell (Birmingham) writes : "I wish to construct an ultra-violet lamp for blueprinting purposes. Can you tell me how this can be done cheaply ? I have been told my best plan is to buy a carbon filament lamp, fixed into a bowl reflector (as used in a bowl fire) and covered with a sheet of horticultural glass. Can you suggest a firm who could supply these items ?"

Mr. H. J. Howells asks : "Have you any information on the construction of a bathroom weighing scales ?"

THE Cyclist
Editor: F. J. CAMM

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

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

WHAT I THINK

By F. J. C.

The Speed Limit

LORD BRABAZON, president of the Roadfarers' Club, would like to see the speed limit abolished. As that is unlikely to come about, he thinks the first thing to do is to limit it to certain times of the day. Take a road like that from Hammersmith Bridge to Mortlake. There are few side turnings, it is a broad road, and the only possible danger is a school. Because of the school, most people would be prepared to tolerate the speed limit during the hours when school children are about, but from eight o'clock at night to seven o'clock in the morning such roads could well be free from the limit.

We have in our legislation various examples of something being legal at one time, and illegal at another, such as sounding the horn, consuming beer, etc., and there is nothing wrong, therefore, in adapting it to motoring. This seems an eminently sensible idea.

In point of fact, what is wanted in London and other busy places is a minimum speed limit and not a maximum. As for many reasons that would be impracticable, the arbitrary speed limit should be abolished altogether. The present law is adequate to deal with any motorist who drives at a speed which is unsafe in relation to conditions obtaining at a particular moment, and that speed cannot be arbitrarily assessed. It might be any speed, between half a mile an hour and 80 miles an hour. The Lord Chief Justice is known to be in favour of the abolition of the speed limit. Although a sub-committee is now listening to the case for the abolition of the speed limit in London, it is my view that it should be abolished throughout the country.

There is certainly no case for retaining the speed limit at night. It is agreed that the roads will not for many years be made suitable for the ever-increasing volume of traffic and it follows that present road policy must be readjusted on a realistic basis to speed it up; whereas the present policy has been to slow it down. The average speed of traffic through London is under eight miles an hour—not surprising when it is considered that the policy has been designed with the safety of pedestrians as the main objective. Such a policy must, if continued, eventually bring the speed of traffic down to that of a pedestrian. The speed limit cannot be satisfactorily enforced and a law which cannot be enforced is a bad law. I suggest that the Minister re-examines the arguments favouring the abolition of the speed limit which were put forward when Mr. Hore Belisha introduced the 30 mile an hour limit. There are few places in London where motorists can exceed the limit, and certainly very few occasions where they can do so because of traffic congestion, and where a motorist can do so with safety, he should be entitled to make up some of the time he has lost in this way without risk of prosecution. When a river is in spate the sluices are lifted, in order to prevent it from overflowing its banks. With the traffic stream the contrary policy has been adopted. It is an affront to and a travesty of natural justice that a motorist travelling at an average speed of less than eight miles an hour through London can be prosecuted for exceeding the speed limit within that hour. This brings the law into contempt.

As part of the plan to speed up traffic stopping places for public service vehicles should be removed from traffic lights, where at present they often render the lights ineffective, especially turn left filter lights. Large numbers of unnecessary traffic lights should be removed; they are insensitive to the needs of the moment and they cannot be pre-set for traffic control so that the duration of the red and green lights complies with traffic needs throughout the day.

The American Market

THE chairman of the Bicycle Manufacturers' Association of America recently stated that imports of British and other bicycles to the U.S. had sapped away 39 per cent. of the total American market. This is not surprising when one examines the leviathan machines made by most American bicycle manufacturers. At the moment of going to press, President Eisenhower is considering the recommendations of the Tariff Commission for further protection of the domestic American bicycle industry.

British bicycles have undoubtedly created a demand for the light-weight type of machine which American manufacturers are unable to supply. Indeed, Americans until their introduction to the British light-weight did not ride bicycles for pleasure. The American public prefers the English light-weights and their demand is increasing. Price is not the factor, for some American machines are cheaper than the British, yet the demand in America is for the more expensive British machines. It would seem that the British manufacturer has created a demand in America and the Americans now want to annex it. Meanwhile, the bicycle industry continues to increase its exports with great success. Figures just released by the Board of Trade show that 577,964 complete bicycles (value with parts £7,510,284) were exported during the first three months of this year, comparing very favourably with 463,295 machines (value £6,278,287) sent overseas during the same period last year.

During March, 1955, 215,511 bicycles (value with parts £2,680,943) were exported against 188,167 (£2,486,942) during March last year.

The Slough Experiment

THE 67,000 inhabitants of Slough are being invited to co-operate with the Ministry of Transport and Civil Aviation in a two-year experiment to determine the relative values of various road safety measures. Results will be scientifically analysed and Mr. John Boyd-Carpenter, Minister of Transport and Civil Aviation, who has arranged the experiment with the Borough Council and interested organisations, expects the analysis to yield valuable information which can be used in formulating future policy on the prevention of accidents throughout the country. It is the first experiment of its kind in Britain.

News of the experiment was given by Mr. J. D. Profumo, Joint Parliamentary Secretary to the Ministry of Transport and Civil Aviation, in reply to a question in the House of Commons recently. He said that during the experiment, selected road works would be carried out, an improved traffic control system introduced, and road safety education and police activity considerably intensified.

R.T.T.C. and Team Trials

TEAM trials are again banned to clubs affiliated to the R.T.T.C. and riders are warned that they must not compete in or officiate at any team time trials. Action against offending riders "will have to be considered," says the statement from the chairman. The R.T.T.C. recently asked the Ministry of Transport to be released from the undertaking given two years ago that the promotion of these events would be temporarily suspended. A similar undertaking was given by the B.L.R.C. and the N.C.U.

From this it must be concluded that the M.O.T., flying in the face of ineluctable evidence still refuses to acknowledge team trials and to permit them. The Ministry makes it clear that should action have to be taken by either the Ministry or the Home Office the result will be the complete prohibition of all time trials, both team and individual. We do not think, however, that if any such prohibition were introduced, it would stamp out time trials. They would continue to be furtively held as road racing was in the early part of the present century. It is true that there was no legal prohibition at that time, but the malicious persecution of cyclists by the police amounted to that. We suspect also that the Government might place a restraining hand on the Ministry, for fear that such action may lose votes—whichever party happens to be in power.

Sir Harold Bowden Retires

SIR HAROLD BOWDEN, Bt., G.B.E., recently announced his retirement from the chairmanship of Raleigh Industries, Ltd., after 55 years with the company. He will, however, continue as a director of the company and will hold the newly created Presidency of Raleigh Industries, Ltd. Sir Harold, who is 74 years of age, was one of the early members of the now famous Roadfarers' Club, in which he continues to take a keen interest. He joined the company in 1899 and was elected chairman in 1921. The company itself was founded 67 years ago by his father, Sir Frank Bowden. The chairmanship of Raleigh Industries has now been taken over by Mr. George H. B. Wilson, C.B.E., M.C., A.F.C. He joined the company in 1927 and was appointed managing director in 1938.

A Radio Receiver For Cyclists

Constructional Details of a Simple Midget Battery Portable Receiver that can be Carried on the Frame of a Bicycle

WIRELESS reception has become such an important part of our everyday life that we are not satisfied merely to listen in our homes, but must take a receiver with us on our travels. Midget portable sets have simplified matters in this direction and we now have receivers which are quite small enough to be carried by cyclists.

The portable radio equipment must obviously be extremely light; it must also be compact and must be designed so that it can either be attached to the frame or fit into the saddle-bag.

The Aerial

The type of reception provided is by means of headphones, and this means that the set will only be used when the cycle is not being ridden. A throw-out aerial only is required, and this might well consist of a 20ft. length of flex with a large washer tied to one end, which can be thrown over the branch of an adjacent tree or even thrown along the ground.

The bicycle frame can be used as a counterpoise earth, although it is better to use a short copper or brass spike which can be pushed into the ground. Alternatively, the bicycle can be used as the aerial, making connection to a bright part, such as the handlebars or pedal crank; an earthing spike is then practically essential.

A Two-valver

The receiver itself can be a two-valve arrangement, comprising a pair of Hivac midget valves—preferably an S.G. valve used as a detector and a pentode output valve, the two being coupled together by means of a midget L.F. transformer. A suitable circuit is shown in Fig. 1, from which it will be seen that there is a very close resemblance to an ordinary "fixed" receiver circuit. The chief difference lies in the fact that automatic grid bias is provided and that the total H.T. voltage is only 45.

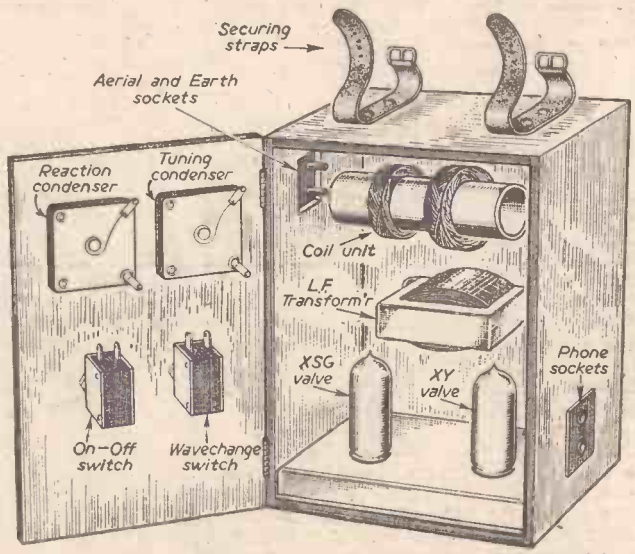


Fig. 2.—The cabinet and general arrangement of components.

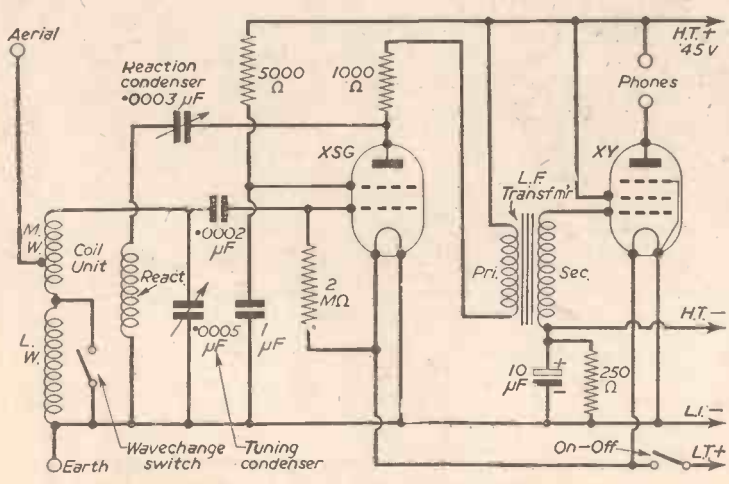


Fig. 1.—The theoretical circuit.

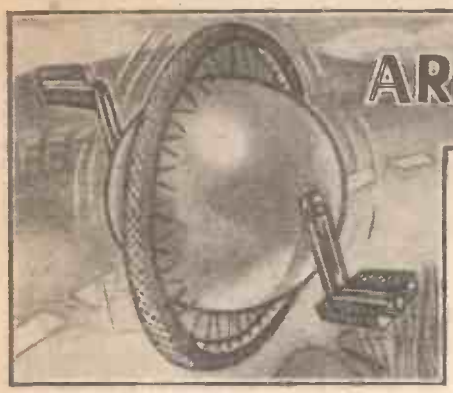
Batteries

It will be found best to construct the receiver itself as a unit, arranging leads to run to the midget 2-volt accumulator and H.T. battery, which may be carried separately. The set can be built into a cigar box without any difficulty, following the general arrangement indicated in Fig. 2. Here it will be seen that a midget coil is employed, and that bakelite-dielectric condensers are used for both tuning and reaction control; suitable components are to be found in most radio constructor stores.

Components and Suppliers

One midget L.F. transformer.
One midget tuning coil (Astral Radio Products, 82, Centurian Road, Brighton, Sussex).
One .0005 μF bakelite-dielectric tuning condenser.
One .0003 μF reaction condenser.
Two Q.M.B. on-off switches (Bulgin type 81).
Four ½-watt metallised resistances: 2 megohm, 1,000 ohms, 5,000 ohms, 250 ohms (Radio Resistor Co., Erie, etc.).
One .0002 μF tubular fixed condenser.
One 1 μF tubular fixed condenser.
One 10 μF electrolytic condenser.
(T.C.C., Dubilier, etc.)
Two terminal socket strips (A and E and phones).
Two midget valves—X.S.G. and X.Y.
Two midget valveholders.
(Hivac)
One 45-volt H.T. battery (Drydex).
One 2-volt unspillable accumulator (Exide).

There is no H.F. choke, and the midget L.F. transformer is directly wired in the anode circuit of the detector. The resistances can all be a ½- or ⅓-watt type, and the fixed condensers should be tubulars. Terminal socket strips are used for aerial, earth and 'phone connections, whilst it is suggested that a four-way battery cable should be used for connecting up the batteries.



AROUND THE WHEELWORLD

By ICARUS

The Law of Trespass

ONE of my readers, Mr. J. H. Dixon, of Sheerness, calls us to task for the recent statement that persons trespassing cannot be proceeded against. Mr. Dixon says that in effect this means that anyone has the right to go where he pleases provided that he does no damage. He says that no action can be taken in a court of summary jurisdiction, but action can be taken in the High Court for "damage by trespass." He thinks, therefore, that "trespassers will be prosecuted" is a sound notice. It is *not* a sound notice. What was stated in this journal was that trespass only was insufficient to sustain a charge and that generally it was necessary to prove damage or malicious damage. Hence, the phrase "damage by trespass." No magistrate could convict on a charge of innocent trespass where damage had not been done. Trespass to land is defined in law as "the unjustifiable interference of another's possession of land," or "breaking his close." Small sympathy would be shown by the Court towards the plaintiff who arbitrarily launched an action for trespass in a petty spirit where the trespass had resulted in no injury to him or his property and where there was no deliberate or persistent attempt to challenge the plaintiff's right to possession. Magistrates' courts have jurisdiction in trespass under the Malicious Damage Act of 1861. Note, emphasis should be placed on *malicious* damage. No one would bring an action for accidental trespass.

The 1955 Tour of Britain Cancelled

THE N.C.U. has authorised publication of the following statement concerning the 1955 Tour of Britain:

"At the request of the *Daily Express*, the National Cyclists' Union applied in November last to have the 'Tour of Britain' included in the International Calendar and this was done for June 11th-25th, 1955.

"When the *Daily Express* decided not to hold the race this year the N.C.U. felt impelled to step into the breach and, even at that late date, make an effort to keep faith with the riders, the manufacturers, and the U.C.I.

"The union's efforts were fairly successful; it had secured from sources other than the cycle industry rather more than half the amount of money necessary to guarantee the success of the event, and the N.C.U. had every reason to believe it would have additionally the full support of a national newspaper.

"Unfortunately, the incidence of the newspaper strike killed the Union's hopes of this support and caused another very substantial supporter to withdraw his financial backing.

"It is no part of the Union's duty to provide financial support for professional and independent racing, and indeed it is prohibited from using funds obtained from amateur sources for this purpose.

"In these circumstances the N.C.U. asked the Manufacturers' Union to guarantee, by way of advertising revenue, the balance of the amount required to stage the race successfully. The N.C.U. had already modified some conditions of the race at the request of the Manufacturers' Union, but the N.C.U. refused to make further modifications which it considered detrimental.

"The Manufacturers' Union has refused to support the race except on conditions which are unacceptable to the N.C.U. in its position as the governing body of the sport and make the race impossible financially. As the members of the Manufacturers' Union stand to gain very considerably if the race is staged, the N.C.U. feels it is entitled to demand from the M.U. adequate financial guarantees in return for these benefits. These guarantees not being forthcoming the N.C.U. Professional Racing Committee has reluctantly decided to abandon the promotion of the event for this year.

"To those people who guaranteed support, especially to the Isle of Man authorities, the N.C.U. offers its sincere apologies for this cancellation, which has been forced upon it by the attitude of people from whom the Union was entitled to expect support."

The strange church of the Dashwoods.

Pedestrians' Judgment of Vehicle Speeds

PEDESTRIANS wishing to cross a road tend to underestimate the time which it will take an approaching vehicle to reach them. They are apt to misjudge the speed of small vehicles, such as bicycles and motorcycles, as compared with that of large lorries. The faster the speed of the vehicle the more likely they are to misjudge the time it will take to reach them. This is the conclusion reached in the Summary of Road Research for 1954, recently published by D.S.I.R. On the subject of skidding, the report says that many road users associate all coarse-textured road surfaces with immunity from the risk of skidding. It is possible, however, for surfaces of this type to become polished on bends, roundabouts, gradients and busy intersections, and many skidding accidents have been reported on roads of this sort.

Another belief commonly held is that roads are particularly slippery when rain falls after a long spell of fine weather. Measurements made on roads during fine periods and again on the advent of rain showed negligible differences in the skid-resisting properties on the roads tested. While there may be some roads which become slippery when first wetted the effect is not a general one on all surfaces.

Warning to Amateurs

AN official of the N.C.U. has issued a warning that amateurs must not race against professionals, and the Union is to investigate reports that some of its members have been competing against professionals in B.L.R.C. events. It is said that such competition is a breach of the rules. Riders will place their amateur status in jeopardy if they continue to ride against professionals.

I do not suppose, however, that members of the N.C.U. whose activities are to be investigated will care two hoots what action the N.C.U. takes in this latest desperate effort to maintain its authority. What the N.C.U. loses in membership the B.L.R.C. will gain. Under B.L.R.C. rules independents and first-class amateurs are permitted to ride against one another in competitions, thus reversing the original league policy.

C.T.C. Membership Still Falling

THE membership of the Cyclists' Touring Club has fallen by 3,000 to 43,000. In 1950 the membership was over 53,000, so the club has lost 10,000 members in five years, although membership to-day is over 6,000 above what it was in 1938. Its membership is puny in relation to the total number of cyclists, and by no stretch of the imagination can it claim to speak for cyclists generally. In fact, as I have said before, it does not even speak for its own membership, since the views which it airily expounds are manufactured in its own office, without reference to its members. Perhaps the members are beginning to realise that the C.T.C. is not a democratic body. It is one where resolutions can be passed, but no notice need be taken of them by head office! Have the C.T.C. and the N.C.U. outgrown their period of usefulness? Or have they become so interested in cycling politics that they have forgotten the reason for their existence? Are not changes necessary both in method and personnel?

Wayside Thoughts

By F. J. URRY, M.B.E.

Laughton—A little village six miles from Lewes. The sketch shows the old Rockbuck Inn.

After the Needful Changes

I READ an article recently criticising the face of Britain when the proposed new motor roads are in working order, and it did not encourage me to hope for their quick coming. Yet it must be remembered that these needful changes frequently seem more horrible in prospect than when they become fact, as so many people have discovered now the power and water schemes are in full operation and all the overspill has been smoothed away. You will remember how well-meaning folk criticised the pylons, carrying convenience and comfort to many districts in the form of electricity, but I think most of us have become so used to them that they form part of the vision and do not greatly rend its beauty. I always said, if they had been wanderers our ancestors would have been "up against" the telegraph poles when they linked places for the despatch and receipt of urgent messages, and they certainly must have altered the outlook of our main roads at the time of their erection. Yet I have never seen a derogatory paragraph on telegraph poles—rather the reverse—because we were born into that period which had made them a normal feature of the land.

That I imagine is what will happen to the coming generation of cyclists when motor roads are developed; they will become the national method of dealing with the heavy and fast traffic, and still leave for the quiet wanderer something like twenty times the road mileage, quietened by the removal of the heavy stuff from their surfaces. The mess will occur during the building process, but that will only be for a limited period, and once over it seems to me the quiet traveller will be better served, so we too will have gained something, and I for one shall be glad of the relief.

Why Resign a Day?

I HAVE talked and written on this subject of the quiet consistence of cycling as the means to the happier aging of mankind because I believe it to be true, and it is certainly a fact in my case. But how difficult it is to make other folk believe it when fortune gives them the money to buy power and widen their wanderings at ease. There is no reason why they shouldn't if such acquisitions give pleasure to themselves and their friends; but why give up cycling? It is, of course, the line of least resistance that gains the victory over the pastime, and sometimes, alas, in their eyes makes cycling almost despicable. They forget their youth, but, far more important, they forget their elder age when a modest activity, like quiet riding, makes all the difference between wearing out genially and rusting out croakingly. I don't think I am putting it too strongly to say the happiest folk are the active ones, and here is a game a man can play in company or in solitude, amid the best of the countryside, without even the strain of friendly competition. It is a man-made form of travel, taken in a restful posture with your weight carried, that has the touch of heaven in its make-up. That would not have been a possible compliment in my younger days on the solid tyre and the fixed wheel, but now, riding on air, sitting on a comfortable seat, and choosing the gear suitable for your ease out of a range of four or more, it is not only possible, it is a fact. All a fellow need do to enter this kingdom of quiet, contented wandering is never to give up the youthful habit of cycling, to keep it going despite all the temptations to quit, and then to enjoy a reasonable activity to the end of the story.

The Dangerous Age

THE dangerous age of cycling—the giving up of the sport and pastime—is when the keen racing days are over, or the natural human urge to "set up house" as our ancients termed it, turns men's thoughts from outdoor things. That wooing of the ardent cyclist from the saddle is more tempting than was the case in my day, because the money side of the story is not so intrusive and easy payment of most of the things young folk desire hangs like ripe fruit to be plucked by all and sundry.

This column, I admit, is not a code of morals, but it is just as well to face the facts. Goodness knows what I should do if I could return to those emotional days, but I think that, because I married a cyclist and we rode tandem until 1917, the attitude to life would remain much the same. After the first world war, I bought a car for the use of my wife, and she never sought to persuade me to give up cycling because she had to. The result was a happy holiday roaming existence with very many week-ends to break up the working months, for when conditions were unkind or the distances too great I could always pack the bicycle on the car and drift home. I can recommend this way of extending the reader's share of the pastime and at the same time giving the lady of his choice a feeling that she is still part of it, including that delightful sense that she is also a help and an aid to the enjoyment. In the latter years of our partnership, we took two bicycles on the car, suspended on rubber-covered steel arms at the rear, so that I could enjoy friendly companionship awheel, and she a special friend for the enjoyment of those times when we two lads tripped off for three or four days and rejoined our lady friends later. It worked remarkably well, for one could phone a hundred miles away for the car party to join us at a certain spot.

You Never Can Tell

NATURALLY when I was six and twenty I never thought it would turn out like that, but you never can tell how and where the luck of life will lead you, and I am glad that it played me so kindly a game. It may not, and probably will not, come to the reader in a similar way and possibly, in any case, being young, he will not worry about the future. Never give up cycling so long as it can be practised with comfort. When one takes on the responsibilities of life there are dozens of ways of keeping up cycling without being selfish; indeed, the most selfish men I know—from the point of view of domestic life—are not cyclists but club men with their golf, billiards and cards.

The cyclist on the hearth has a lot more to talk about, his conversation is charged with more potent things by reason of their country flavour, especially if his wife has known—and still knows—the active freedom of the pastime, than the average individual with an evening paper and a television set. Yes, there is more pleasure in cycling than the mere act, more happy recollection in tranquillity of the scenes and incidents of the road, the day and the place than comes to the sensibility of the majority of people. There is a kindly and intimate nostalgia about almost every wheeling journey and the sharing of these experiences years later makes the pastime so very delightful.

Never give up cycling for the best is always to come, and the day after some to-morrow will prove my words. The cycling call is to the young, but it is the youthful touch it bequeaths to the elderly that makes it so rich an activity to possess.

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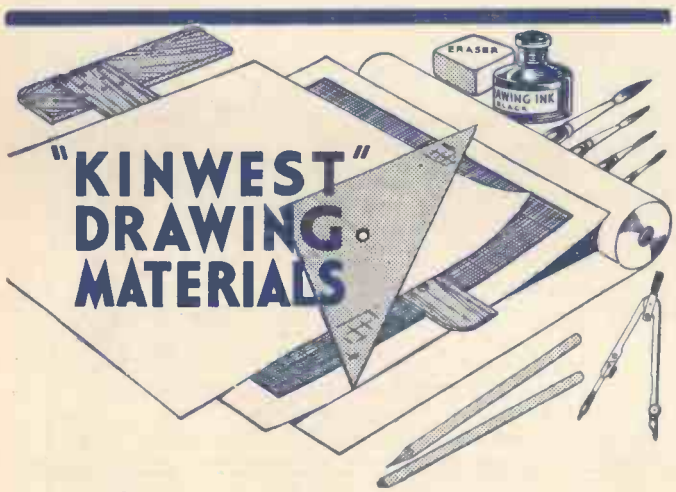

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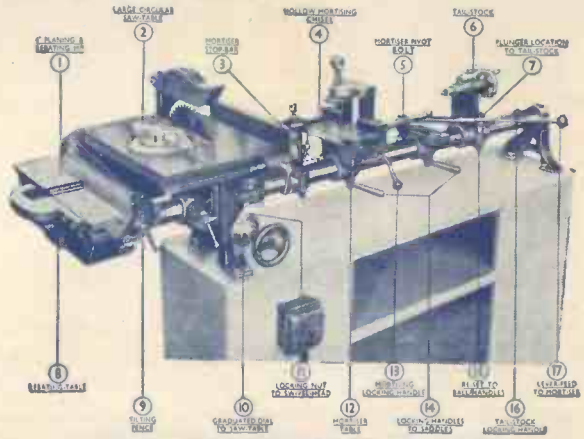

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