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EDITOR : F. J. CAMM

FEBRUARY 1955

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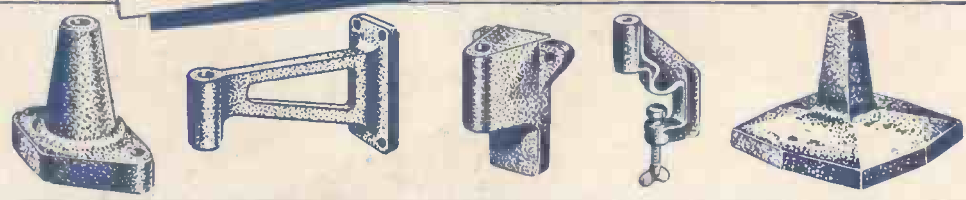

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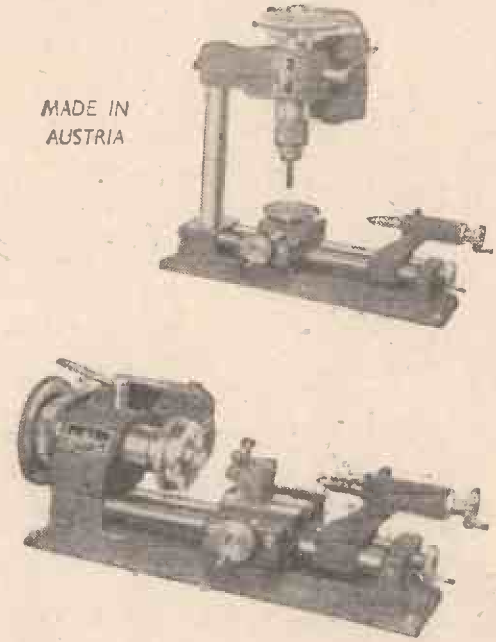

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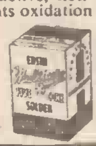

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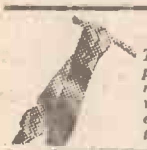

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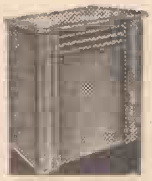

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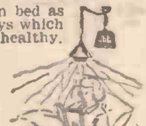

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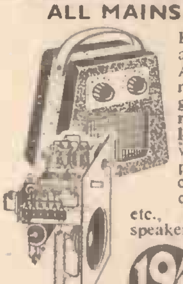

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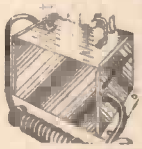

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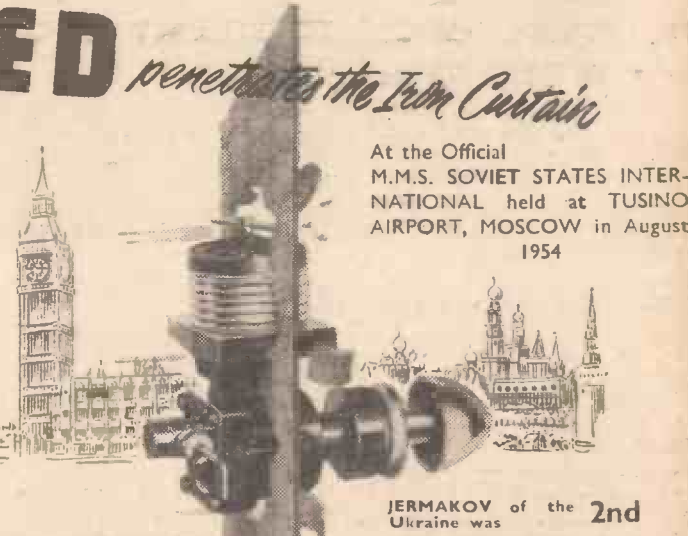

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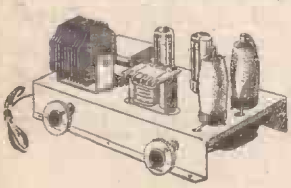

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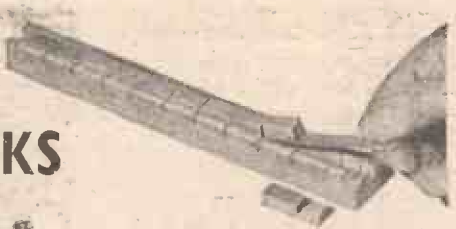

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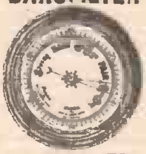

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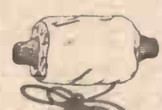

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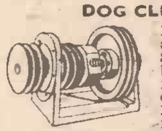

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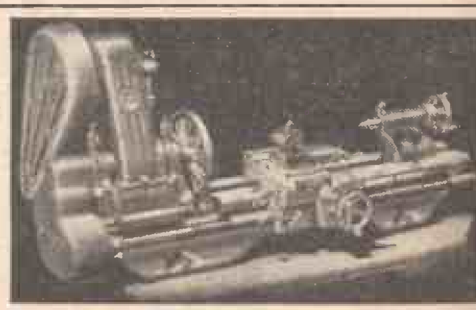

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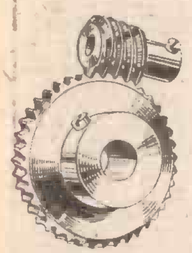

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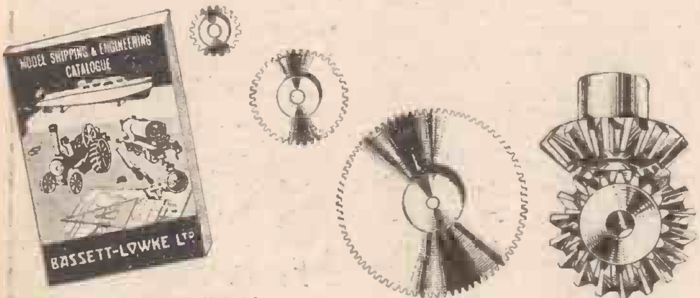

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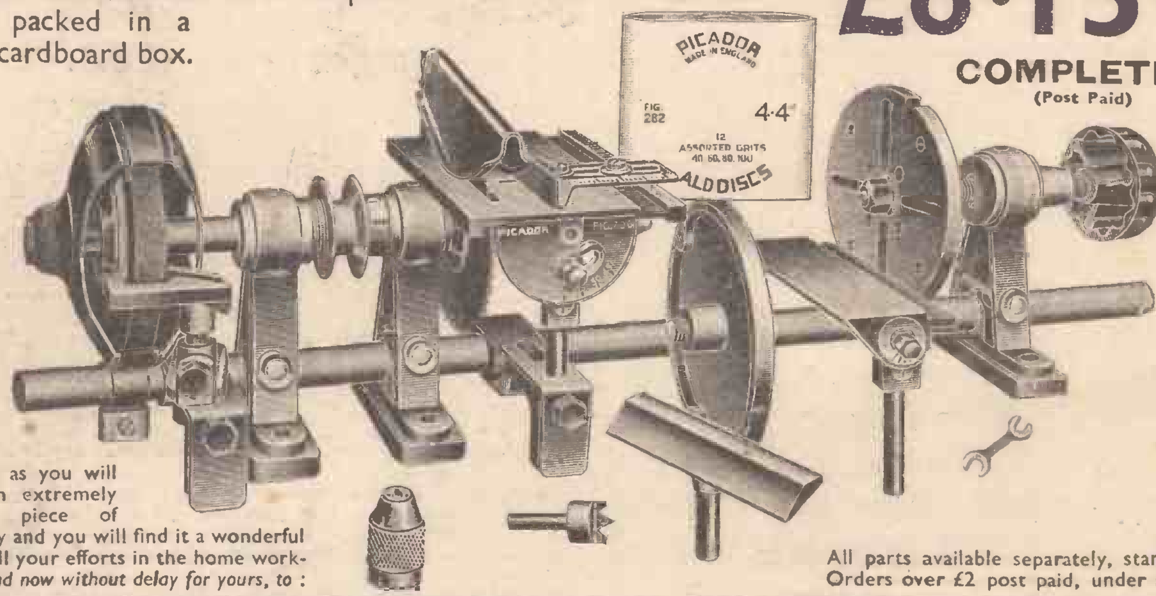

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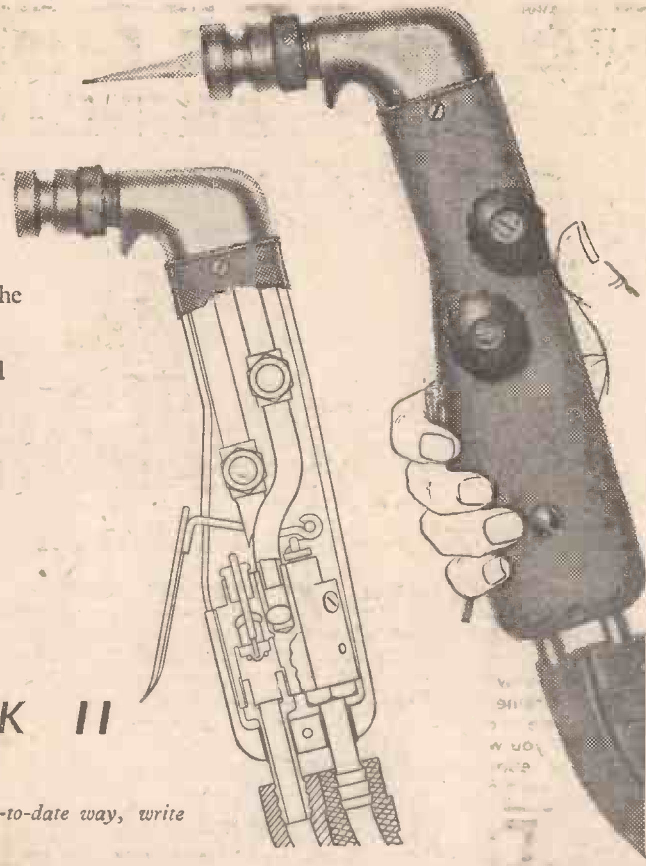

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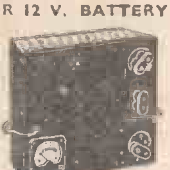

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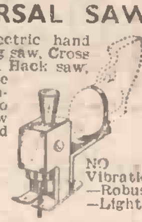

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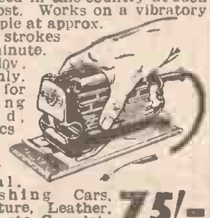

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VOL. XXII. No. 254 Editor: F. J. CAMM FEBRUARY, 1955

FAIR COMMENT

By

The Editor

The Value of an Idea

BY the very nature of its editorial policy, this journal has attracted into its ranks many thousands of those of an inventive turn of mind. I am not referring here to the crank, but to the really practical man who has evolved something which he feels worthwhile, for which he expects to find a responsive market and from which he hopes to draw an adequate reward. The way of the inventor, however, is hard. During the course of the year I received some hundreds of letters from those who have evolved some device, asking for advice as to how they should vend it. This has encouraged me to offer some words of advice to all those who feel that as inventors they are frustrated, and having hawked their notion around, with negative results, feel that the hand of the world is against them.

In the first place, merely to evolve an idea and expect manufacturers to jump at it is one of the first mistakes made by the enthusiast. Without taking the trouble to ascertain whether his idea has been thought of before, whether it has been patented, whether existing devices are already on the market, or whether it infringes existing patents, he endeavours to interest likely manufacturers in his brain-child. In almost every case he is asked whether he has taken out a patent, or registered his idea as a design. In many cases he has to admit that he has not and is not in a financial position to do so.

Now let us take the position of a manufacturer. Like all people in business, he exists to make money, and if he is a limited company he wishes to make it for his shareholders. It is unlikely that he will turn down any idea which shows promise of appealing to public demand. In the course of the year some hundreds of ideas are submitted to him, but in only a minority of cases is he presented with a *fait accompli*, in the form of a patent specification.

To a manufacturer the only evidence of proprietorship in an idea is the possession of a patent. It is a waste of time to approach a manufacturer with the provisional specification. The Patent Office will grant this to anybody. It does not validate the idea, nor does it indeed mean that a patent will be granted. It merely dates the application. An inventor is expected within a period of nine months to present a complete specification for his invention. A search for novelty or originality does not take place until the complete specification has been filed. Manufacturers are not going to take the risk of marketing a device unless they are reasonably satisfied that they will not be subject to an action for infringement. In certain industries manufacturers have to export under licence from the Board of Trade as much as 60 per cent. of their total output. This means that the product must be patented in a large number of foreign countries, otherwise manufacturers in those countries would be free to copy the device without having to purchase from this country. The average inventor is an impecunious individual and unable to afford the very high fees required to keep a patent "live" in this and overseas countries. He is, therefore, dependent upon making some arrangement with the manufacturer which will relieve him of his financial burden. In other words, the manufacturer must take the whole risk of developing the invention, modifying it to suit production methods, protecting it throughout the world, sending travellers abroad to find markets, and advertising it. This is a costly business, and it may involve the manufacturer concerned in loss, for not all inventions turn out to be in such popular demand as was anticipated. The manufacturer bears the loss in these cases, and the inventor merely suffers the disappointment of not reaping the expected reward.

The usual royalty payable to an inventor is 10 per cent. of the selling price. This is important; some manufacturers endeavour to fix the royalty on the manufacturing cost, and this is unfair to the inventor, because after a certain sales figure, manufacturing costs go down, whilst the retail price does not. Indeed, it may be increased. It is usual also for the manufacturer to pay a sum down on account of royalty and for the inventor to insist upon a minimum royalty clause in his agreement. That is to say, the manufacturer must agree to pay so much per year to the inventor, whether the idea is vended or not. Otherwise an unscrupulous manufacturer, realising that the idea might jeopardise his existing interests and destroy the sales of products in which he is already interested, would make arrangements with any inventor whose ideas might clash with his existing products. He would be taking no risk, whereas the minimum royalty clause would force him to go into production or to penalise himself.

I cannot too strongly advise inventors against going into business on their own account in order to vend their ideas. The costs of creating a company and a selling organisation to vend one product always exceeds the expected revenue. The inventor in such case has all his eggs in one basket. Overnight, someone may produce an improvement on his invention. Banks do not readily back speculative ventures of this sort to-day.

My advice, therefore, to inventors who wish to make money is this. First, patent your idea, then you have something to vend. Secondly, endeavour to get a manufacturer to purchase exclusive manufacturing rights, with a minimum royalty clause, and a lump sum down to cover preliminary expenses. Thirdly, remember that you can only make money out of your *invention*, and not out of the *manufacturer*. Avoid endeavouring to market the invention yourself.—F.J.C.

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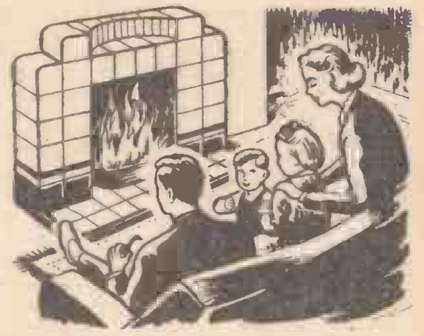
Making a TILED Fireplace



Materials, Design and Construction

By S. A. MONEY

THE construction of a modern tiled fireplace is by no means as difficult as one might imagine, and in fact should be well within the capabilities of the average amateur craftsman.

With care the results obtained may well be as good as, if not better than, those of the professional worker, since he has to complete the work quickly in order to show a reasonable profit. In this article the technique of fireplace construction as used by the high class professional firms will be explained.

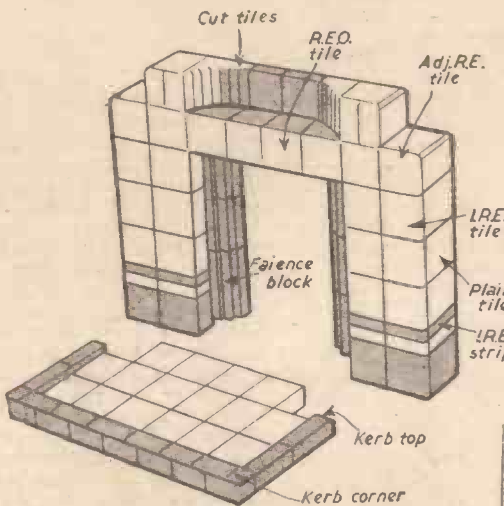


Fig. 1.—A typical surround

The Tiles

Of the materials used for construction perhaps the most important are the tiles themselves, since they make up that part of the fireplace which is normally visible. Some knowledge of the various shapes, sizes and colours of tile and how they are used is essential when the fireplace is being designed.

The tiles used for fireplaces are made in much the same way as glazed wall tiles with the exception that the glazing is more resistant to the effects of heat. On the back of the tile is a design of raised bars and circular depressions called the key. A section through the various recesses is shown in Fig. 2a. The function of the key is to provide a surface by means of which the concrete backing is able to grip the tile. The wet concrete will fill the key and when it sets the resultant wedge of concrete inside the key will be firmly locked into the body of the tile.

The tiles can be obtained in a wide variety of colours. Usually they are not plain but have a mottled or tortoiseshell finish, and may be broadly classed as light or dark tiles. The lightest tiles are in varying shades of cream, mottled with brown or green. Next come the brown mottled tiles and tortoiseshell types, and darkest of all are the dark brown tortoiseshell colours. Green and blue-green mottled tiles are also made and are used to contrast with cream tiles. Fireplaces are usually made in light colours and the darker tiles are used to provide contrast effects.

The simplest type of tile is the plain square edge type. These plain tiles are not, however, used as much as might at first be thought. Since the edge of a plain tile is not properly glazed, it cannot be used in any position where the edge would be visible. This limits their use to the sides and top of the surround and the hearth. In fact there are usually as many plain tiles in the hearth as there are in the rest of the fireplace.

Round Edge Tiles

In order to give a smoother finish to the job, all of the edges of the fireplace are rounded off. Because of this a large proportion of the tiles used have rounded edges. The simplest and most frequently used of these has one of its edges rounded off and glazed and is called appropriately a "one-round-edge tile." Such tiles are used for the edges of the front face of the surround and for the ends of the mantelshelf as shown in Fig. 1.

For the outer corners of the surround, a tile which has two edges rounded will be required. Such a tile has the round edges on adjacent sides and is called an "adjacent-round-edge tile." Usually there are not more than about four of these tiles used on the fireplace. In the design shown in Fig. 1 the three-round-edge tiles used at the top of the surround were made up from halves of two adjacent-round-edge tiles.

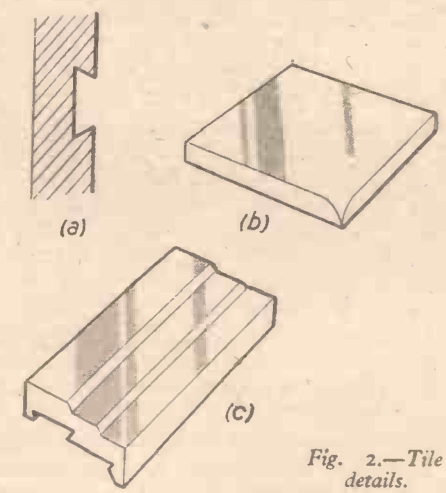


Fig. 2.—Tile details.

Another type of tile having two rounded edges has them on opposite sides of the tile. This one is known as an "opposite-round-edge," often abbreviated to R.E.O. tile. Such a tile might be used above the fire arch as shown in Fig. 1, and is also used for the raised kerb around the hearth.

Mitre tiles, which have one corner mitred, as shown in Fig. 2b, are used at the inside angles of the fire. These tiles are usually more difficult to obtain than the other types but, when used, they do give that extra finish which distinguishes the work of a craftsman.

Both plain and round edge tiles are made in two sizes. The smaller are 4in. square and are generally used for the small bedroom fireplaces, whilst the larger 6in. square tiles are used for the larger living-room fireplaces.

Other Tiles

Besides the plain and round-edge tiles there are several other types. Of these perhaps the most used is the Faience block. This is the special stepped block which is often used to make up the sides of the fire arch. These blocks are 8in. × 4in. × 2in. in size, with the steps running lengthwise along the tile, as shown in Fig. 2. Faience blocks are obtainable in both light and dark colours.

Another type of block which is occasionally used is the circular arch block. This is a curved version of the Faience block and is used to make up the semi-circular arch which is a feature of some designs. These blocks will be difficult to obtain; they are usually sold as a set to make up a semi-circular arch.

In many designs, strips of tile 1in. wide are used. Besides providing a pattern, these tiles are often necessary to make up the fireplace to a particular width or height. Half tiles are also used in this way. All strip and half tiles are obtained by cutting down from whole tiles. By cutting down from round-edge tiles it is possible to obtain strips with rounded ends or sides.

When the fireplace has a curved front or shelf, some of the tiles used will have to be cut to match the curve. This is also necessary when an iron arch is used or when a semi-circular arch is incorporated into the design. Sometimes small pieces of tile are used to make up a mosaic design. Such work calls for considerable skill and patience on the part of the constructor and amateurs are advised to avoid such designs at first.

Surround Design

Perhaps the most important consideration in the design will be the size of the completed fireplace. The height usually lies between 36in. and 40in.; anything lower or higher than this becomes inconvenient or ungainly. The amount which the surround stands out from the wall is more or less fixed by the size of tile used and will be either 4in. or 6in.

The greatest variations in size occur in the width of the fireplace. A fireplace intended for a bedroom is fairly small and of quite simple design. Its width may vary from 30in. up to 36in., and the tiles used are almost always 4in. square. The living-room and lounge fireplaces are larger and more impressive

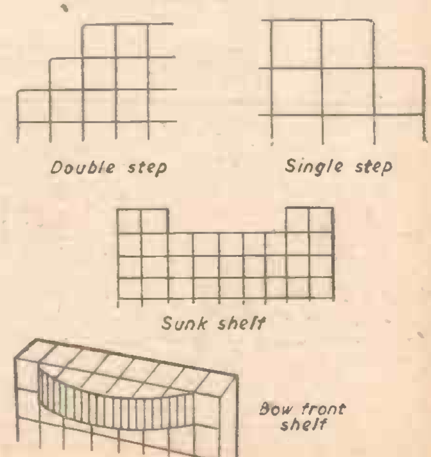


Fig. 3.—The mantel shelf.

affairs, since they are the ones which will normally be seen by any visitors to the house. Widths range up to 48in. and sometimes even larger; the tiles used are often 6in. square.

The size of the actual grate itself will also influence the design to some extent. For bedroom type fireplaces, a 14in. fire grate and brick back are normally used. The use of this size of grate, however, means that there will be a 2in. space between the tiles above the fire arch, which has to be filled up. This is where the 1in. strip tiles mentioned earlier come into the picture. An alternative to using two strips would be a half tile at the centre of the arch.

On the larger fireplaces, where a 16in. fire brick is used, there is no longer any need for such padding. When 6in. tiles are used the Faience blocks at the sides of the fire arch will make the width over the arch equal to four tiles.

One part of the fireplace which permits of a wide variety of design is the mantelshelf. One rarely sees a fireplace with a plain shelf. Most designs have a step at each end of the shelf as shown in Fig. 3. The simplest step takes up the space of one tile. Steps can be made which are half a tile wide or half a tile high, or both. Again, the step need not be the full width of the shelf so that the range of possibilities becomes quite large. Some of these possibilities are shown in Fig. 3. When 4in. tiles are being used, a double step can be made.

Instead of putting the step at the ends of the shelf, it can be in the middle, thus giving a low shelf between two end pillars. A variation of this is shown in the design in Fig. 1. Here there is a step at each end and between them is a recessed shelf. Yet another arrangement is the bow-front shelf which is shown in Fig. 3.

The Hearth

Another part of the fireplace which calls for some attention is the hearth. With the old style fireplace this usually consisted of tiles laid directly on the floor. With modern designs the hearth is raised and is made up as a unit in the same way as the surround. A raised kerb is made around the hearth proper and at the back is a tongue which fits under the surround.

The kerb is made up from R.E.O. tiles known as kerb tops, which are usually supplied as a set complete with corner tiles. For use with 6in. tiles, the kerb tops are 6in. × 3in. and the corners 3in. square. In the case of 4in. tiles it is possible to use ordinary R.E.O. and Adj.R.E. tiles, although the special kerb sets are available.

The Concrete Backing

The tiles alone are not enough to make a tiled fireplace; some substance such as

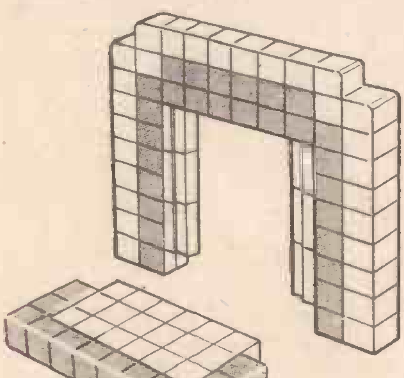


Fig. 4.—A simple surround.

concrete is needed to bond them together and to provide a solid backing for the tiled front. Some people have the impression that a tiled fireplace is made by fixing the tiles to a slab of concrete with tile cement. With the older type of fireplace this might have been done, since the building of them was more in the nature of a wall-tiling job. The modern tiled surround is made by laying out the tiles in the form of a mould and then filling in with concrete.

The concrete is made up from a mixture of cement and washed grit. For use on fireplaces the grit must be clean, since any dirt which is allowed to enter the concrete will sink to the bottom of the wet mixture and form a barrier layer between the concrete and the tiles. This means that the tiles will be held by the layer of dirt only, which when it dries will crack and allow the tiles to fall away. The concrete should be mixed on a clean floor or board.

The other is, of course, cement, and there is no reason why ordinary Portland type cement should not be used; the only disadvantage being that it takes a long time to harden. Concrete made with this type of cement may take anything up to seven or eight days. In order to save having to wait for long periods before the fireplace can be moved, it is a definite advantage to use one of the rapid-hardening aluminous cements such as Ciment Fondu.

These aluminous cements are black in colour and normally take about 24 hours to harden as distinct from the time taken to set, which is usually about two hours, the same as for ordinary Portland cement. The water used to mix the cement should be fit for drinking, since if it contains any dirt or organic matter

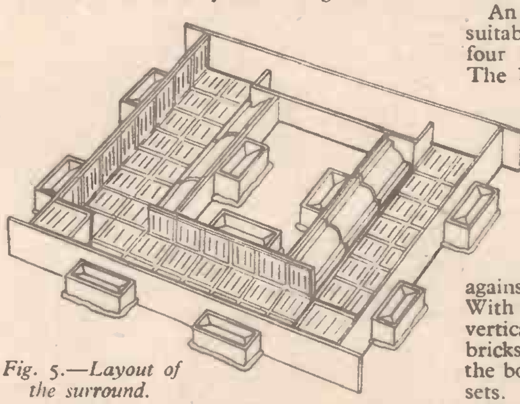


Fig. 5.—Layout of the surround.

the action of the cement may be upset. Certain types of sand and grit are also unsuitable for use with aluminous cements. The supplier of the materials should be able to advise on this point.

Although the concrete backing of the fireplace is quite strong, it is usually reinforced by means of iron rods. This is usually carried out with $\frac{3}{8}$in. diameter reinforcing iron such as that used for normal concrete work. About 12ft. of this rod will be needed for an average fireplace. All of the materials required should be readily obtainable from the local builder's merchant.

Having collected together the various materials required and worked out a suitable design for the fireplace, construction may be started. The construction of the simple design shown in Fig. 4 will be described, followed by methods of making up the more difficult designs.

The Front Face

The surround is constructed first, the hearth being made up as a separate unit. It will be necessary to clear a space, somewhat larger than the surround, on which the work can be carried out. It is more convenient to work on a bench, if possible, but, since most home workshop benches would not be large enough, it will probably be necessary to work on the floor. It is important that the surface should be smooth, flat and level, these factors being checked with a straight edge and spirit level.

Once the working space has been prepared, the tiles making up the front face of the surround may be laid out according to the design. It is an advantage to lay these out with the glazed surface upwards, at first, so that the design can be seen. This will enable any errors to be corrected and the tiles arranged to give the best effect. When the layout is considered satisfactory, the tiles can be laid out in their correct positions with their glazed surfaces downwards.

A mixture of Mountfield plaster and water should now be made up and coated over the joints between the tiles. The purpose of this plaster coating is not only to hold the tiles in position, but also to prevent the concrete from forcing its way through the spaces between the tiles and thus fixing the surround to the bench. This could be rather inconvenient when the time comes for the surround to be moved.

The Frame

In order to hold the tiles at the side of the surround in position, a frame of some sort will be needed. The frame used by the professional often consists of a pair of concrete lintel blocks at the sides, and a pair of slate boards at the top and bottom of the surround. This arrangement makes for great flexibility and long service, since neither the slate nor the concrete will warp. The boards are usually clamped to the bench with "G" clamps whilst the concrete blocks are sufficiently heavy to be self-supporting.

An alternative type of frame, which is more suitable for use by the amateur, consists of four wooden boards supported by bricks. The boards should be about $\frac{1}{2}$in. thick and free from warping or any other irregularity. The width may be either 4in. or 6in., depending upon the size of the tile being used.

One of the boards for the sides of the surround is cut to length and placed on edge, just touching the tiles at one side of the front face layout. Two bricks are then placed against the outside of the board to support it. With the aid of a square, the board is set up vertically and then both the board and the bricks are fixed to the bench with plaster, the board being held vertical until the plaster sets.

Having set up one of the sides of the frame, the other three are set up in a similar manner, care being taken to see that the corners are square.

When the frame is completed the tiles for the sides and top of the surround can be placed in position. These tiles stand on edge against the sides of the frame and it will be found that they tend to fall over unless fixed in some manner. The best method of doing this is to smear the glazed surface of the tile with lubricating grease so that when placed in position the tile sticks to the wooden frame. The grease will not damage the glaze and can easily be removed when the surround is completed.

The Mantel Steps

The tile which lies directly under the step at each side of the surround should have a $\frac{3}{8}$in. strip cut from its top edge so that the tile for the top of the step overlaps it. The tile making up the side of the step itself can also be cut down in the same way. The method of cutting tiles will be given later.

The two tiles making up the step will need some support, since they are spaced away from the frame. The space left at the corner of the frame will need to be filled. This can easily be done by placing about a dozen tiles on edge in the space and if necessary packing out with cardboard to the correct size. The tiles used for this can be ones for making the hearth.

When all of the tiles have been fixed in position the cracks between them should be covered with plaster in the same way as for the front face tiles. The tiles used for filling the step spaces can be fixed with a dab of plaster over their upper edges.

The Fire Arch

Last in the setting up process comes the fire arch. This requires a more complicated arrangement of small frames to support it. These frames can be made up from 2in. x ½in. wooden battens supported by bricks.

First, the six Faience blocks should be placed in position. A piece of batten should be cut to fit across the top of the arch between the blocks and two more pieces are then cut to support the sides of the arch ; these should just reach to the bottom of the blocks. These three boards can now be fixed in position with bricks and plaster.

Another frame is needed under the arch to make the slot into which the hearth will fit when the surround is completed. To make up this frame a piece of batten extending to the outer edges of the Faience blocks is placed across the bottom of the arch. A block of wood at each end of this board wedges it against the lower edge of the arch block and provides an end to the frame. When set up, this frame should be fixed with plaster.

A row of half tiles should now be placed along the top of the arch. These tiles will be fixed in place with grease and plaster, as were the tiles at the sides of the surround. The inner edges of the arch blocks should be vertical when the boards are in position and the joints between the blocks may then be plastered.

The state of the surround at this stage is shown in Fig. 5. This diagram also shows in detail the layout of the various frames supporting the fire arch, the packing of the corners and support of the tiles making up the steps.

Reinforcing

It is usual to reinforce the concrete backing with iron rods. General reinforcing is carried out with a large U-shaped piece of rod which surrounds the arch about half way between it and the edge of the surround. The rod used for this is ⅜in. or ½in. diameter and may be bent in a vice.

In addition to the U-shaped rod, several shorter pieces are used to strengthen particular parts of the surround. One length is laid along the inside of the blocks on each side of the arch. A rod or two may also be used to strengthen the shelf. These short rods are laid directly on the back of the tiles or blocks.

Fixing Lugs

A fixing lug is usually fitted about two thirds of the way up, on each side of the surround. These are used to support the surround whilst the cement, which will finally hold it in position, hardens.

A simple type consists of a length of 1in. x ⅛in. steel bar bent into an L shape with a hole drilled in one arm of the L. The undrilled arm is then cemented into the back of the surround so that there is about an inch of the other arm, with the hole in it, projecting beyond the side of the surround.

These fixed lugs have the disadvantage that they may be in such a position that the fixing nail would have to be driven into a brick. To overcome this a moveable lug is often fitted. This lug slides along a U-shaped rod which has its ends buried in the surround. The lug can now be moved to a position such that the fixing nail goes into the wall between the bricks. Both types of lug are shown in Fig. 6.

Concreting

The surround is now ready to receive the concrete. Three parts of grit and one of Ciment Fondu should be mixed dry, until the mixture is of even colour throughout, and then water should be mixed in. The amount of water used should be about five gallons for each hundredweight of cement used. When all of the water has been mixed in, the concrete should be turned over again before being used. Mixing should be carried out on a clean board or floor to prevent any dirt from entering the mix.

The filling-in is carried out in two stages since there will be two thicknesses of concrete in the surround. Firstly with all reinforcing in position except the U-shaped rod, the surround should be filled until the concrete reaches the level of the arch blocks. This is then allowed to set.

A U-shaped wooden frame is now made up which is 4in. larger, all round, than the arch. This is laid on top of the concrete in the surround so that it is evenly spaced around the fire arch. The U-shaped reinforcing rod is placed in position. Then the outer rim of the surround is filled up to the level of the outside tiles and whilst the cement is still wet the two fixing lugs are pressed into it.

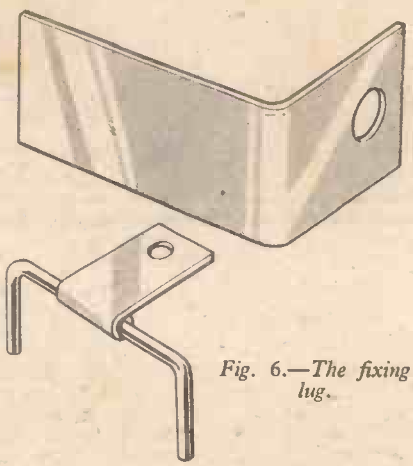


Fig. 6.—The fixing lug.

When the concrete is being mixed, only enough for the part of the job which is being done should be made up otherwise any that is left over will set before it can be used.

After about 24 hours, when the concrete has hardened, the surround may be removed. It is advisable to have at least two people to do this since the surround will not only be heavy but also rather cumbersome.

Tile Cutting

In the simple surround just described only about six of the tiles have to be cut, whereas in the more elaborate designs the number may be anything up to fifty.

Making straight cuts across a tile is simple. First, a straight line is scribed across the glazed surface with a glass cutter and the tile is then held glazed side uppermost and cracked over the edge of the bench or some similar sharp edge. Only a light tap should be needed for this. It is advisable to keep the scribed line parallel to, and roughly over the sharp edge, so that the tile breaks easily, since any undue force may shatter the tile.

When small pieces are being cut there is no reason why four or five should not be cut from a single tile. The cutting will, however, become a little more difficult as the piece of tile remaining becomes smaller, since the smaller the piece the more awkward it is to handle. When round edge tiles are to be cut the scribed line should be continued over the rounded edge where necessary.

Curved lines are much more difficult to cut. The line is marked with a pencil and then the waste part of the tile is removed by biting it away, a little at a time, with a pair of pincers. This process should not be rushed since it is so easy to cut away too much and have to start again with a new tile. There may be some advantage in scribing the curved line with a glass cutter so that the tile will then tend to crack along the line as the last of the waste is being cut away. In some cases a part of the waste can be removed by making a straight cut. The rough edge left after the removal of the waste can be smoothed with emery cloth.

The Use of Formers

In many fireplace designs parts of the surround are set back from the front face so that it becomes necessary to use wooden formers to support the recessed tiles.

A typical case of this is the recessed fire arch, shown in Fig. 7a. Here the arch blocks are set back about an inch from the front face. The former in this case will consist of a wooden slab or a shallow box placed under the arch blocks. The former can either extend right across the fire arch or may be in two parts, one under each set of blocks.

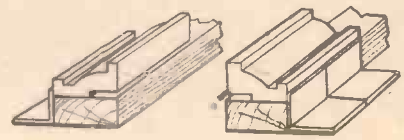
Where the centre of mantel has a curved recess, a curved former will be needed to support the tiles as shown in Fig. 7b. For the bow front surround a much more elaborate former is needed since practically the whole of the surround is raised above the bench. A projecting shelf will also need a complicated former and in general the amateur would be well advised to steer clear of such designs as these.

The Hearth

When the surround has been completed a start can be made on the construction of the hearth. This is much simpler than the making of the surround. Firstly any tiles which were used for packing the steps on the surround should be cleaned off ready for use.

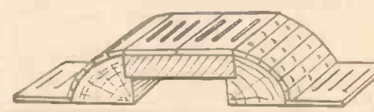
The first step is to make up a former for the well of the hearth which will have to be supported ¾in. above the bench. The former is then laid on the bench and the kerb tiles laid around it. The tiles for the top of the hearth are then laid out on top of the former.

A frame is then set up around the hearth in the same way as that for the surround and the tiles around the sides of the hearth are placed in position. Again all the tiles are coated with plaster to prevent the concrete forcing its way through the joints.



(a)

Fig. 7a.—Arch former.



(b)

Fig. 7b.—Recessed shelf former.

The hearth need not be reinforced but if desired a single U-shaped rod may be laid around the inside of the kerb tiles. The hearth is then filled to the top with concrete and allowed to set.

When the fireplace is fitted together the tongue at the back of the hearth fits into the slot under the fire arch of the surround so that the surround rests partly on the hearth and partly on the floor.

Before fitting the fireplace, an enquiry should be made to see if there are any council regulations governing the fitting of fireplaces.

A MECHANIC'S WORKBENCH

A Solidly Designed Unit for the Home Workshop

By C. W. TAYLOR, M.I.E.T.

MANY home mechanics and craftsmen are sooner or later confronted with the task of making a bench on which to do their work. In equipping a new workshop the task is an immediate one. The most important dimensions are the width, which must be chosen with regard to the width of the workshop door, so that the bench can be taken outside, if necessary, without any trouble, and the height.

An engineer's bench is often subjected to heavy shock loads, and the structure should be carefully designed so that its joints will not be shaken loose and the bench will remain permanently rigid.

The bench described here is of timber throughout, and was designed to fulfil the above requirements. The size chosen is 5ft. long, 2ft. 6 in. wide, and 3ft. high. This is considered to be a most useful size for the average home workshop, but of course these sizes can be changed to meet individual needs.

The two large drawers which are fitted for tools, etc., can be made and fitted at any convenient time. Some of the more complicated joints, especially those used for constructing the drawers, are well worth the extra work which they entail.

It will be noticed that the frames made up from each pair of legs and the top and bottom bearers are braced in one direction against compressive loads transmitted from the vice or from the front of the bench. The front and back planks are called upon to resist considerable side loads, so these planks are not weakened by cutting apertures to admit drawers. Instead, the drawers are supported on runners screwed to the legs.

The bench is fitted with a removable back board to stop tools rolling or falling from the bench, and a toolrack can be screwed to the back board if desired.

Selecting the Timber

It is not necessary to use hardwood for constructing the bench, yellow deal or pine can be used throughout, but probably a better plan would be to have hardwood, such as beech or oak, for the top planks and drawer runners, and all the remaining parts of the bench in soft wood, say, yellow deal.

If heavy work is anticipated the top should not be less than 2in. thick and these planks should be 8in. to 10in. wide.

The legs should be sawn and planed to about $3\frac{1}{2}$in. square, and the front and back planks should be planed up to finish 9in. × $1\frac{1}{2}$in. The top bearers are also finished 9in. × $1\frac{1}{2}$ in., and the bottom bearers are planed 3 in. × 2 in. The braes are 2 in. × 2in. and the bottom rail planed 3in. × 2 in. The back board and the drawers are made from $\frac{3}{4}$in. and 1in. thick boards.

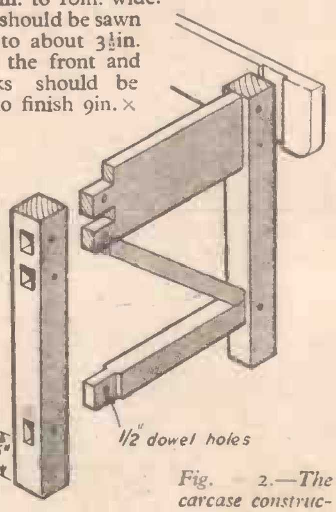


Fig. 2.—The carcase construction.

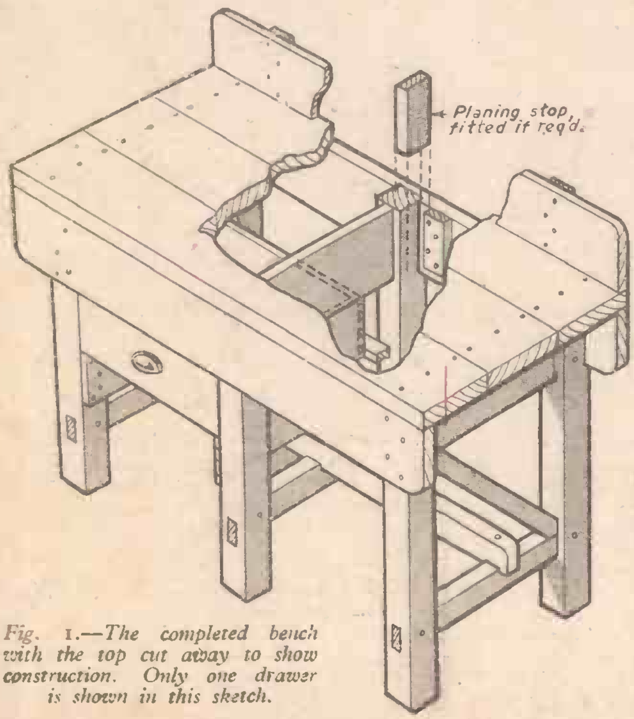


Fig. 1.—The completed bench with the top cut away to show construction. Only one drawer is shown in this sketch.

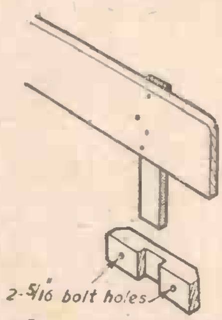


Fig. 3 (Above).—The back board and the method of fixing.

Fig. 4 (Right).—Drawer construction.

Constructing the Bench

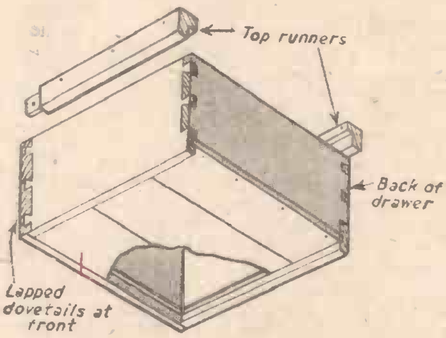
The three pairs of legs are prepared by planing and cutting to length. The best surfaces should be selected as the outside surfaces and should be given the face side and face edge marks. The six legs are then laid side by side and the mortise lines are marked across all six. A mortise gauge set to the correct chisel will then complete these lines and the mortises can then be cut.

The three top bearers and the three bottom bearers are similarly prepared, laid side by side, and the lines for the tenons are marked. The tenons are then sawn and in the usual way are made a good push fit in the mortises. Each frame should next be temporarily assembled and held square for the purpose of marking out the braces on each end of which a bridle joint is cut. It will be seen that the braces are notched into the legs beneath the top and above the bottom bearers. Great care must be taken with the marking and cutting out of these particular joints, since it is very easy to cut a brace too short, or a notch too large or at the wrong angle.

Having cut the braces and the necessary bridle joints, the mortise and tenons on the legs and bearers must now be drilled for draw dowelling. This consists of drilling the legs through the cheeks of the mortises and then marking the tenons by pushing them into the mortises and spotting with the drill. The position for the hole on each tenon is then moved a little closer to the shoulder of the tenon, say, 1/40in., and each dowel hole is then drilled. Later, when the dowel is driven in, the tenon is thus drawn tightly home in the mortise. It now remains for each mortise to be pared away on the outside to receive wedges.

Glueing the Frames

The three sets of legs, bearers, and braces can now be glued up and the joints drawn



tightly home by driving in the dowels and cutting the ends off flush. Glue should also be applied to the set of wedges and these can be driven tightly in the mortises. Ordinary slab glue can, of course, be used, but cold water casein glue such as "Casco" is recommended for this work. The assembly of these frames is shown in Fig. 2. If there is any tendency to winding in any of the frames all three should be clamped together until the glue has set hard. The front and back planks should next be planed up and the positions of the grooves for the legs are then marked. The actual width of the grooves will, of course, be marked direct from the legs and care must be taken to ensure that the grooves, which are ½in. deep, are cut to a tight fit on the legs.

The bottom corners of the planks can now have a radius put on them and they can then be screwed firmly to the legs. Four 3in. woodscrews secure each plank to each leg.

Woodscrews, 5in. long, are used to screw the top planks to the bearers. The planks should be drilled so that the screws are tightened down ½in. below the surface of the planks, and the top of the bench can then be planed flat.

The bottom rail is next planed and cut to length and the three grooves ½in. deep which fit tightly on the bottom bearers can be cut. The rail is secured to each bearer by a long 5/16in. bolt and nut.

The Back Board

This board need not be fitted unless desired. There is no doubt, however, that it stops tools falling from the bench as a result of vibration. The back board is a piece of 8in. × 1in. timber. Two battens are screwed across the board and the ends of the battens fit into two pieces of slotted timber bolted to the back plank. The back board can thus be lifted up and removed whenever necessary. As previously stated, a simple tool rack can be fixed to the back board if desired.

The Drawers

Work can now commence on the drawers which must be strongly constructed to withstand the weight of tools, etc.

The front pieces are cut from 9in. × 1in. board, the sides and back are of ¾in. thick timber, and the bottom is made from ½in. thick boards or thick plywood.

The joints are lapped dovetails, and the front pieces and sides are grooved ½in. wide and ¼in. deep for the bottom.

The dovetails should be marked out as shown in the drawing. The pins are often cut first and the sockets marked from them, some workers, however, prefer the reverse procedure.

Having cut all the dovetails, the bottom edges of the front and sides should be planed level and the grooving plane can be set to cut the grooves in the front pieces and sides. If a plough is not available the grooves must be carefully chiselled out.

After the grooves have been cut the front, sides and back of each drawer can be glued up and cramped. They must of course be tested for squareness.

The bottom boards or plywood are next cut and these pieces are slid into the grooves beneath the backs of the drawers and glued in position. A few oval brads are driven through the rear edge of the bottom into the back as shown in Fig. 4.

The drawers are next generally cleaned up and the top edges planed level.

" Oxidized " handles screwed to the fronts will then complete the construction.

The runners and the sides of the drawers can, with advantage, be made of hardwood to resist wear.

The Drawer Runners

The top runners for each drawer consist of two pieces of rebated hardwood batten screwed to the top bearers.

The bottom runners are pieces of ¾in. thick hardwood board screwed to the legs and resting on the bottom rail.

If the bench is to be situated in a rather damp place, the actual fitting of the drawers should not be too precise, otherwise they will almost certainly stick.

The Planing Stop

Those home craftsmen who do a good deal of woodwork will require a bench stop for planing. A vice will usually be bolted at the front of the bench so perhaps the best place for the stop slot is in the back plank of the top and at the side of the centre bearer. An additional support and guide for the stop can be screwed to the back plank.

When constructing the drawers, the depth, in this case meaning from front to back, should be made so that a drawer stop consisting of a batten, say 2in. × 1in., can be screwed to the bottom runners inside the legs. Part of the drawer stop can just be seen in the view of the complete bench. This drawing (Fig. 1) shows only one drawer fitted for clarity.

In Fig. 3 is shown part of the removable back board and the way in which it is fitted to the bench. The two pieces of slotted timber, into which the battens slide, are bolted to the back plank, with two 5/16in. bolts for each. Fig. 4 shows the drawer construction, part of the bottom being shown cut away to reveal the grooves. The top runners are also shown; these are cut to fit between the legs from front to back, and are screwed to the top bearers.

Making a Haybox

A Method of Conserving the Heat of Food Already Brought to the Required Temperature

By F. GILLSON

Two views of the completed haybox.

HAYBOX cookery is a useful means of conserving the heat of food that has been brought to boil on a fire, or baked in an oven. With the aid of a haybox food can be kept warm for several hours. It is not difficult to make. A large wooden box is required, such as may be obtained from a grocer. A strong sugar box is admirable for the purpose. You will also need about half a truss of hay, from an obliging farmer.

First, line the inside of the box with old newspapers, in order to make it airtight. Particular care must be taken to see that the box is lined stoutly with the paper, as a thin layer is useless. For the final inner layer, a piece of brown paper makes a pleasing finish. Place a thick layer of hay at the bottom of the box, and put a piece of hessian sacking on top of this layer. Now stand two saucepans in the box. If the handles are cut off with a hacksaw, it will be easier for packing purposes.

Put some hay in a piece of sacking, and carefully wrap this cushion around each of the two saucepans, leaving the lids exposed. The saucepans should be placed a few inches apart, and a slight turn should be sufficient to enable each saucepan to be lifted out of the box and to be replaced. More hay must be pushed in around the saucepans until the inside of the box is firmly stuffed (see sketch).

A cushion (A) is next to be made, to cover the top of the box immediately above the saucepans. Again use hessian, and stuff it thickly with hay (see sketch). All that now remains to be done is to add a strong lid. Attach it to the box with hinges, and fix a hasp and staple in front. The lid must press down firmly on the hessian cushion, so as to exclude the air.

To use the haybox, open the lid, and take out the top cushion. Then gently remove the saucepans. Put in the saucepans the food that has been brought to the boil, and immediately replace the saucepans in the spaces from which they have been taken. Cover quickly with the cushion, and press down the lid, securing it firmly by means of the hasp and staple.

Any vegetables, or stews, that have been brought to the boil and placed quickly in the haybox, will cook without further attention. There will be no need to fear the food will be burnt or overdone. Moreover, the haybox serves a double purpose. Not only does it keep things hot—it can also be used as a refrigerator! In the same way in which it conserves heat, it also keeps cold food cool by excluding the air.

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A COMPACT FLASHGUN

Constructional Details of a Flash Unit With Collapsible Reflector

By J. H. LOWE

Fig. 1.—The complete unit in its collapsed position.

A FLASHGUN, to be truly portable, must obviously incorporate a folding or collapsible reflector. In this design it is attained by the construction of leaves or sectors of 22-gauge aluminium alloy, pivoted at a common point on the body, which is constructed of similar metal. The body is, in fact, integral with the reflector when this is open.

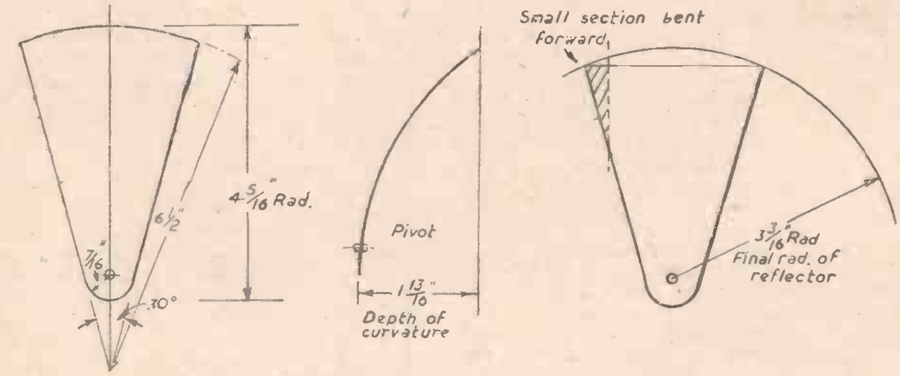


Fig. 2.—The development of the reflector segments.

Portability is maintained in the construction of the body in that the profile of this follows the curvature of the reflector—and, when this is closed, the body lies within the curvature of the reflector, see Fig. 1.

The flashgun has been designed to take small bulbs only, but an extension socket is incorporated to enable the operator to employ a further light if required.

This design is purely a basis for further development, and any measurements given should be taken as a guide only. For instance, the depth of curvature of the reflector will have a bearing on both the final diameter of this, and on the profile of the body, for any given set of measurements for the construction of the sectors. The body could be greatly improved if the constructor has facilities for riveting, etc. Some improvements are suggested in the accompanying diagram but readers will doubtless have many other ideas!

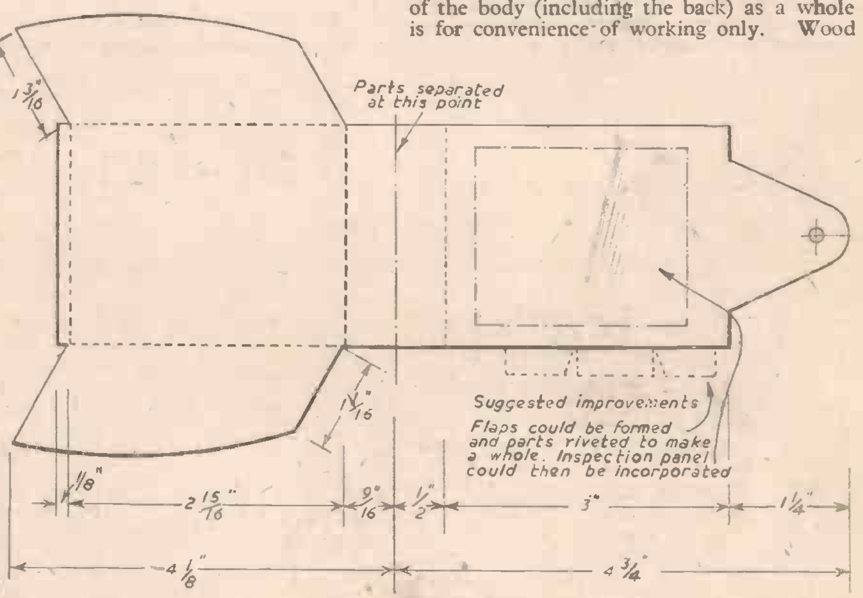


Fig. 3.—The development of the body.

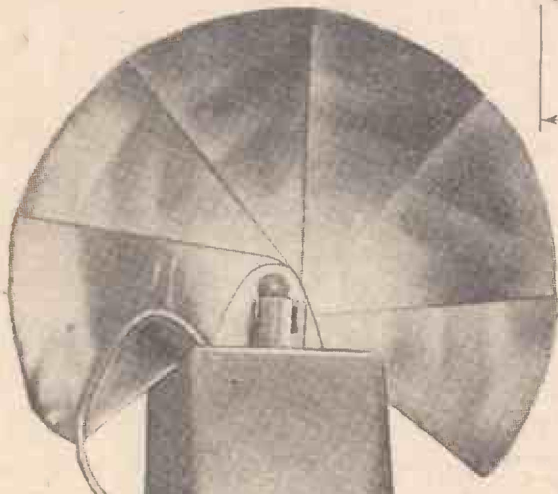


Fig. 7.—The completed reflector.

The Reflector

This consists of six sectors based on dimensions given in Fig. 2. All sectors should be cut and drilled and then pinned together temporarily whilst the curvature is formed. This is a simple operation since the metal used is very easy to work. The sectors are placed on the bench and one hand is pressed firmly down on the wide end. The opposite, or pivot point end is now pulled steadily upward. From time to time it will be necessary to alter the point of pressure on the sectors to obviate any tendency to form creases. The sectors will, of course, also slide along the one below as the curvature is formed. With the aid of pliers or vice, a small section at the top edge of each sector is now bent forward. This will cause extra pressure between the sectors at this point and so hold them firmly in position. It also forms a stop, so that the reflector may be quickly and easily brought into use. It is shown complete in Fig. 7.

Of the body, little need be said, since Figs. 3 and 4 are self-explanatory. The delineation of the body (including the back) as a whole is for convenience of working only. Wood formers are placed at the top and bottom of the body, the top being drilled to take the bulb (standard car type) holder, extension socket and synchroniser lead.

When fitting the bulb holder, the small lug at the side should be pushed back into line with the side of the holder. The bulb holder is then pushed through the hole in the wood former and the lug is carefully levered back to its original position. The holder is now pushed back through the hole till the lug is firmly embedded in the wood. Before carrying out this operation, a wire should be placed around the bulb holder and soldered in position at a point on the side, since, as the reader will know, the side of the bulb holder acts as one contact with the flashbulb.

The extension socket is wired in parallel with the main bulb holder and can, therefore, be ignored if one bulb only is being used. In a series circuit the socket would have to be shorted out. The socket is very simple, and is made up from 3/16in. brass tube. Two pieces

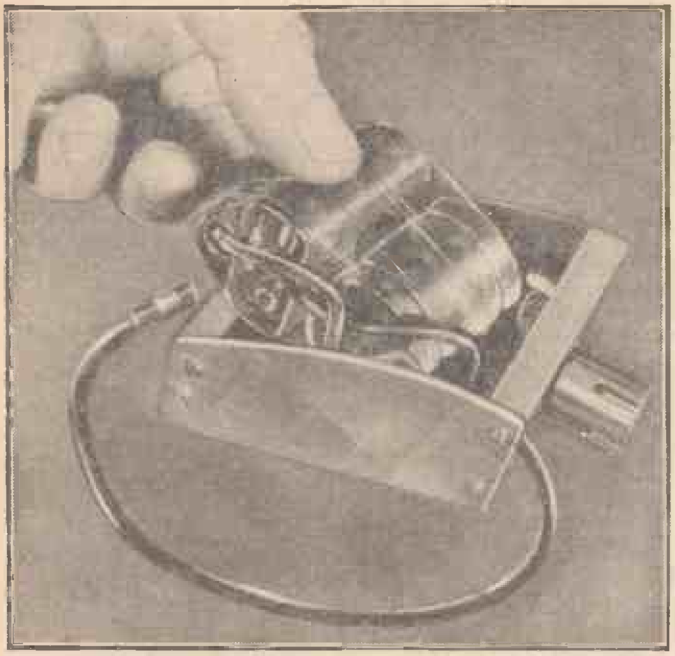


Fig. 6 (*Left*).—*How the component pack fits into the body.*

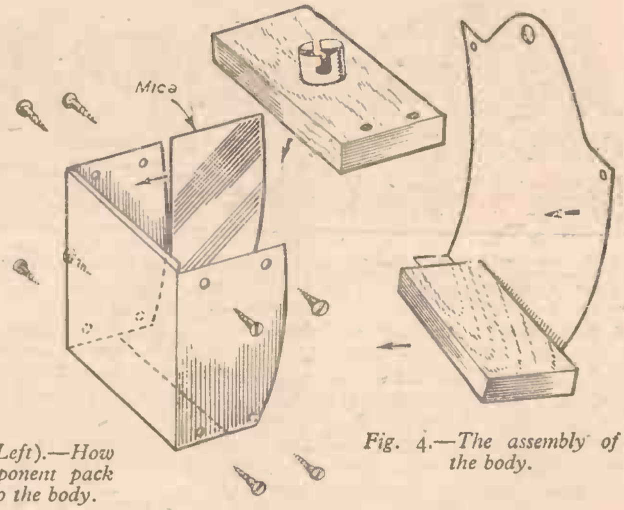


Fig. 4.—The assembly of the body.

Fig. 5 (*Below*).—*The circuit and the assembly of the components in the pack.*

are forced into holes drilled in the wood former of the body. These pieces will, of course, have been wired into the circuit before this is done. The plug is made up from brass rod soldered to each wire of the extension lead, and tapered to fit the tube. Improvements can obviously be made to this arrangement, but in practice it is very efficient.

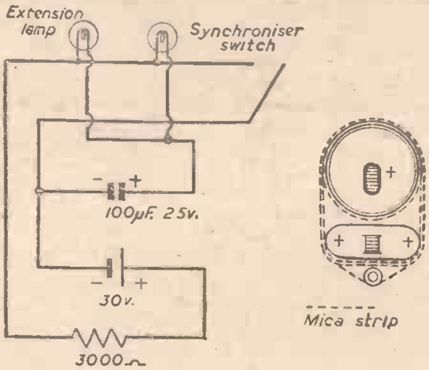
Circuit and Components

The circuit is of the well-known battery capacitor type and is shown in Fig. 5. Components are as follows:

One hearing-aid battery, 22.5 or 30 volts.

One dry electrolytic condenser, 100 μF. 25 volts.

One resistor, 2,000 or 3,000 ohms.



Wiring

These components are wired together at the appropriate points, and other wires are atta.hed ready for connection to the holder, extension socket and synchroniser lead. All components are now rolled in strip mica to form a pack. When a new battery is to be fitted the terminals can be slipped off the old battery and replaced on the new one, when this is in position in the pack. All wires to be attached to the parts within the body of the flashgun must be fairly long to enable the constructor to complete the wiring of the circuit before the pack is placed into position. Wires can then be folded into the spaces at the sides of the pack. The reader will have noticed from Fig. 4, that strip mica has been placed on the inside of the body at the sides only. The pack provides insulation at the front and rear, see Figs. 5 and 6.

The method of attaching the flashgun to the camera will have to be determined by the constructor, who will know which is best for the camera in use.

SCIENCE notes

Yellow versus White Light

AFTER motoring on the Continent many motorists return convinced that the yellow headlights used in France are far less dazzling than the white lights used in Britain. In order to find out if there are any advantages in using yellow light some new experiments have been carried out at the Road Research Laboratory. It was found that the colour of the light made practically no difference.

Apart from questions of colour, the British dipped beam is less sharply defined and is more powerful than the French beam. When the motorist from Britain drives in France he fits yellow bulbs in his headlights but the other differences remain; his lights are still more powerful. French drivers are dazzled by his headlights but he can see much better than at home; but if he sacrificed his advantage by fitting lights of the French pattern, he would find that, provided everyone used the same lights, it would matter little whether they were yellow or white.

Diffuse Reflection Glass

IN power stations and elsewhere it is a common practice for many instruments to be mounted on a control panel and because of the glare from the lighting points, or wrong positioning of the instrument panel in relation to windows, the clear glasses have a mirroring effect, often making it impossible to read the dials at certain angles. Changing of position in order to read the dials correctly may not always be possible if the observer is some distance in front of the panel and has to control the machinery at the same time. After a series of experiments, Pilkington Brothers Limited have produced a glass with both surfaces lightly obscured which successfully mitigates the nuisance of reflection without actually reducing the amount of light reflected.

New High-power Industrial Stroboscope

The new high-power instrument (Type 3B), produced by E.M.I. Engineering Development, Ltd., of Hayes, Middlesex, is capable of visually arresting the motion of machinery so that it can be examined under white light of very high intensity. The grid-triggered gas-discharge lamp is coupled through a specially developed circuit to a high-grade moving-coil meter with an accuracy of one per cent. of full scale deflection. The easily readable 6in. scale is calibrated in both r.p.m. and flashes per second, with a maximum of 100 flashes per second, corresponding to 6,000 r.p.m. Speeds up to 48,000 or more can be satisfactorily measured by reading every second, third or fourth, etc., repetition image by multiplying the scale reading appropriately.

The lamp may be made to flash by the closing of a mechanically operated contact, or from a five-volt sine-wave input or a one-volt positive pulse.

New High Frequency Ignition System

THE Plessey Company, in conjunction with Messrs. D. Napier and Son, the patentees, have developed a new type of ignition system operating on the capacitor discharge principle. The necessity for this new type of ignition results from the greater energy requirements for the ignition of fuels of low volatility used in gas turbines or oil-fired boilers.

This system, termed a high frequency system, has a high spark repetition rate, low initial firing delay, and uses a conventional type of sparking plug.

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MACROPHOTOGRAPHY WITH AN ENLARGER

Using the Enlarger to Photograph Small Objects Larger Than Life Size

By F. G. RAYER

Unidentified coin. Such subjects are best illuminated by one lamp only above and to the side.

"MACROPHOTOGRAPHY" is a term usually applied to the photographing of small objects at larger than life-size, but with a lower degree of magnification than is used for microscopic specimens. In general, subjects suitable for macrophotography are such that most features are visible to the unaided eye, as compared with microscopic specimens where this would not be so. Subjects for macrophotography are numerous—coins, stamps, large insects, small flowers, and so on. These may be in their natural state, or prepared to show certain features, which can then be photographically recorded. (Specimens showing the form and construction of flowers are an example of the latter.)

If macrophotography is to be undertaken with success, some means of working at really close distances is required, and the usual type of photographic enlarger is very easy to employ, as the most important "movements" are already present. Namely, means for adjusting the degree of enlargement (by moving the enlarger head up and down its column), and a fully-adjustable focusing movement. A fully satisfactory lens will usually be present, in addition. Being specially computed for close-up work, a very high degree of definition can normally be expected so that the negatives obtained may be subsequently enlarged in the usual way. With an average enlarger, it will be possible to obtain photographs many times larger than life size, and of a standard enabling very small detail to be visible.

For photographing with an enlarger, a film or plate needs to replace the usual negative. This can be done by using a camera of suitable type, or by inserting film in the negative carrier. No shutter will be required for the enlarger lens as the exposure can be made by switching on and off the lamp illuminating the subject photographed.

With Camera

The usual type of enlarger has a lamp-

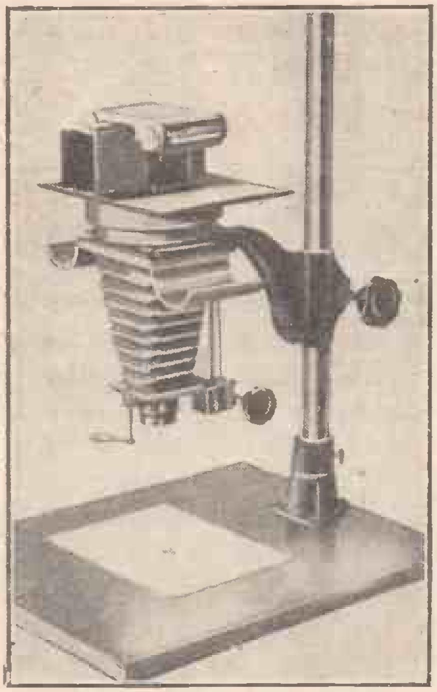


Fig. 3.—Enlarger with camera in place of lamp house.

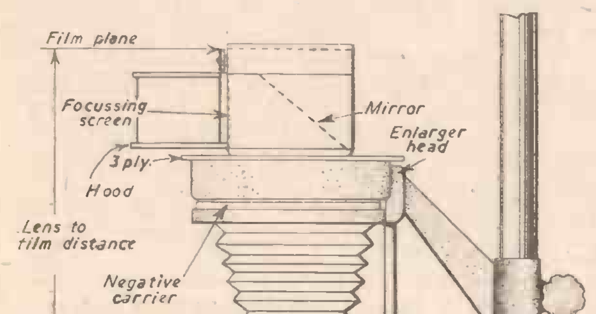


Fig. 1.—Set-up with reflex camera.

house which can be lifted off to gain access to bulb and condenser or diffusing glass. The lamphouse should be removed, and the condensers or opal glass lifted out. The glass in the negative carrier should also be taken out, to avoid reflections.

The simplest type of camera to use is a reflex, its lens being unscrewed. It may be placed front downwards on the enlarger head, or upon a piece of plywood lain across the top of the head, as shown in Figs. 1 and 3. The ply has a central hole of about the same size as the lens mount in the camera front.

With this arrangement, the reflex focusing screen will come vertically, and the subject can be focused upon it by means of the enlarger focusing control. If the image is too small, the enlarger head is moved down the column, and the lens re-focused. When composition is satisfactory, the lamp illuminating the subject is switched off, and the camera shutter set open by means of the "B" or "T" setting. The enlarger lens is then stopped down somewhat to increase definition, and the lamp switched on for the time required by the exposure.

A similar method can be used with cameras having a back focusing screen, if the lens is removable. Shots taken in this way, with any type of camera, may, if desired, be mixed on the spool with ordinary photographs, as they require no special treatment.

Without Camera

If a camera with focusing screen or removable lens is not available, then other methods will have to be adopted. The possibility of making up a simple "camera" body to take an ordinary spool of film should not be overlooked, as no shutter or lens will be required in it.

To use film or plates directly in the enlarger, a sheet of ground glass should be placed in the negative carrier, and the subject composed on this. The lamp illuminating the subject is then switched off, and an ortho plate or sheet of cut film is inserted in the negative carrier, emulsion side down. This may be done by the light of a ruby safelight, provided panchromatic emulsions are avoided. A dark cloth is then placed round the negative carrier to keep out stray light, and the exposure made as explained.

If no ground glass is to hand, an undeveloped plate may be used. It should be rocked in ordinary fixing solution until it has reached the desired degree of transparency, then washed. This may be done in daylight. To avoid errors in focusing, the ground glass or fixed-out plate should be so placed that its surface is on the same plane as that which will subsequently be occupied by the emulsion on the film or plate used for the exposure.

Results obtained by using plates or cut

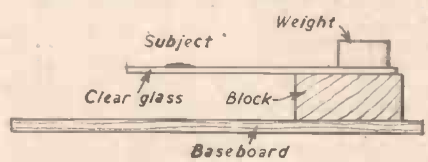


Fig. 2.—Glass platform for back lighting.

film in this way will be the same as those from a camera, and no particular difficulty should arise in either case.

Exposure Calculation

Though exposures may be found by trial and error, calculation is preferable as a correct exposure can then be obtained first time, without any need for experimentation. The exposure is governed by emulsion speed, distance and power of lamp, lens-to-film distance, and aperture. To eliminate unnecessary variables, a 100-watt lamp situated at 1ft. from the subject is suggested, with a 30 deg. Sch. film such as Selochrome. The lamp should be so screened that direct light from it does not fall on the lens. If the subject is such that one lamp casts shadows, two lamps can be used, and the exposure halved. This also gives more even illumination.

When photographing very small objects, the lens-to-film distance will be greater than the normal working distance of the lens, so that the " F " markings, or apertures, will no longer be correct. This difficulty (which would result in under-exposure) is overcome by calculating the *effective* aperture. This need only be done for one convenient stop, such as F/11. The effective aperture may be found by dividing the lens-to-film distance by the diameter of the iris opening. To save measurement, the latter can be ascertained accurately enough by dividing the normal focal length of the lens (as marked on it) by the " F " number. For example, the diameter of the iris opening with a 3½in. lens set at F/11 will be approximately .32in. If the lens-to-film distance is 12in., then the effective aperture, with the lens set at F/11, will be approximately F/38.

The effective aperture for other lens-to-film distances can be worked out in the same way. No real need for a range of apertures exists. It is thus only necessary to work out one " iris opening " diameter, such as that for F/11, and subsequently to divide this into the actual lens-to-film distance. The latter is found by measurement, and will be different for each shot if the degree of magnification is changed. The calculation need only be approximate. It should not be overlooked, however, or the negatives are likely to be very thin, especially when the distance between lens and film is much increased, to obtain high magnification. Exposures can be as follows :

Postage stamp enlarged to 6½in. by 4in. in the actual print.

Effective Aperture	Exposure
F/11	1 second
F/16	2 seconds
F/22	4 "
F/32	8 "
F/45	16 "
F/64	32 "
F/90	1 minute
F/128	2 minutes

This is for 30 deg. Sch. ortho film, with a 100-watt lamp 1ft. from the subject, the lamp not having a polished reflector, and will be correct for average subjects. For very light-toned subjects, the exposures may be halved. Very dark subjects will require twice the exposure.

The accompanying illustrations of small objects show shots made in this way, and the original prints have very good definition. It is preferably to avoid photographing at exactly life size, as film and subject will then lie upon planes of conjugate foci, and focusing will be very difficult. When calculating exposures as explained, the distance between lens and subject may be disregarded because changes here will automatically make an adjustment in lens-to-film distance necessary, which will be compensated for in the calculation.

Compressed and Composition Firelighters

In response to readers' requests we are publishing fuller details on making firelighters. We reprint this information by kind permission of the Rural Industries Bureau.

WHEN making sawdust firelighters, the best inflammable ingredient to use is crude naphthalene or creosote salts, with perhaps a very small amount of creosote oil, not exceeding one quart per cwt. of salts added. The addition of the oil retards combustion to some extent, but prevents evaporation of the creosote salts, which is otherwise likely to occur if the lighters are stored for any length of time, unless wrapped in paper, which should be greaseproof. The above proportion of oil, however, should not be exceeded, and rather less may often be found sufficient ; it also reduces the efficacy of the salts as a binder. The mixture melts at a low temperature, and is highly inflammable. The fumes, however, are not liable to ignite as with petrol. On no account should any naked lights be allowed near it during the process of manufacture ; smoking must be prohibited in the neighbourhood of the building in which it is carried on, and this will have to conform with Home Office Regulations.

The crude naphthalene or creosote salts may be used, obtainable from gas works or tar distillers. Prices fluctuate very considerably, and quality also. It is a heavy, greyish brown, rather greasy substance. More highly refined qualities can also be got from tar distillers, who as a rule carry the processes further than gas works.

The melting point of creosote salts is about 80 deg. C. or 176 deg. F. This being well below the boiling point of water, it should theoretically be possible to melt it in a water-lined tank, the water space of which is connected to one of the ordinary type of atmospheric pressure hot-water boilers, such as are used for domestic heating or hot water supply systems.

To melt by steam is quicker and more economical, and the method recommended is to use a low-pressure boiler, such as is used for steam heating and cooking, and a steam jacketed pan. The steam pressure required will not be more than 20 lbs. per sq. in. A small size boiler only will be required and, if of the vertical type, need not be more than 4ft. high by 2ft. in diameter, and the essential fittings would be a safety valve, stop valve, pressure gauge, gauge glass, two gauge cocks, and either an injector or a hand-feed pump and check valve. A blow-off cock at the lowest point of the water space is also desirable.

Steam jacketed pans are obtainable in stock sizes and patterns from 10 to 200 gallons capacity, suitable for low-pressure steam.

Mixing and Pressing

Various methods of mixing the ingredients may be employed ; one is to compress the sawdust by itself into blocks and dip these into the liquid. This method uses up very much less of the salts and, therefore, produces an efficient lighter at a low cost for material ; but very high pressure is required to make the sawdust or peat waste adhere together in the dry state in this way, and hydraulic or other sorts of power presses would be necessary.

A simpler way, and one which is more suited to the worker on a smaller scale, is as follows :—

A fairly large shallow mixing pan, which is preferably made of sheet iron, and for a small plant might be about 2ft. square and 6in. to 8in. deep, will be required. This should be close to the melting tank and should be steam heated also, but it will be found quite sufficient if the steam piping leading from the boiler to the melting tank passes close underneath it in two or three flat U bends. The sawdust or other materials are placed in this pan, and the melted creosote gradually added from the tank and well mixed in with a shovel until the proper consistency is attained. This will be when the sawdust is well impregnated, but still in a crumbly state, i.e., it should not hold together, being in appearance rather like a bran mash. Skill and experience is of great importance in this operation to ensure that there is no unnecessary waste of salts. The mixture can now be removed direct to the presses, but for continuous working it would be more convenient to have another similar feeding pan also kept warm to pass the supply on for the press workers to draw from without preventing a fresh lot from being mixed. Contact with the iron moulds should assist the lighters to set fairly solid, and the blocks can soon be withdrawn finished ready for packing.

Presses and Equipment

The amount of pressure required is not great, and if the mixture has been properly done there should be very little of the liquid squeezed out in the process. Special presses are made for this, and other somewhat similar purposes in various sizes, both hand and power operated.

The hand-operated machines should be quite sufficient for the worker on a small scale, and dies to make cakes of various shapes can be supplied for them.

Combustion of the lighters is improved if they have a hole in the centre, allowing freer access of air. If there is no hole they may burn more slowly. They are often, however, moulded in a grid-iron pattern, i.e., a single large slab is divided by V grooves into a number of smaller tablets, which can be broken off as required. This latter kind seems often to be preferred by householders.

PRACTICAL MECHANICS HANDBOOK

By F. J. CAMM

12/6, or by post 13/-.

Obtainable from booksellers, or by post from George Newnes, Ltd. (Book Dept.), Tower House, Southampton Street, Strand, W.C.2.

Home-made Fishing Tackle

A Series of Articles Describing the Construction of Various Types of Fishing Rods and Reels

6.—A Dry Fly Rod

By C. W. TAYLOR, M.I.E.T.

FLY rods in general are designed with the emphasis on lightness and a springy action. A light rod is necessary for this type of fishing to minimise fatigue of the angler from casting. A springy action in the rod is essential to enable the angler to cast his artificial fly, which would otherwise be difficult due to the absence of weight and due to low rod tip velocity.

Many small variations are made in fly rod designs to meet the needs and preference of the individual angler. Rods described as "inclined stiff" have become increasingly popular, and these have most of their action confined to the tip.

Only the very finest quality Tonkin bamboo is used for making fly rods to withstand the repeated stresses to which they are subjected. Too much attention cannot be paid to the selection of the bamboo, and in this matter experience is obviously of the greatest value. One or two rules will, however, give quite a good indication as to the quality and suitability of samples of bamboo. The enamel or skin of the bamboo should be a uniform buff colour; greenish bamboo should be rejected. The skin should be free from dents and abrasions. Good dense bamboo is required, and an examination of a clean section should show a good uniform structure with no flockiness at the inner layers. The fingernail should not be able to make any impression at all in the section. A fracture test can be applied, and the best samples should splinter and should not break off suddenly. Large diameter poles, say, 1¼in. or more in diameter, should be used for this work and these may be obtained from certain rod material suppliers.

The rod to be described is 9ft. long, is in two joints, and is made with two tops, one slightly stiffer than the other. The joints are of hexagonal split bamboo and these are made by the process given in the first article, using the triangular former on which the rough bamboo strips are shaped.

The Top Joints

These joints are 54in. long and the flat which must be planed on the former (see article No. 1) tapers from 3/64in. wide to ⅛in. in a length of 54in.

Twelve triangular strips will be required for the two tops, and before the rough strips are shaped on the former, six of them for the stiffer top should be toughened by baking the bamboo until it turns a uniform medium brown colour. The strips should be continually turned and kept on the move during the baking process to prevent scorching.

Building up the Ends of the Joints

Most good-class rods that are intended to withstand arduous work have the ends of the joints built up—with thin slivers of bamboo glued to the flats of the hexagon—to a round section to receive the metal ferrules. Eighteen slivers will be required about 2in. long and the same width as the hexagon flats. The slivers are bound on with thread while the glue sets. "Casco" powder cold water glue is used. When the glue has set the ends of the joints (where the slivers are glued) are shrunk to a more stable condition by warming them several times at intervals to drive out the remaining moisture. The slivers are next carefully filed round and should be a tight fit in the bores of the ferrules.

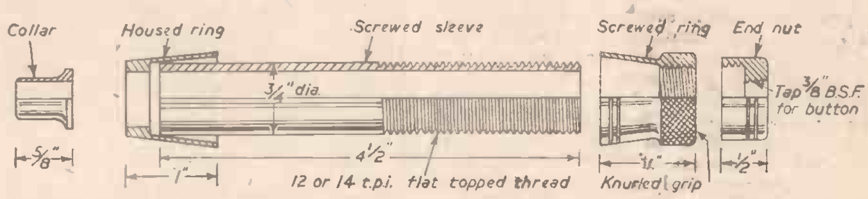


Fig. 2.—Handle and reel fittings (half full size). The material used is duralumin.

The other six strips of bamboo are, of course, left unbaked, and by this means the difference in the stiffness of the tops is obtained without any change in dimensions.

All the knots on the strips should, of course, be carefully staggered so that any weakness due to the knots is not localised.

The Bottom Joint

This joint is also 54in. long and the flat which must be planed on the former (article No. 1) tapers from 9/64in. wide to 3/16in. in a length of 54in.

The six strips for this joint should be toughened by baking.

The Joint Ferrules

Good quality metal joint ferrules should be turned from suitable sizes of hard drawn brass tubes. The two pieces should be turned to an accurate push fit, and the ends which go on the joint timber should be turned to about .015in. wall thickness for about a ½in. length. On this reduced portion six fine saw cuts are made so that the ferrules can be whipped down on to the joints with thread.

Ferrules of this type can be purchased and are known as splint-ended suction ferrules.

The Screw Reel Fitting

The rod should be fitted with a screw grip sleeve in duralumin. Such a fitting can easily

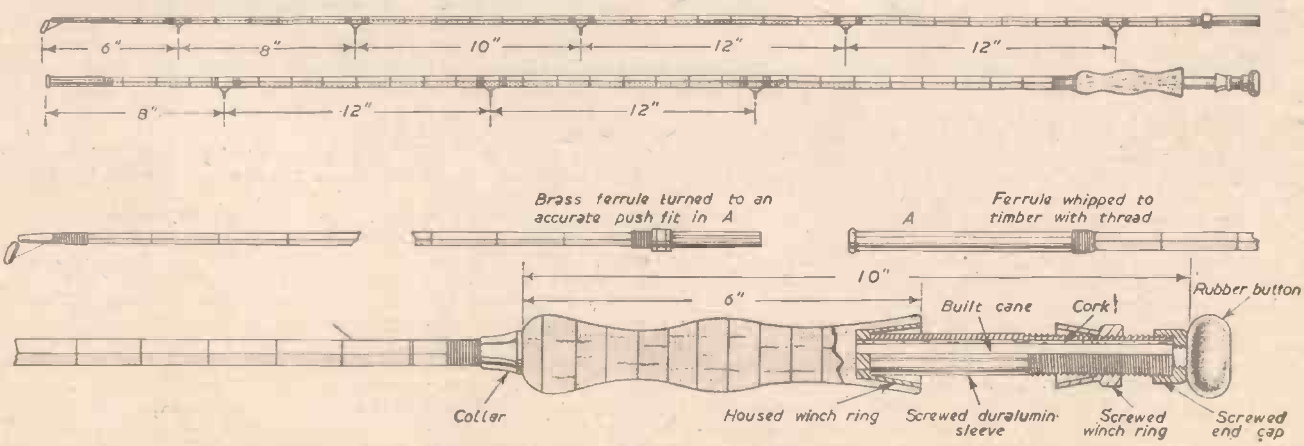


Fig. 1.—The completed rod, showing spacing of the rings, the joint ferrules and the handle construction.

be turned and screw cut by those readers who have a lathe.

A flat-topped screw, as shown in Fig. 2, should be cut on a short length of ⅞in. diameter duralumin tube; 12 or 14 t.p.i. is suitable.

The housed ring and the screwed ring can be turned from short pieces of duralumin tube or bar. A collar and butt cap as shown in Fig. 2 complete the fittings for the handle.

The Line Rings

The tip ring should be very light, agate or substitute lined, and about 3/32in. diameter bore.

The butt ring should also be lined with agate or substitute, about ¼in. diameter bore, and should be the type to match the plated wire intermediate rings. These latter rings should be the type known as full open bridge rings. All the above rings can be purchased at tackle stockists.

Assembling the Rod

The two tops and the bottom joint should be cleaned up with a light scraping and sand papering, and the metal ferrules can then be driven on using a block of wood. The reduced portions of the ferrules are tightly whipped to the joints.

The handle can next be built up using short lengths of bored cork. It will be noticed that one or two of the corks are filed out to a tapered bore to accommodate the housed winch ring. A number of the corks should be filed down to a firm fit in the bore of the screwed duralumin sleeve. These corks are then coated with "Casco" glue and the duralumin sleeve is pushed over the corks to its correct position.

The handle can then be shaped with a file and various grades of sandpaper to a smooth finish. Any imperfections in the cork may be filled and the appearance of the handle improved by working into the cracks or holes a stiff mixture of cork dust and glue. The end of a small screwdriver can be used to force the mixture down and ensure that each hole is tightly filled. The stopping mixture can be sandpapered smooth when the glue has set.

The end nut and the button screwed in position will then complete the handle.

Although it has not been mentioned in previous articles, some readers may prefer joints darker in colour than the natural shade of bamboo. Baking the bamboo to toughen it will turn it to a pleasing shade of brown, but if an even deeper brown is required the joints may have a spirit stain applied to them. Alternatively, it is suggested that two or three applications of french polish are made to the joints. This procedure can be recommended because in addition to deepening the colour of the joints, the polish will completely fill the whippings and make an excellent surface on which to apply the final coats of varnish.

The method of whipping the rings and the joints has been shown in the previous articles, but it can be added that, although whippings are usually made using a fine gauge coloured silk, an excellent type of whipping which is transparent and of pleasing appearance can be made, using as whipping material a very fine mono-filament nylon, such as that used for fishing line, about 1½ to 2lb. B.S. line would be suitable.

The suggested spacing of the rings is shown in Fig. 1.

Building a Simple SYNCHRO MOTOR

By "EXPERIMENTER"

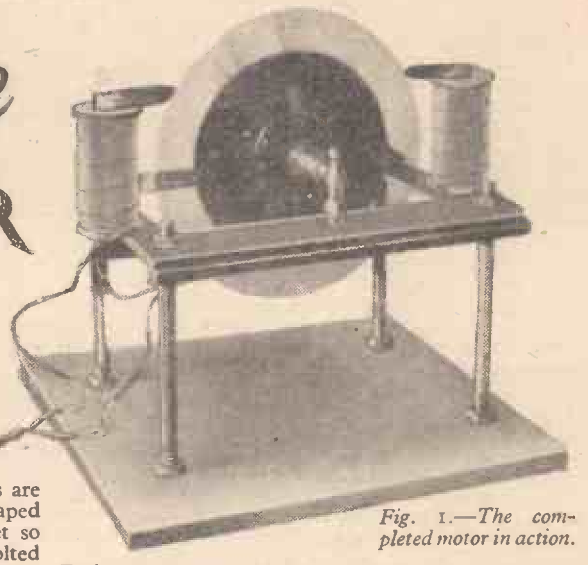


Fig. 1.—The completed motor in action.

THIS motor may be used to demonstrate the method of operation of a synchronous motor, or to drive a clock or *very light* model. If made with reasonable care, it is quite soundless in action, and, in common with motors of this type, has no commutator, brushes or similar contact arrangements which may cause noise or deteriorate due to friction or sparking. To avoid the difficulty of winding a mains-voltage pair of coils, the motor is operated from a transformer. As the number of turns is thus comparatively small, winding by hand is feasible. Operating on 2 to 4 volts, no appreciable heating of the windings was noticed after 24 hours' running. Voltages up to 6 to 8 volts could be used if slightly more power output is required, and the current consumption is extremely small, so that some hundreds of hours' running may be obtained from one unit of electricity.

Figs. 1 and 2 make construction clear, small transformer stampings being used for the magnet cores. Six such stampings are sufficient for each core and a shaped bracket is bound up with each set so that the completed core may be bolted to the end members of the frame. Each core must be covered with tape to avoid possible short-circuits which would arise if the enamel insulation of the wire were fractured. The gauge of wire is not critical, nor is the exact number of turns. If no stampings are available, these may be cut from thin sheet iron. Aluminium or other non-ferrous metal must be used for the frame. This should be reasonably strong, and the side members may be fashioned into girder shape to achieve this end.

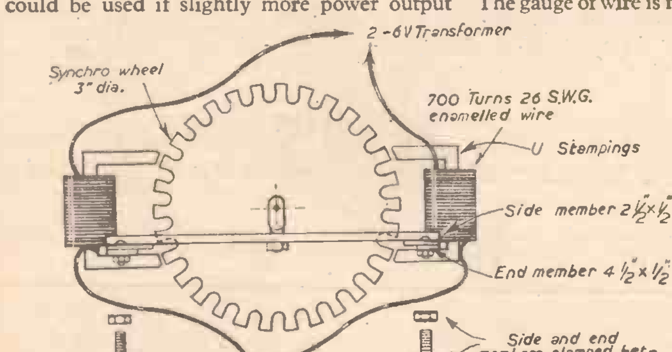


Fig. 2.—Constructional details and dimensions of the motor.

The synchro-wheel is cut from sheet iron about 1/16in. to ⅛in. thick. This is most easily done by cutting the disc and filing it true before making the teeth. The latter are made by drilling holes, then sawing from the perimeter. The number of teeth is not important, but must be arranged so that in any position of the wheel four teeth are simultaneously opposite the magnet poles, as shown. To achieve this, the number of teeth may be adjusted to suit the distance between the poles of the stampings, which should be filed to the shape shown for best running.

The finished wheel is clamped between bushes on a suitable spindle. This is best reduced in diameter at the ends to lessen friction. Or a brass spindle may be used, with small steel pins set in 1/16in. diameter holes. The bearing pillars should be so drilled that the wheel can turn freely, but without wobble.

Very light models may be driven by taking a thin elastic band round the motor spindle. For time-keeping purposes, worm or other reduction gearing of definite ratio is required. With 30 teeth the motor will run at 200 r.p.m. A reduction ratio of 200 : 1 would thus be required to the clock second hand (if fitted), followed by ratios of 60 : 1 and 12 : 1 for the remaining hands.

The motor is not self-starting, but is started by turning the spindle with the fingers at approximately the correct speed. At first a little difficulty may be experienced in doing this, but once the correct speed has been noticed, starting will be reasonably easy. The actual speed required is quite low, and this should be remembered when first starting the motor. Once started, it will continue to run at the exact speed set by the number of teeth and mains frequency. As 50-cycle mains provide 100 magnetic impulses per second, the r.p.m. of any particular wheel will be found by dividing the number of teeth into 6,000. If friction or any other cause slows the wheel down, it will cease to run completely.

A Simple Sunshine Recorder

Make This Interesting Device for Use in Your Garden

By R. M. HARRIS, B.Sc.

THE blueprint paper described in the issue of PRACTICAL MECHANICS for September, 1954, may be used as the recording medium in a very simple and efficient sunshine recorder.

The recorder is, in fact, a camera in which an image of the sun is allowed to fall on a sheet of sensitised paper fitted against the back of a half cylinder through a small hole in the flat front of the camera. The sun records a blue track on the paper.

It is clear from Fig. 1 that the use of only one cylinder would furnish a record of a little less than 12 hours of sunshine, but by using two half cylinders a continuous trace from 4 a.m. to 8 p.m. (G.M.T.) may be obtained on a June day. Fig. 2 should make this clear.

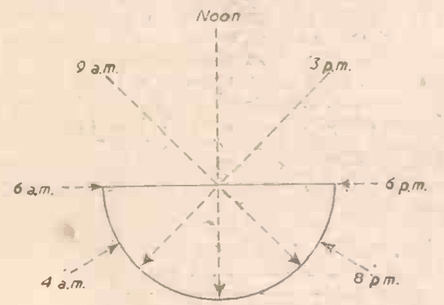


Fig. 1.—Showing the basic principle of the sunshine recorder—a half cylindrical pinhole camera. Note that a single cylinder will record somewhat less than 12 hours sunshine only.

It will be realised that if 1in. graph paper is sensitised by the method described in the September issue of PRACTICAL MECHANICS and used in this recorder, and if it is desired to work on a scale of 1in. of trace to one hour of sunshine, the total record for 12 hours would be 12in. long. The diameter of the half-cylinders should, therefore, be $24in. \div 3^1/_7 =$ 7⅝in. approx. It is on this basis that the recorder has been designed, since graph paper subdivided into tenths would then record down to six minutes of sunshine.

Constructional Details

A square metal box and lid, with internal dimensions of 9⅛in. by 5½in. deep, is first constructed from either copper or brass sheet. These, of course, are rustless and if steel sheet or iron is used it must be galvanised or suitably painted to prevent rust, which would result from continuous exposure to the elements.

Two semicircles of hardwood 7⅝in. in diameter and ¾in. to 1in. thick are then prepared and marked with clear lines of Indian ink as shown in Fig. 2. These blocks are then placed in the bottom of the box with their flat sides against adjacent sides of the box (Fig. 3) and with their curved sides about ¼in. apart. The outline of the two curved sides is then scored on the bottom of the box and two metal partitions are soldered to the box with their bases running very slightly outside the scored lines. The partitions should reach almost to the top of the box.

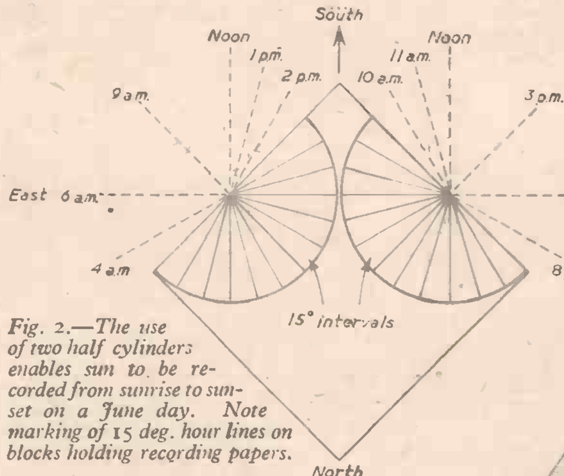


Fig. 2.—The use of two half cylinders enables sun to be recorded from sunrise to sunset on a June day. Note marking of 15 deg. hour lines on blocks holding recording papers.

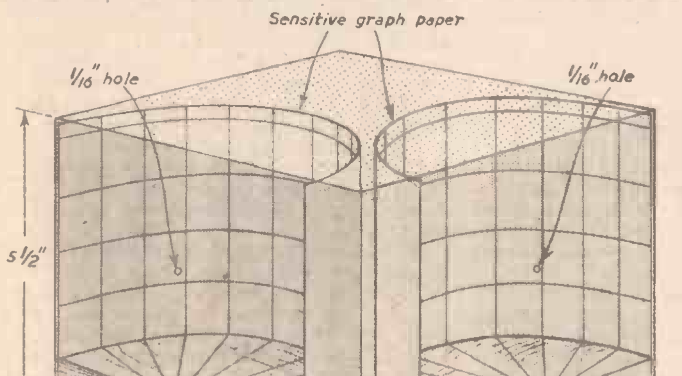


Fig. 3—Diagram showing the essential dimensions of the completed recorder. The 1/16in. hole may be replaced by a ¼in. slot and either should be countersunk on each side.

A 1/16in. hole or short vertical slot is then made in the box sides above where the wood blocks rest and in positions indicated in Fig. 3. The sun enters through these holes and shines across to the paper, which is held opposite on the curved partitions, and it will be seen that if the holes are countersunk on each side the sun will be able to enter at a much finer angle at early morning and late evening.

A supply of sheets of sensitised graph paper each 12in. by 5¼in. should be prepared. If one of these sheets is placed in each half cylinder against the curved partition and then the semicircular blocks dropped in place the paper will be held securely. The sheets will have to be slid very slightly to the left or right until the vertical lines on them coincide with the hour line marked on the blocks. The 6 a.m. and 6 p.m. lines are marked in pencil so that on removal after exposure to a day's sunshine the exact times of the sunshine periods will be known. Using the first two, all the other papers may be marked prior to use.

Erecting a Stand

It is a well-known fact that the elevation of the sun above the horizon at noon on any day is given as 90 deg. — lat. plus or minus the distance the sun is north or south of the equator. These two latter values are 23½ deg. at the extreme distances in June and December. The latitude of Southern England is 51 deg., so that in December the sun is at an elevation of 15½ deg., in June it is at 62½ deg., while in March and September it is at its average altitude of 39 deg. In order that at this average elevation it will make a track along the

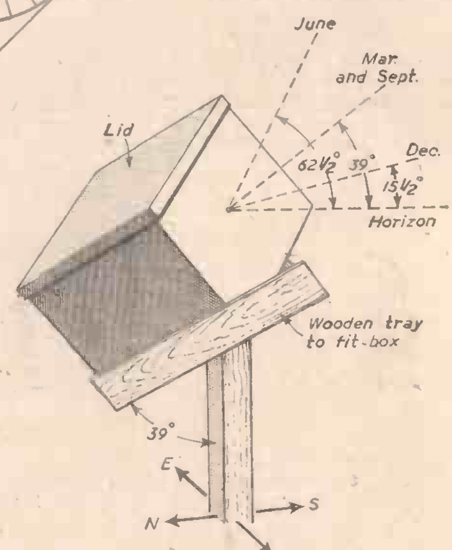


Fig. 4.—Mounting the recorder in a tray on a post, set at an angle of 39 deg. to the horizontal, and with the four corners approximately facing the compass points.

middle of the paper, along its base in June and along its top edge in December the recorder must be set up with its base at an angle of 39 deg. to the horizontal.

With this in view a simple stand may be made by sawing off the top of a suitable post at an angle of 39 deg., or rather 90 deg.—lat. if this is much different from 39 deg., and fixing thereto a board slightly larger than the box and surrounded by a low wooden side or frame to prevent the recorder being blown off.

The post is erected where it will be in full sun at all times of the day, and may be set initially by placing the recorder on it with the lid off and turning it so that the sun image is on the correct time line on the papers. The post is then tamped in place.

It will have been realised that for several hours (from about 9 a.m. to about 3 p.m.) there will be a sun trace on both papers and so if the latter are mounted for display a suitable overlap must be made. The exchange of papers may be made at any convenient time each day provided that the time of exchange does not vary from day to day. Again, this may be allowed for when the papers are mounted or the results recorded.

The labour of making the metal box for the recorder may be avoided and its efficiency in no way diminished if a half (4lb.) biscuit tin is used. Unfortunately, these are not square but about 9in. by 8½in. by 4½in. deep, but may be used by cutting the blocks so that the straight edge of one measures approximately 7¾in. and that of the other 7¼in., and shaping the partitions accordingly. The parts removed from the blocks should be the corners away from the centre. In this way the record lost from one sheet will be retained on the other. In effect the overlap will be less.

An Erasable Writing Tablet

I HAVE one of these devices in my possession and to find out how it works I took it to pieces, as it had completed its useful life, and the following description may help readers to make one for themselves.

The construction of the apparatus is very simple, and the parts readily obtainable with one exception, this being a piece of dark-coloured paper (red, blue, green or black, according to the colour of the impression required), of heavy texture, smooth and either impregnated or coated with wax.

The instrument consists of two main parts, the names of which might be called the platen (Fig. 1) and the envelope (Fig. 2), and the operating principle is as follows: A stylus, which can be an empty ball-pointed pen or a propelling pencil with the lead retracted, is used for drawing or writing upon a cellophane surface, the pressure causing the waxed paper and a piece of flimsy tissue paper to stick together in the track of the stylus, this track appearing through both flimsy and cellophane and remaining visible until separated by the knife-like action of a strip of paxolin or similar material attached to the envelope and interposed between these two sheets.

This separating action is produced by drawing the platen out of the envelope, when the impression disappears.

There appears to be no limit to size, providing all the parts fit snugly and the slight difference in width between the several sheets of material which make up the platen (as per the dimensions given) are observed. The dimensions given are for an instrument of handy pocket size.

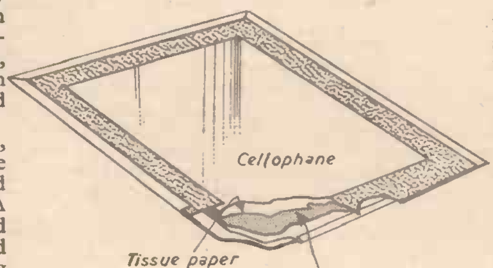
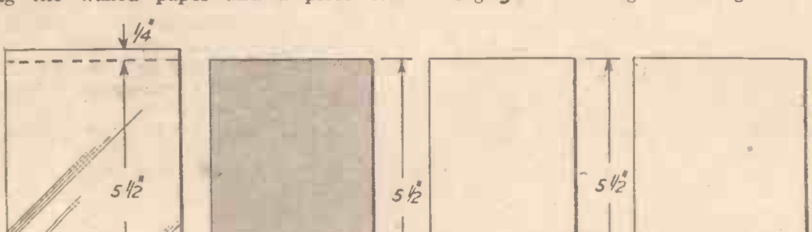


Fig. 3.—Assembling the writing tablet.



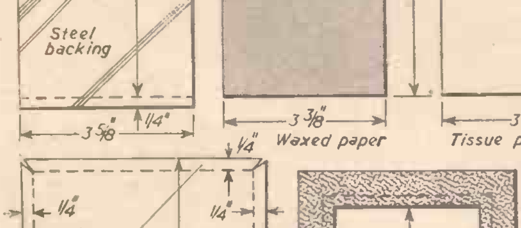


Fig. 1 (Above).—The dimensioned component parts of the platen.

Fig. 2 (Left).—Details and dimensions of the envelope.

The Platen. This consists of four sheets of different materials cut to sizes shown; one is of thin gauge sheet steel, one of waxed paper; there is a piece of smooth flimsy or tissue paper, free from flaws or creases, and a sheet of fairly thick cellophane, mica or Perspex, such as is used for covering maps, etc.

The Envelope. This consists of a sheet of thin gauge sheet metal, and, as shown in Fig. 2, is cut ¼in. wider on its upper edge and both sides than the vignette, which is merely a sheet of stiff cardboard cut to the shape shown and which is sealed to the backing by pressing down these overlapping edges, small V.s being cut out of the top right and left hand corners before doing so.

The order of assembly is as follows: Place the waxed paper on top of the steel backing of the platen, the flimsy paper on top of these two and the cellophane last. Bend over the overlapping upper edge of this backing and seal the upper edges of these four items by pressing them together in the jaws of a vice, taking care, of course, to keep the sheets clear of the jaws. While the bottom edges of the platen components are still free, pass the backing and the waxed paper through the separating strip, which has been riveted in position as shown in Fig. 2, then with these two items below and the remaining two above the strip seal down all four in the same manner as used in the upper edges.

All that remains to be done now is to place the vignette over the whole assembly and follow the same sealing procedure with this and the backing of the envelope as before.

Finger and thumb apertures are cut out of the two envelope components as shown to facilitate the withdrawal of the platen.

It is not advisable to use pencil graphite or any kind of ink on the cellophane surface, as the marks thus caused will necessitate washing or rubbing off, and the pressure will cause more adhesion than the strip can separate between the waxed paper and the flimsy, with the possibility of damage to either or both. Empty ball pens or propelling pencils are easy enough to obtain.

The dotted lines within the frame of the vignette, Fig. 2, indicate the position of the platen when at rest in the envelope.

An Ice Rink in the Desert

THE ice rink, which was one of the main features at the Baghdad Trade Fair measured 30ft. by 30ft. and was housed in an air-conditioned building.

When it was decided to install an ice rink the engineers were set many problems. Temperatures of 120 deg. F. (49 deg. C.) occur practically every year in Baghdad and although by the end of September the hottest time has usually passed, this cannot be guaranteed. With such temperatures it was essential to house the ice pad in a building, to protect it from the sun, and one that could be air-conditioned to create suitable conditions for ice skating and the maintenance of a good ice surface.

The temperature of the ice is about 20 deg. F. (−7 deg. C) and the air-conditioned temperature inside the building would need to be reduced to approximately 85 deg. F. (30 deg. C.).

Approximately 2,700ft. of piping was used in the rink floor set in damp sand. The refrigerating plant necessary for this installation included a 6½in. by 5in. twin-cylinder monobloc compressor driven through Vee-belts by a 30 h.p. motor, the refrigerant used being Arcton 6.

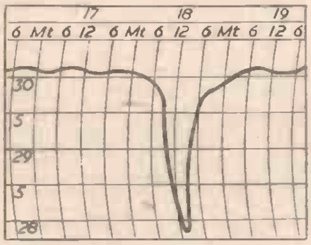
In addition to the comfort of the spectators and the reduction of the temperature in which the ice rink was to be placed, the factors of fog and condensation had to be taken into account. With as many as 180 spectators and a slab of ice the moisture condition of the air would be considerable and some guard had to be made against condensation.

Messrs. J. & E. Hall, Ltd., Dartford, the designers and manufacturers of both the ice rink and the air-conditioning plant solved all these problems

Characteristics of Tropical Revolving Storms and Tornadoes, Emergency Actions, Planetary and Atmospheric Forces

By WILLIAM ELLWOOD

IN tropical oceanic regions the normal trace of a self-recording barometer is a uniform wavy line, with two maxima and two minima in 24 hours. This occurs with great regularity and is termed the semidiurnal pressure variation. Very small dislocations in this regular period line usually imply sudden squalls of short duration. However, perhaps once a year for any given station, the trace may plunge in an alarming manner (Fig. 1).



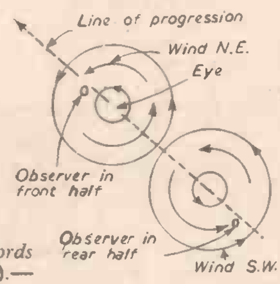


Fig. 1 (*left*).—*How a barogram records the passing of a cyclone. Fig.* 2 (*right*).—*Observed wind backs to the opposite quarter.*

This is accompanied by the advance and onset of a tropical revolving storm.

These storms are known by various names, according to the area where they manifest. For instance, in the Western Pacific and China seas they are named *typhoons*; in the Western Atlantic, *hurricanes*; in the Bay of Bengal, *cyclones*; and off Western Australia they are occasionally referred to as *willy-willies*, a name at once amusing, yet which only partly allays the apprehension connected with these appalling storms.

We shall use the name cyclone (*kuklos*, from the Greek, meaning, amongst other things, the coil of a snake), as it has at least some affinity with the cyclonic depressions of northern latitudes, particularly in regard to mode of circulation. One major difference is that tropical cyclones seldom exceed 400 miles in diameter, whilst some northern depressions have been known to span upwards of 2,000 miles.

Characteristic Features

A cyclone can be described as a huge vortex, having a vertical axis. The whole system moves along a curved path at 10 or 12 m.p.h., but the circulating and converging air *forming* the system may attain a velocity well in excess of 100 m.p.h.

The approach of a cyclone is characterised by an ominous cloud, very black near the horizon and changing to a copper hue nearer the summit. The upper edges of the cloud seem to merge into a whitish glare. As may be gathered, the general appearance of this cloud is rather ghastly. It may often be seen 10 hours before the storm arrives. As it approaches the wind strengthens rapidly, bringing with it torrents of rain, accompanied by terrific thunder and lightning. This may persist for about 12 hours. Suddenly the wind abates and an area of comparative calm is entered—but it is a treacherous position to be in!

This area of calm is the centre of the vortex, or *eye* of the storm, round which the circling wind reaches a maximum velocity. The wind velocity outside this ring decreases in inverse ratio to the distance from the centre of the vortex. In this eye the seas run short and fast and possess great destructive power. They are particularly dangerous due to the violent conflict of opposing wave trains set in motion by the ever-changing direction of the surrounding wind. A ship caught in this area cannot adjust itself to the erratic conditions and stability is often seriously affected. The ship behaves rather like an eggshell swivelling and lurching on a pond into which a number of large rocks have been hurled. On top of this a heavy swell is built up along the line of progression of the cyclone. This swell travels faster than the storm itself. After two or three hours of these conditions the wind again increases in violence, but this time from the opposite direction (Fig. 2). The duration of wind and rain from this quarter is about equal to that experienced earlier. This is the passing of the "rear half" of the cyclone. Slowly the wind dies and before long the weather becomes fine and clear.

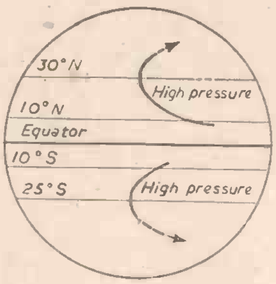


Fig. 3.—*Typical lines of progression.*

The Cyclone's Path

In Fig. 3 is shown the usual line of progression of cyclones in the two hemispheres. It will be seen that they originate in a belt of latitude 10 to 12 degrees north or south of the equator. Knowledge regarding their origin is not yet conclusive. However, it is of importance to realise that air-streams flowing from north and south towards the equator are very unlikely to be of identical constitution. The resulting coalescence of these two different air-streams could well give rise to tropical phenomena of cyclonic nature.

In the northern hemisphere the newly formed cyclone travels first towards the north-west, recurves at latitude 30 deg. north and, if not totally spent, moves towards the north-east. It is on this second stage of travel that tropical cyclones may occasionally reach Europe from the Atlantic area. It is generally accepted that the path of a cyclone is determined by the disposition of high pressure areas to north and south of it. In the sub-tropical zone, it will be recalled, there are areas or belts of high pressure. Round any one of these the cyclonic system must travel —first to the north-west, then swinging north-east. The usual line of progression in the southern hemisphere is first towards the south-west, recurving at latitude 25 deg. south and thence towards the south-east. The season for cyclones or hurricanes in the western area of the Atlantic is from July until November.

Emergency Action

Nautical science incorporates a study of the cyclone, thus being able to state the action required in case of emergency. Two examples of this action are given.

In Fig. 4 a ship is steaming east in the northern hemisphere. The wind strengthens on the port beam and backs to the north-west (anti-clockwise). This indicates that the ship is entering the left-hand half of a cyclone usually termed the *navigable semicircle*. The correct procedure here would be to turn the ship and run with the wind on the starboard

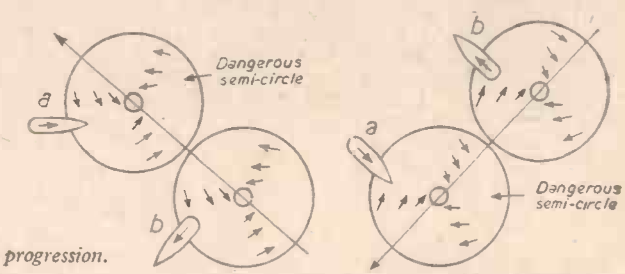


Fig. 4 (*left*).—*Evasive action in the northern hemisphere. Fig.* 5 (*right*).—*Evasive action in the southern hemisphere.*

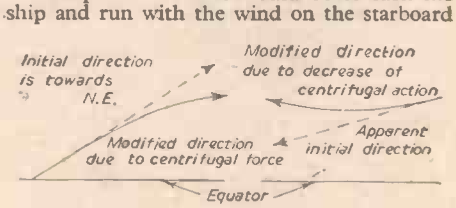


Fig. 6.—*Tendency of the wind to the right.*

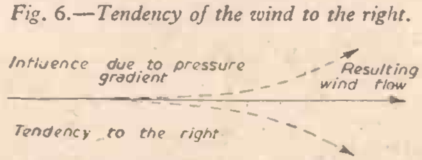


Fig. 7.—*Creation of a geostrophic wind.*

Fig. 9.—The tornado pursuing its grim course.

quarter until the barometer rose and the weather moderated. In Fig. 5 a ship is steaming south-east in the southern hemisphere, with the wind increasing on the starboard beam and veering (clockwise). If she proceeds she will run straight into the eye of the cyclone. The natural thing to do in this case is to turn the ship in the opposite direction and go as fast as possible. The *dangerous semi-circle* of a cyclone is so named because the wind and heavy seas meeting a ship compel it to drift into the line of progression, thus forcing it virtually into the eye of the advancing cyclone. In all cases where this threatens it is advisable to heave to and ride it out. The dangerous semicircles are opposite for northern and southern cyclones.

We have previously seen that airflow in the northern hemisphere tends to the right. Air flowing northwards from the equator has a greater velocity eastwards than the surface over which it flows. This creates a south-west wind. The earth's centrifugal force also accentuates the tendency of the wind to turn to the right, as it attempts to pull the fast-moving air-mass back towards the equator. Winds apparently flowing from the east or north-east actually possess less velocity to the east than the surface over which they flow. In each instance the centrifugal force acting on the air-mass is decreased, and the airflow tends to bend towards the north pole. Thus we again have a tendency to the right (Fig. 6). In the southern hemisphere this tendency is to the left.

Pressure Gradient

Buys Ballot's law implies that a person standing with his back to the wind (in the northern hemisphere) will always have the lower pressure at his left hand. In the southern hemisphere it will always be at his right hand. The term *pressure gradient* enters the story here. Briefly, it is the change in barometrical pressure per unit horizontal distance, and is always measured in the direction where pressure changes most quickly, i.e., at right angles to the isobars. Rapid pressure change over a given distance indicates that the gradient is steep. Air is directly subject to the force imposed by the varying steepness of the pressure gradient. If we were solely concerned with a pressure gradient as existing between low and high pressure areas, the airflow would be a straight line between the two areas. This is only part of the story, however.

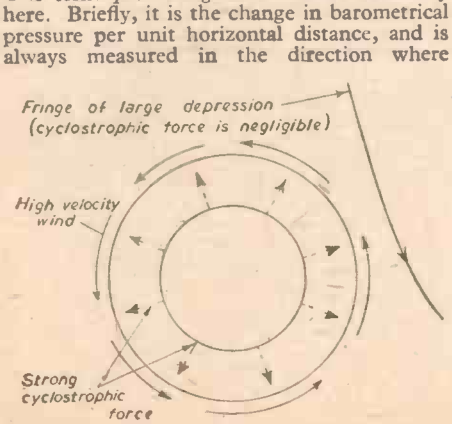


Fig. 8.—The cyclostrophic component.

A body moving in a straight line may continue to do so only if the forces acting upon it are equal to each other. If the tendency of the wind to the right—which is directly proportional to its velocity—is balanced by the pressure gradient which presses the wind to the left, the resulting wind is said to be *geostrophic* (Fig. 7).

The pressure gradient relevant to a cyclone must counteract the tendency of the circling air-mass to swing to the right, also the centrifugal force inherent in the system itself, which tends to force the air away from the centre of revolution. The latter force is called the *cyclostrophic* component. The geostrophic component is negligible in the case of a cyclone, whilst the same can be said of the cyclostrophic component when considering a large depression in northern latitudes (Fig. 8).

The Tornado

There is one other type of revolving storm we have hitherto not mentioned, i.e., the *tornado.* This storm, which frequents the temperate zones, has characteristics similar to the tropical cyclone. It is very much smaller than the cyclone, its track seldom exceeding a mile in width — but the intensity of the phenomenon is so great as to beggar general description. In most instances it manifests over land areas, in contrast to the oceanic wanderings of its big brother. Tornadoes are frequent in the plains of the United States and Australia. On rare occasions the British Isles are subject to these visitations, but the storms are much less violent than those experienced in America.

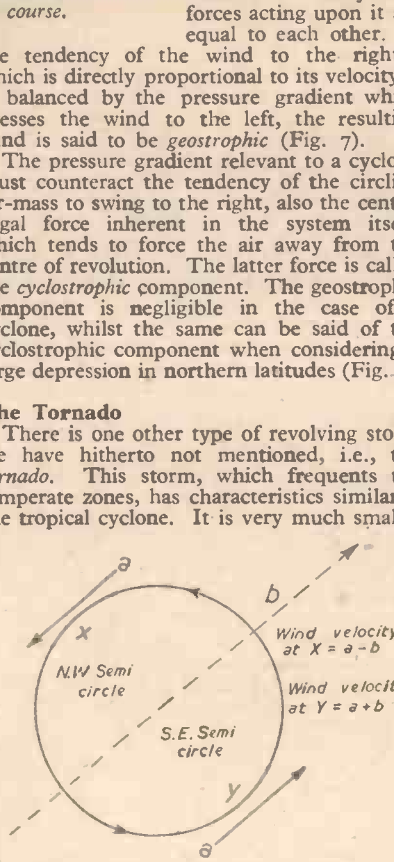


Fig. 10.—Tornadic wind velocities.

Advancing out of the angry south-west with a terrifying roar, the tornado lays out a path of destruction in the methodical manner of a vast reaping machine. From the base of the extremely turbulent main cloud-mass, a grey, funnel-shaped cloud writhes to and fro, descending and ascending as the whole system sweeps forward (Fig. 9). In some cases there are more than one of these funnel clouds suspended from the same cloud-mass. They are the dreaded sign of the tornado—the *twister* of the Americas. The pressure gradient of such an ascensional vortex—the word *gradient* seems hopelessly inadequate here—must be unbelievably steep, as the very large cyclostrophic component involved needs tremendous counteraction. This will be obvious when we realise that the tornadic funnel may be only a few hundred feet in diameter, yet the velocity of the air forming it often exceeds 500 m.p.h. ! As the tornado is carried along inside a south-west air current, which itself possesses a velocity often approaching 60 m.p.h., this velocity is added to that of the wind in the south-east side (dangerous semicircle) of the tornado. In the north-west semicircle the wind velocity is correspondingly *reduced* by 60 m.p.h. due to the anti-clockwise rotation of the tornado (Fig. 10). Devastation on the right of the line of progression is always greater than that to the left of the line.

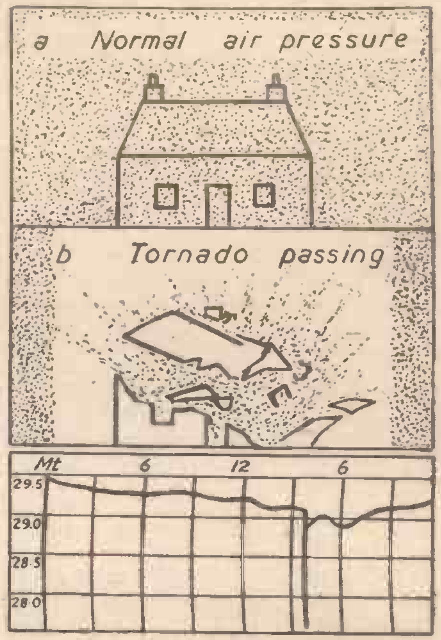


Fig. 11 (top).—The explosive effects. (Bottom) Typical barogram of a tornado.

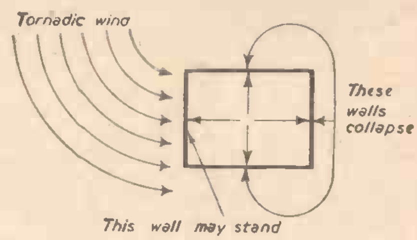


Fig. 12.—Outward collapse of walls.

In semi-darkness, illuminated only by vivid flashes of lightning, the surface winds overthrow trees and buildings and most other exposed objects. Within the central vortex human beings, animals and vehicles are whirled aloft and dashed to the ground. Clothing is stripped from people and torn into shreds. Nails are driven into doors head first and blades of grass forced into woodwork. Even bridges and other heavy structures are dislodged from their foundations. Due to the sudden reduction in air pressure at the centre of the storm (Fig. 11) air present within houses and other buildings has no time to gain a pressure distribution equal to the outside air. This inequality of pressure results in the apparent explosion of buildings as the internal air lifts roofs off and pushes the walls outwards, especially those walls facing away from the advancing wind (Fig. 12). Almost instantly the tornado passes, leaving in its wake a terrible scene of tragedy. In one or two hours the tornado is spent. It is as short lived as it is intense.

This type of storm invariably originates in the west or south-west, and advances rapidly towards the north-east, until final dissipation occurs. On an average 70 or 80 tornadoes may be expected in the United States each year between early spring and late autumn. The year 1953 was a particularly bad one, when 250 tornadoes had been recorded by the end of June! The origin of tornadoes is not yet fully understood, but tornadic conditions are commonly encountered when a layer of very cold air passes over a warm, moisture-laden surface air-mass. Also we may suspect that spasmodic but intense solar radiation could provide atmospheric conditions suitable for the generation of tornadoes. Moderate geomagnetic storms have long been associated with the periodic return of M regions of the sun. It is assumed that when these restricted corpuscular emitting areas traverse the sun's disc, the resulting streams in due course sweep across the earth, giving rise to various electrical and atmospheric disturbances. In these speculations we see the need for an extensive knowledge of the solar constitution if we are to master the meteorology of our planet.

The Velocity of Light

New Results Give Rise to Speculation

By C. O. LLOYD

THE growth in the use of radar after the war, for a wide range of important duties, focused attention on the real velocity of light. The accuracy of radar computations depend upon an exact knowledge of that velocity, while the growth of short-wave radio also demanded an answer. Faced with an increasing urgency to supply an up-to-date value, the National Physical Laboratory carried out an experiment, or more exactly, a series of experiments, a few years back, which confirmed the suspicion that the traditional velocity used by the world of science was not accurate. Such a task was a formidable one, calling for the highest refinements of physics, electrical engineering and mathematical approach. To attempt to find out, more exactly than hitherto, the speed of light was something which could not be gone into without elaborate preparations, but in this case the work was dictated by necessity.

There have been seven determinations since 1940, and it is significant that all of those made since the end of the war have shown that the speed of light is higher than the classical value assigned to it. These determinations have been carried out in various countries, including America and Sweden.

The generally accepted speed of light is 186,000 miles per second, or 300,000 kilometres per second, in round figures. As one can readily imagine, the accurate measurement of velocities of this order is no mean feat. Some very good values were found, by experiment, in the latter half of the nineteenth century, but the historic experiment is that of Michelson and Morley, two American scientists, whose value served as the world standard for many years. It will be obvious that to measure with any degree of accuracy the speed of anything moving as fast as light one must measure over a very long distance. A few miles might be insufficient if the apparatus used is not hypersensitive. The need for long distance operation of a light beam, so that the time factor would not introduce too big an error, was ingeniously answered by the use of rotating mirrors.

If one flashes a beam of light to a mirror the beam travels back on a path in accordance with the laws of light reflection. By using mirrors rotating at high speed one can produce a series of interrupted beams, and using these in conjunction with some integrating device the light speed can be calculated.

Classical Methods

The speed of light was first measured by Romer, a Danish astronomer, in 1675. He made careful observations of the position of certain satellites of Jupiter during an eclipse and arrived at a reasonably accurate value. About half a century later the English astronomer, Bradley, made use of the aberration of light to calculate its speed. But some years were to pass before direct experimental methods were employed to measure the velocity.

The two most well known are that of Fizeau and that of Foulcault, both Frenchmen. The former sent a beam of light between the teeth of a rotating wheel, to a mirror at some distance from the source of light. The beam would pass through two teeth, but by the time it had arrived back at the wheel, by reflection from the mirror, a tooth would have moved into a position where the returning beam was obstructed. From a knowledge of the speed of rotation of the wheel at which the returning beam is interrupted or obstructed one can calculate the speed of the light beam. Foulcault made use of a rotating mirror, the time taken for it to move through a certain angle providing the clue for calculating the speed of light.

But the experimental determination which served to establish a value for modern science was made by the American scientists, Michelson and Morley. They went to great lengths to find an accurate value, but their main object was to see whether light moved at the same speed in all directions. There had been suspicions that the direction of rotation of the earth might affect the speed in that direction. Michelson and Morley found that the value was the same in the direction of rotation as for that in an opposite direction. In doing so, they not only confirmed the value of about 300,000 metres per second, but helped to establish the validity of relativity, for according to Einstein's theoretical concepts, the speed of light should be the same in all directions on this earth.

The Modern Methods

The latest experimental methods depend upon the fact that light moves with the same speed as radio waves. This was predicted in the latter half of the nineteenth century by the brilliant Scottish scientist, Clerk Maxwell, who propounded the electromagnetic theory of light. It was this work, incidentally, that led Einstein to his relativity theory.

The progress in instruments has made possible the latest determinations giving greater accuracy than hitherto achieved. Specially designed phototubes, resonators and wave-meters have been used, while optical methods have also been employed in certain countries. The latest data is that of Drs. L. Essen and Gordon-Smith at the National Physical Laboratory, Teddington.

They used a tube through which short waves could be passed. Of special design, the tube, which virtually comprises a resonating system, enables close control over the path of the short radio waves and prevents attenuation. From calculation of the results, Dr. Essen has found that the speed of light is 299,792 kilometres per second, with an error of two parts in a million.

In the year 1950, Bergstrand, of Sweden, reported a series of optical experiments which produced a value of 299,792 kilometres per second. Here again the factor of error was found to be quite small (plus or minus 0.25 km/sec.). He employed an ingenious method based on one invented by Anderson in 1941. A light beam was passed through a Kerr cell which caused a modulation, the beam being divided into two parts. One part was sent on a comparatively long path while the other was sent over a path shortened by means of a mirror. The two beams would be out of phase on arrival at a phototube, and this could be measured by the change of voltage in the tube resulting from the different photo-lectric effects. The mirror can be rotated at a suitable speed to produce the maximum out-of-phase effect, when the voltage produced in the tube would be at a minimum.

The Latest Values

Up to 1935 the most accurate value for the speed of light accepted by science was 299,774 km/sec., with a certain tolerance. This served its purpose well, as far as radio wavelength calculations up to then were concerned. The steady development of radio devices, such as radar, called for a more thorough investigation of the position. Several attempts were made to improve on the certainty of this value, but they gave velocities no higher than 299,776 where the value stood at 1941.

The Second World War emphasised the great importance of the subject and theoretical preparations were made in various countries to attack the problem anew, using instruments developed during the war. Exchange of information and ideas was hampered until the end of the war, when the problem was taken up in earnest. In consequence the following values have been determined:

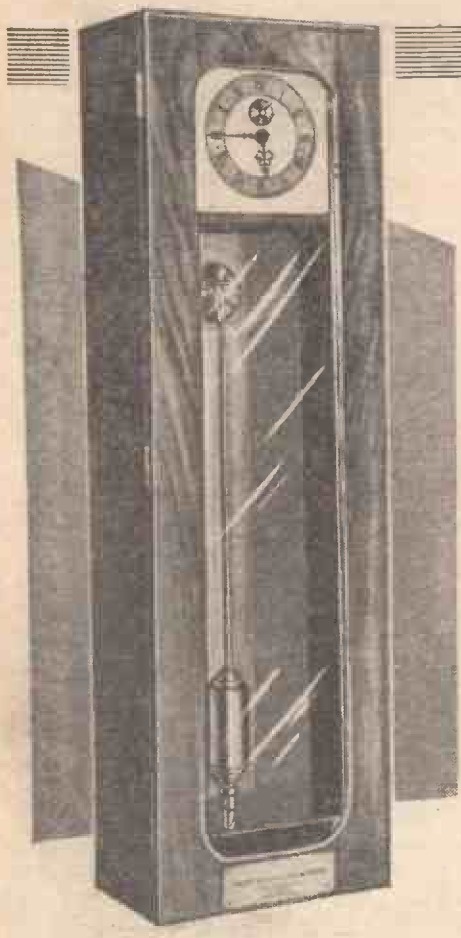
Date	Experimenter	Values, km/sec.
1948	Essen and Gordon-Smith	299,792 ± 9
1949	Aslakson	299,792 ± 2.4
1949	Bergstrand ..	299,796 ± 2
1950	Bergstrand ..	299,792 ± 0.25
1950	Essen (N.P.L.) ..	299,792 ± 3

Not only is a higher accuracy revealed in this latest work, but all of the observers are agreed that the velocity of light is about twenty kilometres greater than hitherto supposed. While for ordinary experimental work this might not mean much, the larger value now confirmed will bring greater accuracy to radar calculations, and will help also to tighten up certain radio theory.

If one stops to think about it, twenty kilometres per second is a considerable velocity in itself. That man has not been able to bring his measurements within the limits of this figure is due to the enormous velocity with which we are dealing when we consider light. The magnitude of the speed of light is well illustrated by the fact that a beam can pass about seven times around the earth in one second. He has done remarkably well in being able to measure such a velocity with the instruments at his disposal, and it is becoming clear that we are very near to having found the real velocity of light, the present value being accurate for most practical purposes.

Making a FREE P

A New Pendulum Desig
Swing is Magnetic



The completed clock.

THE writer has built many clocks, using the well-known Hipp principle, and all of these have, sooner or later, developed certain faults which appear to be inherent in this system, unless the parts are very accurately made and adjusted. These faults, which do not appear in commercial examples of this system, many of which are still working to-day after many years of service, have all been discussed in this journal in the past, and seem to group themselves generally as follow :—

1. Bouncing of the trailing blade off the notched block.
2. Dead end effects.
3. Varying amplitude of swing.
4. "Yawing" of the pendulum through faulty tracking.

In addition to these, the pendulum of any Hipp clock suffers interference from three sources, the trailing blade wipes the block with every swing, the contacts have to be depressed at intervals, and some form of counting mechanism has to be driven mechanically from the pendulum rod. It was with the object of eliminating these faults that the system described was designed, and, though it might in time develop its own peculiar faults, it does, by eliminating the Hipp entirely, also eliminate the troubles associated with it.

No claim is made that this is a free pendulum in the strictest sense of the term, because, as will be seen later, there is a certain amount of interference with the free swing of the pendulum, but this interference is magnetic and not mechanical and will, therefore, be constant.

In this system the pendulum touches nothing in its swing, yet the motor coil is switched on and off at the correct time, and the hands of primary and secondary movements turned, with seconds indication thrown in for good measure, all at the cost to the pendulum of a gentle slide in and out of a permanent magnetic field.

This slight interference takes place at that part of the swing least likely to affect the time-keeping of the pendulum, i.e., when the latter is slowing up before stopping momentarily to change direction and it is during this brief pause that the maximum drag on the pendulum is felt. Upon this point of the best place to interfere with the swing of a pendulum (if interference there must be), the leading horologists of the day are not agreed, but it is my opinion that it is better to interfere with a moving object before it has begun to accelerate, than afterwards. It might also be argued in favour of this idea that the momentum lost by the pendulum in dragging itself out of the magnetic field is made up on the return swing by the same magnetic field pulling the pendulum towards it, but these two points are debatable.

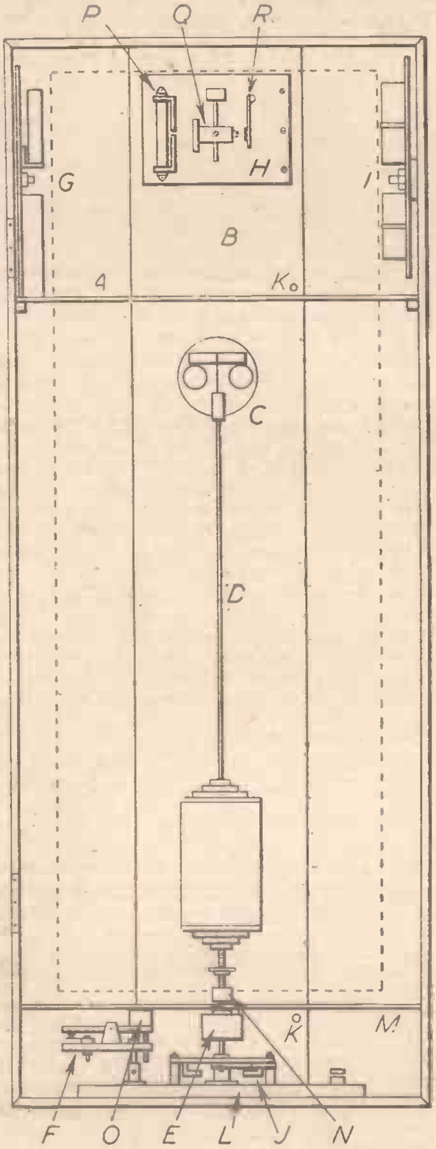


Fig. 1.—Lay-out and general principle. Key : A—Movement shelf ; B—Backboard ; C—Suspension ; D—Pendulum ; E—Motor Coil ; F—Magnetic switch ; G—Power unit ; H—Escapement ; I—Reserve batteries ; J—Advance and retard switch arm in normal position ; K—Hole in backboard through which 4 leads pass ; L—Motor platform ; M—Motor cover ; N—Armature ; O—Permanent magnet ; P—Escapement coil ; Q—Escapement armature ; R—Escapement contact.

Lay-Out and General Principle

The clock shown is of the three-quarter second type. A full second pendulum would have been preferable, and will be the length chosen by most builders, but a cabinet of this size was available and so was used. The controlling factor here will be the arrangement of the room and just where the clock will be running but there seems to be no great advantage in the full second pendulum from the point of time-keeping as the clock, which was originally designed to hang on a wall, but was later found to be too heavy, is keeping perfect time.

The cabinet measures 3ft. 7in. in length, by 13in. wide, by 7in. deep, outside measurements, is of ⅝in. ply, walnut veneered, is lined with dark brown baize and fitted with a shelf 8½in. from the top as shown at A in Fig. 1. Upon this shelf is supported the mains power unit, the primary movement and the batteries.

A view of the door removed

The pendulum and escapement are supported on a hardwood backboard ¾in. thick, which must be of good well-seasoned timber and is about ½in. less than the inside length of the cabinet. Under this backboard and into the ¼in. space slides a ¼in. thick plywood panel upon which is assembled the motor coil, magnetic switch, advance/retard switch, and four terminals. This arrangement is described later in Fig. 5. A further shelf (M, Fig. 1) of paxolin or similar non-magnetic material rests on pins driven into the side of the cabinet and the armature N carried on the end of the pendulum rod just clears this shelf as it swings.

This shelf serves no other purpose than that of hiding the assembly beneath the pendulum and enhancing its apparent freedom from mechanical interference. The correct position of this shelf will be described later. The mains unit G is bolted by a 2BA bolt to a fillet which is screwed into the side of the cabinet and secured by a wing nut. The batteries are secured by brass bands to a ¼in ply panel fixed to the opposite side of the cabinet in a similar manner.

The Principle

The door of the cabinet should be vignetted as shown by the dotted lines in the sketch, and thus, when the door is closed, the mains unit, batteries and all beneath the motor

PENDULUM ELECTRIC CLOCK

n Which is an Alternative to the Hipp System and One in Which the Only Interference to Pendulum

By J. A. ROBERTS

cover are hidden, and only the pendulum and face exposed.

From the position of rest Fig. 1, the pendulum is given a push to the left just sufficient to carry the Armature N well into the field of flux of the permanent magnet O which, being free to do so, rises to meet it, thus, through a see-saw action, closing the contacts, situated at the other end of the bar to which the permanent magnet is attached, and switching on the escapement coil P. This remains energised and the escapement armature Q held against it until the pendulum has begun to swing in the opposite direction, when, once the attraction between N and O is broken, the latter falling under its own weight, the contacts open and the escapement coil is switched off, thus releasing the escapement armature, which falls away. Before the latter has resumed its normal position of rest, as shown, it overswings once to the right of the perpendicular, striking, in doing so, the contact R. This action, which is the merest flick, switches on the motor coil E just as the armature N arrives in the correct position of the field of flux of the motor coil.

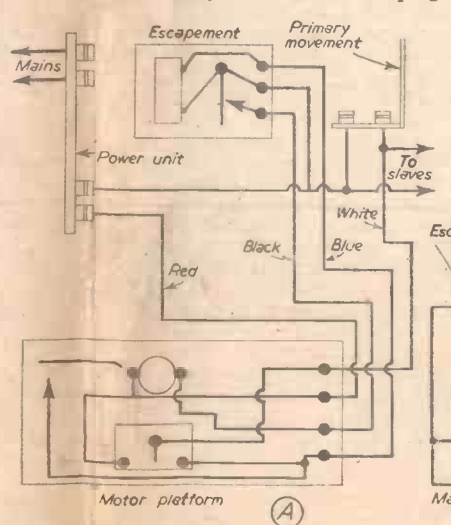
e clock face with the vignetted ; the suspension is also shown.

Thus with every swing of the pendulum in one direction, the coil P is energised and the coil of the primary and slaves, being connected across it in parallel will also be energised. The hands are turned by the counting device described later.

The Circuit

Fig. 2 B will show that two simple switches switch on two coils alternately from a common power source. The magnetic switch closes the circuit to the escapement coil, this attracts the escapement armature which, after release, swings over and switches on the circuit to the motor coil, the latter keeping the pendulum in motion.

The advance/retard switch throws the slave coil(s) across the escapement coil in one position, disconnects slave coils completely in another, and in the third of the three positions shorts the slaves across the power source thereby allowing them to be advanced at the speed at which the switch arm is being depressed. This latter operation may seem laborious in practice as each depression produces an advance of only three quarters of a second, but with the degree of timekeeping of which this clock is capable, thanks to its almost free pendulum, very little of this should have to be done.



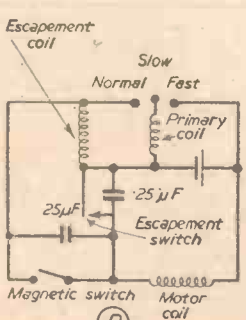


Fig. 2.—The circuit.

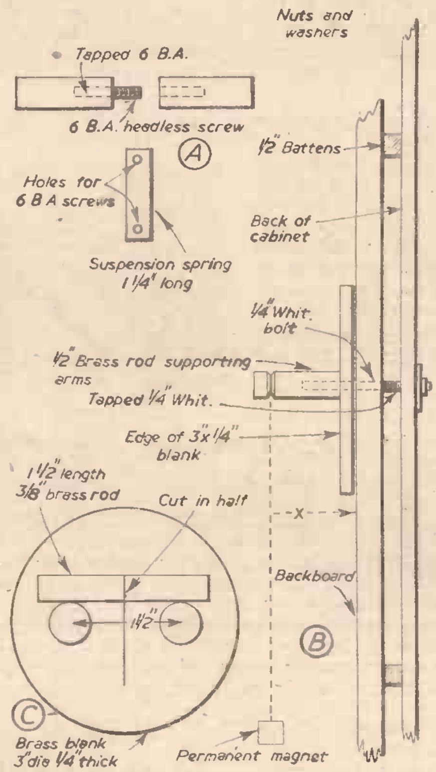


Fig. 3.—Suspension details.

The condensers, shown across the magnetic and escapement switch contacts, are a refinement but were found to eliminate any possibility of interference to nearby radio sets in the event of sparking at these contacts developing.

As will be seen from Fig. 2 A, four leads leave the motor platform, disappear behind the backboard and reappear through the same above the movement shelf, thus being completely hidden from view when the door of the case is closed, and for this reason a colour scheme was found very useful.

Suspension

As the pendulum in this system has no mechanical work to perform during its swing, there is no necessity for a very heavy bob as there is in cases where the pendulum has considerable work to do. The pull on the magnetic switch is the same whatever the weight of the bob, and for this reason a comparatively light suspension is possible.

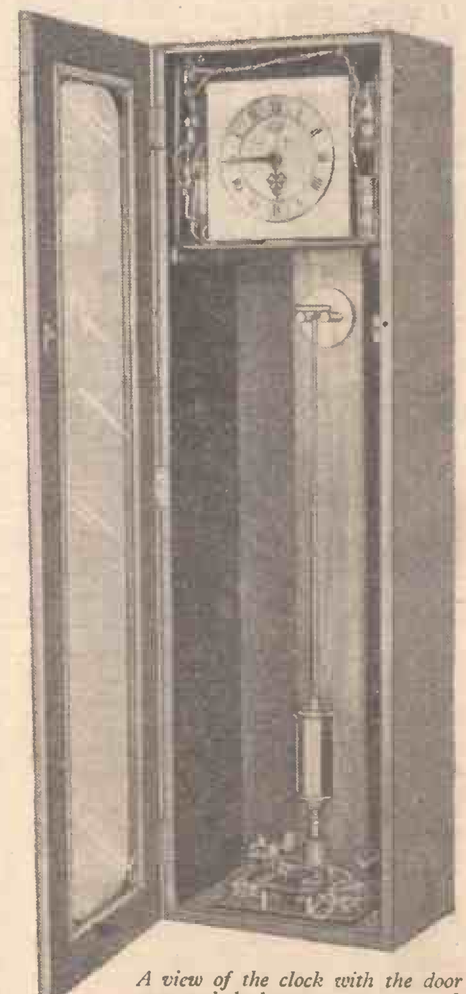
The arrangement described in Fig. 3 was found to be quite suitable, A shows a brass blank 3in. in diameter and ¼in. thick, cleaned up in the lathe. The three-jaw chuck was used and the centre found and popped, a diagonal line drawn and the centres of each half marked and drilled 2BA clearance. These holes admit the two bolts (Fig 3 B) which pass into the two brass supporting arms and out through the backboard and the back of the cabinet, being held tightly there by nuts and washers.

Half inch hardwood battens hold the backboard sufficiently far away from the back of the case for the leads to pass behind and the backboard is further held by two ¼in. Whitworth bolts at each end.

The locating groove in which the pendulum cross-bar (Fig. 3 C) rests is cut into the supporting arms and must be identical both in depth and position on each arm and, as will be seen by the dotted lines at X (3 B), must be the same distance away from the backboard as is the common centres of motor coil and permanent magnet.

This cross-bar method of hanging the pendulum follows general commercial practice and has been found very efficient, as, by this means, the pendulum is self-aligning and can be removed very easily.

In the construction of this a 1½in. length of ⅜in. brass rod was cut in half, the adjacent ends being tapped 6BA and a corresponding headless screw fitted. This passes through one of the two holes worked into the suspension spring. The writer's favourite method of producing holes in clock spring is to centre punch spring at the point to be holed, rub off the pimple thus produced and a tiny hole should appear.



A view of the clock with the door open and the bottom cover removed.

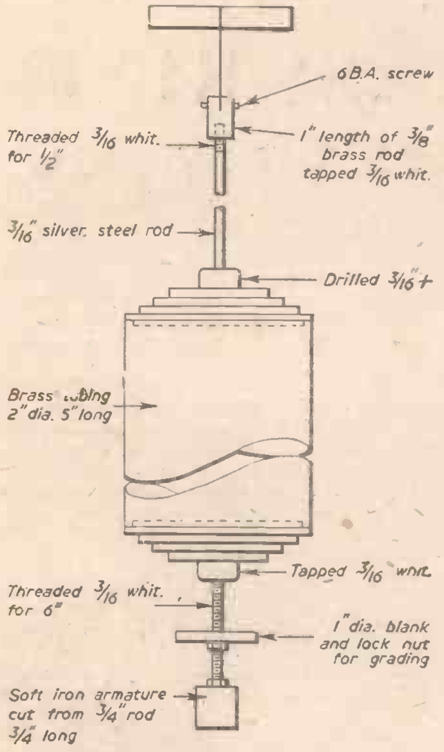


Fig. 4.—Pendulum details.

A needle file held in the three-jaw chuck and the spring held in flat nose pliers will enlarge the hole to the size required with no loss of tension. The pliers must be used as the file grips the spring when it bites; if it is held in the fingers, production might be held up!

The Pendulum

This is simple in design and as yet uncompensated. A silver steel rod 3/16in. thick is threaded 3/16 Whitworth for about 4in. of its length at one end and ½in. at the other. Invar rod would be preferable as this material is practically impervious to temperature changes, but it is difficult to obtain, expensive and difficult to work.

On the subject of the pendulum rod, one of the many attributes required of the perfect pendulum is that its weight should be concentrated in the bob which should be suspended by a fine cord.

This has up to now been impossible, as we have not had a mechanically free pendulum, but now that we have one, we do not need a rod at all, and this method of motivating a pendulum permits the silken cord to replace the orthodox pendulum rod. This is a field in which the reader might like to experiment.

The bob in present use is shown in Fig. 4, and is built up as follows: the can is a 5in. length of heavy brass tubing 2in. o.d., two ¼in. brass blanks being flanged to fit tightly into each end; three similar blanks of diminishing size but the same thickness are drilled to clear the rod and are fitted at each end of the can. The cone thus formed, which is for appearance only, terminates in two brass terminal heads, the lower of which is drilled and tapped 3/16in. Whitworth and supports the whole bob on the long thread of the rod.

The grading ring is another 1in. blank, the whole bob on the long thread of the rod.

The grading ring is another 1in. blank, tapped 3/16in. Whitworth as is the armature, which is a piece of Swedish Iron from an old W.D. coil to the size shown, though this is not critical. If the lower end of this armature could be ground to a curve corresponding to the arc it describes, so much the better.

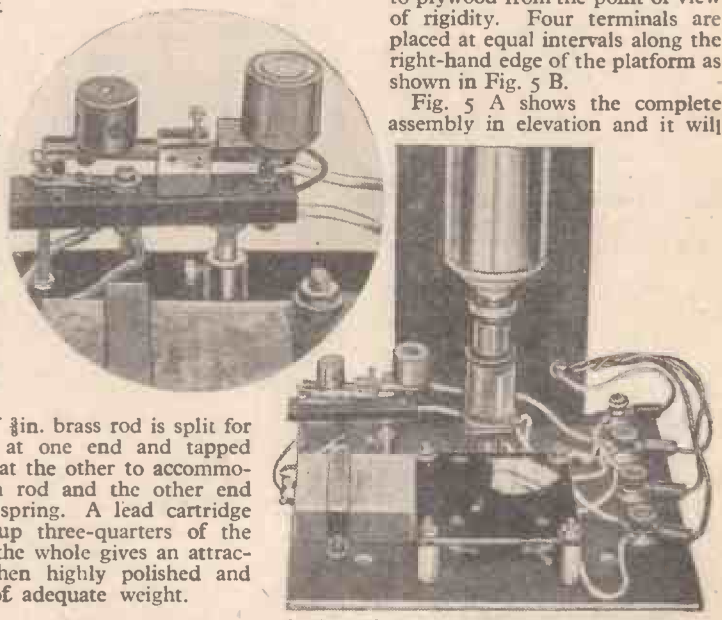
A short length of ⅜in. brass rod is split for ½in. of its length at one end and tapped 3/16in. Whitworth at the other to accommodate the pendulum rod and the other end of the suspension spring. A lead cartridge was cast to take up three-quarters of the space in the can; the whole gives an attractive appearance when highly polished and lacquered and is of adequate weight.

Motor Platform, Coil, and Magnetic Switch

The platform itself is simply a ¼in. plywood panel which slides under the backboard into the ¼in. gap left between this and the bottom of the case. The backboard could, of course, come right down to the bottom and the panel cut to fit, but the former was found to be the simpler method.

The platform could also be raised up on narrow battens and the wiring passed beneath it, but as the motor cover (M, Fig. 1) covers the whole of this assembly, it was deemed to be an unnecessary refinement. If available, ¼in. ebonite or hard plastic might be preferable to plywood from the point of view of rigidity. Four terminals are placed at equal intervals along the right-hand edge of the platform as shown in Fig. 5 B.

Fig. 5 A shows the complete assembly in elevation and it will be seen that the magnetic switch consists of a 2¼in. length of ebonite of ½in. square section, which carries at about its centre a small brass pivot bracket, which is merely a short piece of brass strip bent to shape as shown at C. The contact bar is a 2in. length of 3/16in. square section brass bar, to which, at one end, is soldered a small platform of the size shown and which carries the permanent magnet. This is an eclipse type, and will be found, not only to be of ample magnetic strength, but also conveniently tapped 2 BA.



A view of the motor platform and (inset) an enlarged view of the magnetic switch.

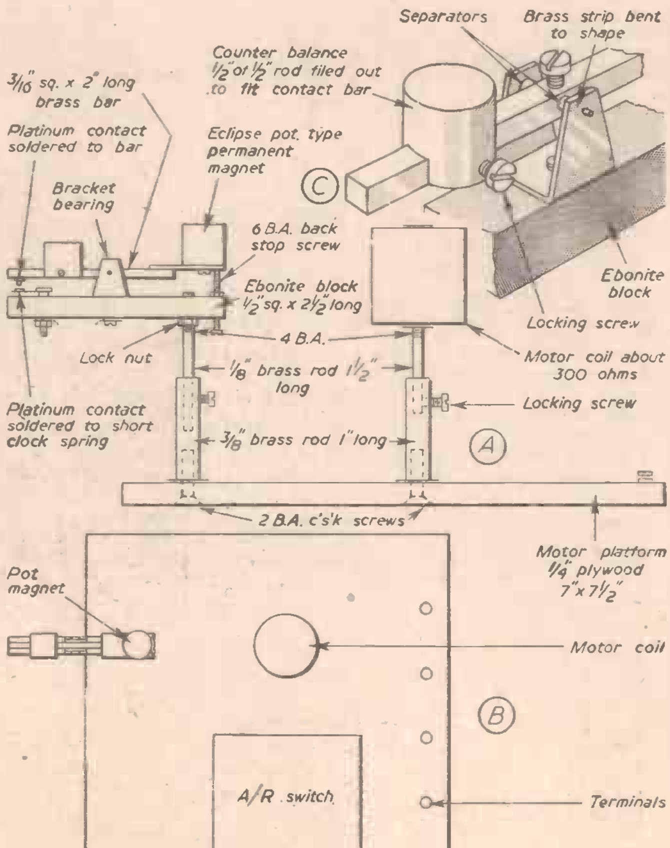


Fig. 5.—Motor platform, motor coil and magnetic switch.

At the opposite end a small platinum contact from a heavy duty W.D. relay is soldered, and the whole arrangement pivots on a steel pin which passes through the bar and is locked by the screw as shown, small separators being provided to keep the bar in position.

A small counterbalance is provided, as the weight of the magnet specified is too great to rise under its own magnetic force through the space occasioned by the presence of the motor cover (if used).

This switch is the trickiest part of the whole mechanism as we have to preserve the full magnetic force of the permanent magnet, whilst minimising its weight. At the same time, we have to preserve enough of this weight to ensure that the P.M. will drop cleanly under gravity to break the contacts at the other end. Unless there is enough weight left at the P.M. end of the fulcrum bar there is a tendency for the contacts to stick for some seconds before opening again, with disastrous results to the timekeeping. The true cause of this has never been discovered but it may be some form of amalgamation due to the two metals forming the contacts fusing under the heat of the slight spark caused when they "make." This is a subject for debate, however, and the trouble was overcome once the correct balance was achieved. A nice balance must be found between the distance between the P.M. when

(*Continued on page 222*)

EQUIPMENT for MEASURING and RECORDING VIBRATIONS

A Description of the Apparatus and its Application to Industry

By ROLT HAMMOND, A.C.G.I., A.M.I.C.E.

SCIENTIFIC study of vibration is of comparatively recent origin, and this is not to be wondered at when we consider the complexity of a mechanical vibration waveform, because it is generally the resultant of a number of superimposed vibrations of different amplitudes and frequencies. Thus, the vibration of a gas turbine plant may originate from blade resonances, imperfect gear wheels, mis-alignment and unbalance of shafts and components rotating at very high speed. The first step towards elimination of unwanted vibrations is the measurement and recording of amplitude and frequency of each component; from this detailed analysis the source of the most serious vibrations can be traced and necessary steps taken to eliminate or reduce them.

Measurement of vibration is difficult because the waveform is generally complicated. Frequency is never constant, it varies irregularly and often over a wide range; frequencies may be from 1 cycle per second upwards; a vibration waveform may contain several unrelated components differing only slightly in frequency; and in electrical machinery many vibration frequencies are multiples of the power line frequency, so that hum pick-up may be experienced.

A gas turbine for aircraft operates at a temperature up to 800 deg. C., and at speeds from 3,000 r.p.m. up to 28,000 r.p.m. Such operating conditions demand great care in the design of the turbine blades, measurement of blade resonance frequency and amplitude being of great importance. Some unsuspected resonance may result in blade failure and lead to complete destruction of a power unit. Vibration measurements are therefore carried out on individual turbine blades before they are fitted into a rotor or stator assembly; they are excited by means of a moving coil vibrator or an air jet. Electric resistance strain gauges are cemented to the blades and connected to the recording apparatus.

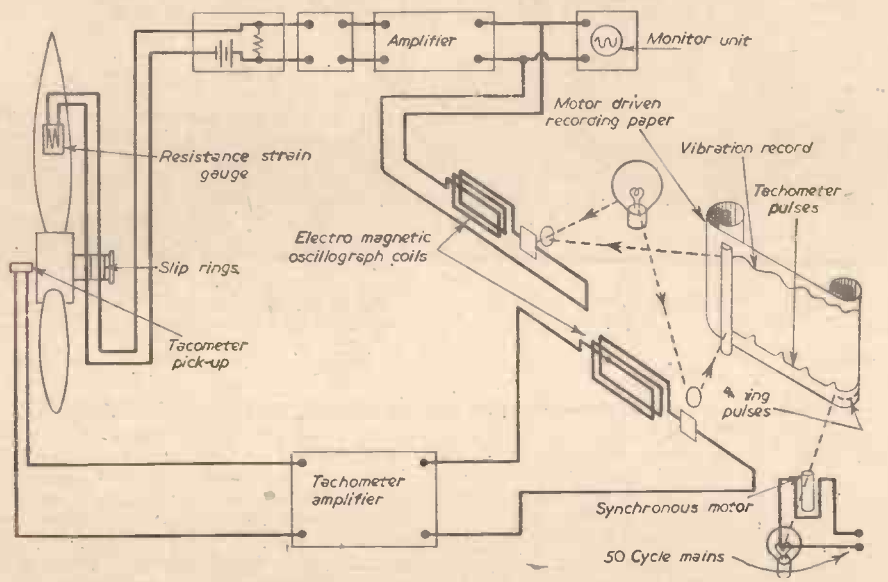


Fig. 1.—Layout of apparatus for recording alternating stresses from propeller blades.

The Apparatus

In Fig. 1 we have a diagram of the apparatus developed by de Havilland Propellers, Ltd., for measuring and recording alternating stresses from propeller blades, the basic principles of this equipment being applicable to any kind of mechanical vibration. An amplifier has been developed which satisfies certain conditions and which is also extremely compact; it includes an integrating network which can be switched out of circuit when strain gauges are employed as the recording source. One of the most interesting features of this equipment is the special oscillograph which has six cathode-ray tubes arranged so that a continuous motion camera can obtain a satisfactory simultaneous record at film speeds up to about 9 ft. per second. Amplifiers with the necessary extended frequency range have also been developed for strain gauge measurements on gas turbine components.

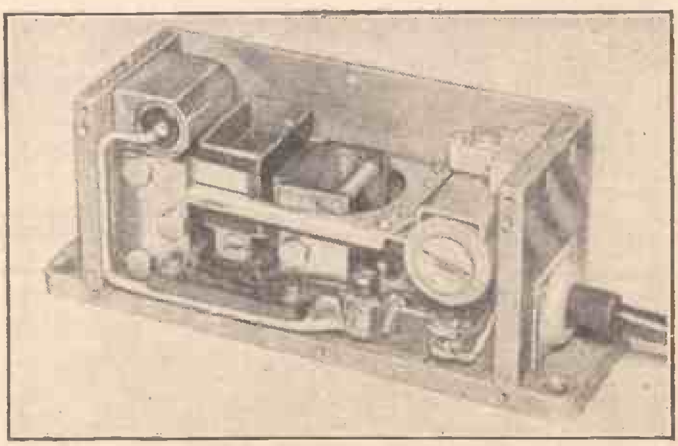


Fig. 2.—View of the de Havilland moving coil pick-up with cover removed. Note the compactness of this instrument.

Very sensitive instruments are available for picking up vibratory movements, Fig. 2 showing the device developed by de Havilland Propellers, Ltd., this pick-up responding to a single component of vibration, and it may be used in any axis; it can be used with camera equipment for obtaining vibration records. It is of the electromagnetic moving coil type and can be rigidly bolted to the body undergoing test.

The seismic element is a light stiff pivoted vane, mounted on four crossed strips of beryllium copper to reduce friction and wear to a minimum. The free end of the vane carries the moving coil, wound on a metal former; eddy currents, induced in this coil, provide damping for the system.

The Strain Gauge

Much research work in recent years has been carried out on the development of electric resistance strain gauges, a remarkably successful recent device being the foil strain gauge developed and made by the Helicopter and Electronics Division of Saunders-Roe, Ltd., of which the potential applications in all branches of industry are immense. The final pattern of this foil strain gauge is shown in Fig. 3, the pattern of which is produced on an Araldite lacquer backing. This material was chosen because of its excellent mechanical and electrical properties, claimed to be far superior to those of paper. Foil thickness varies from 0.0005in. to 0.0006in. and backing thickness from 0.002in. to 0.003in. The gauge consists of 12 parallel lines 0.010in. wide by 1in. long spaced at 0.010in., with linkages 0.050in. wide at alternate ends.

Careful tests were made of the high power sensitivity of this type of strain gauge. The instrument used was developed by the Admiralty Research Laboratories, being a 12-channel recording galvanometer in which the galvanometer elements have a coil resistance value of 90 ohms with an average sensitivity of 1cm. deflection at the film for a current of 100 microamps through the coil. Range of frequency is from 150 to 200 cycles per second. The recorded amplitude corresponded to an alternating stress from zero to plus or minus 2.69 tons per sq. in. in the beam tested, a light alloy conforming to specification D.T.D. 683. Definition of the trace was so excellent that it was considered possible to read off stresses to within 50 to 100lb. per sq. in.

Simplification of the recording technique represents a very important contribution by the foil strain gauge to vibration research. One of the most attractive features of this foil gauge is the complete freedom to design various patterns for special purposes, and particularly for the strain gauging of torsion members and diaphragms. A four-gauge diaphragm arrangement, developed in conjunction with the Admiralty Research Laboratories, is shown in Fig. 4.

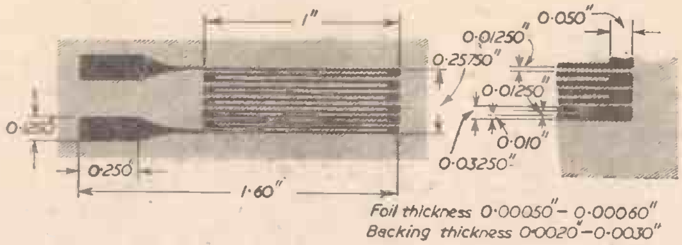


Fig. 3.—Foil strain gauge, the pattern of which is produced on a backing of Araldehyde lacquer.

A modern synthetic resin lacquer is used in the manufacture of these gauges, known as Araldite. This is unaffected by moisture and has much better electrical properties than cellulose acetate cements. It is claimed that after a little practice in mixing and application there is no difficulty in achieving resistances between 5 and 10 thousand megohms.

One of the most outstanding instruments used for vibration research is the Muirhead-Pametrada wave analyser, developed by Muirhead and Co. Ltd., in conjunction with Parsons and Marine Engineering Turbine Research and Development Association (Pametrada), originally designed for vibration measurements on marine turbines and their reduction gears. Turbine speed ranges from 1,500 to 3,000 r.p.m. and frequency of vibration from 25 cycles per second upwards can be recorded. Measurements are carried out with the aid of a crystal or moving coil pick-up. An analyser has also been developed for vibration measurements of diesel and steam engines, where frequencies down to 5 cycles per second have to be measured, but a low-frequency modulator enables the wave analyser to be employed over the whole of this range.

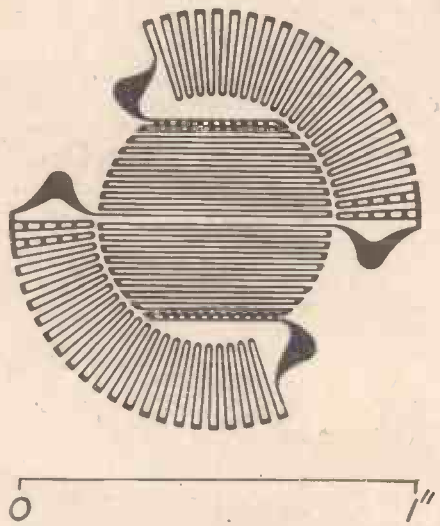


Fig. 4.—Four-gauge diaphragm developed in conjunction with the Admiralty Research Laboratory.

A Special Case

A difficult vibration problem was presented to David Brown and Co. Ltd., the gear specialists, in connection with the drive for an alumina kiln which, after some years of successful operation, developed alarming vibrations and could not be run at even half its normal speed. Loss of output was serious, and lengthy tests were carried out by the makers of the kiln without finding the cause of the trouble. This problem was particularly baffling because frequency of vibration at 120 per minute did not coincide with calculated critical frequency of 200 per minute. Preliminary examination revealed that the girth gears were seriously worn, frequency of vibration corresponding to frequency of tooth contact of the girth gears.

The motion of the kiln was examined with the aid of an extremely simple device, comprising a strip of linoleum fixed at the side of the girth ring, with a small electric motor mounted alongside, so that a revolving scriber fixed to the motor shaft made scratches on the linoleum at equal intervals of time. By measuring the distance between these scratches it was possible to plot speed/time curves. At all speeds below 50 r.p.m. audible vibrations did not occur, but motion of the kiln alternated between short periods of rapid acceleration, followed by longer periods, when the kiln, having overrun the drive, coasted with the girth gears out of engagement until the drive was again taken up. Therefore, instead of uniform load being transmitted by the gearing, the drive took the form of short hammer blows during which instantaneous load on the gearing sometimes rose to five times normal.

At a speed of 50 r.p.m. the character of motion changed, and violent lashing of the gears took place, accompanied by intense hammering noise. The motion curve shows that the normal sinusoidal curve to be expected with torsional oscillations was broken up into half-cycles separated by intervals where the girth gears were coasting between the driving and reverse flanks. The half-cycles corresponded to the calculated critical frequency of 300 cycles per minute, but the effect of excessive backlash in the girth gears, combined with clearance in the bearings of the pinion shaft, both due to wear, reduced effective natural frequency to 120 cycles per minute. This coincided with the girth gear tooth contact frequency at 50 r.p.m.

After the worn tooth profiles had been repaired, and after backlash in the girth gears and clearance in the bearings had been taken up, with improved lubrication provided for the open gears, satisfactory running conditions were restored at all speeds.

The Way to Spaceflight

A Report on the International Astronautical Congress, Held at Innsbruck

By ERIC BURGESS, F.R.A.S.

MAN is already well on the way to spaceflight! High-altitude rocket 'planes have carried pilots into regions of the atmosphere where space-equivalent conditions are met, missiles are available which could be modified to enable an uninstrumented radar-reflecting satellite to be established, and plans are in hand for the construction of a 10,000 miles an hour rocket bomber. These facts were revealed at last year's International Astronautical Congress at Innsbruck. In addition it was also announced that an Institute for Astronautics has been started as a department of the Stuttgart Technical College under the leadership of Dr. Eugen Sanger, a past-President of the International Astronautical Federation.

Biological Considerations

It was Dr. Strughold, head of the Department of Space Medicine, U.S. Air Force, who told delegates that man had already been into space. High-flying aircraft, such as the Bell X-1a and the Douglas Skyrocket, had carried their pilots so high that, as far as protection from low pressures, temperature extremes, and lack of oxygen was concerned, no more difficult conditions would be met with in space. From these aspects, the cabin of the high-altitude aircraft was essentially the same as that of a spaceship. Problems remaining were zero-g, meteorites, and cosmic rays. Dr. Strughold was of the opinion that zero-g would not present an insuperable hazard; men would "acclimatise" themselves to lack of weight. N. H. Langton, of the British Interplanetary Society, showed that meteorites might be thermally dissipated by bumper screens and Dr. H. J. Schaefer's paper concluded that cosmic rays, if they were to be hazards, would probably only be effective after prolonged exposure in space. From the biological standpoint the prospects of spaceflight seem good.

The Technical Aspect

Technically, however, it is another story. According to one American delegate, the necessary "hardware" is already available for the establishment of a satellite vehicle, but that is a long way from spaceships.

Dr. Dornberger—who was in charge of Peenemunde—announced that the United States were working on a project for a Mach 14 rocket bomber; that is a speed of just under half escape velocity. Dr. Ehricke, a colleague of Dr. Dornberger from Peenemunde and also now with Bell Aircraft, gave a design analysis of the possibilities of establishing a manned satellite. His conclusions were very different from those of Dr. von Braun. His satellite station would be much smaller, having a complement of only four men, while his freighter rockets were postulated as a more practical 600 tons compared with the 7,000-ton monsters envisaged by von Braun.

But military secrecy prevents one from giving any full appraisal of these various schemes. A lot depends upon how far military rocket workers have gone towards realising practical specific impulses which are a large fraction of the theoretical ones. Generally it is not known how efficiently large rocket motors can be made to operate. Unless we can be assured of a specific impulse from the larger motors in the region of 300 secs., the brute force of chemical propellants seems to be inadequate for any but the simplest of missions into space. This appears to be realised by a number of workers, and accordingly a fair proportion of time was given at the Congress to the discussion of ion rockets. Unfortunately, these propulsive systems, although economical in propellants, have to be operated in space, they even have to start from orbits beyond the atmosphere. Hence, until the chemical rockets can get man outside the atmosphere into the satellite orbit these efficient ion rockets and the other methods of atomic, solar and electrical propulsion, must remain only of theoretical interest.

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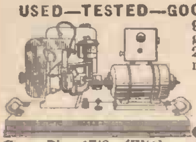

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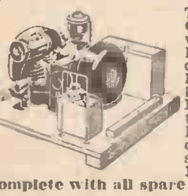

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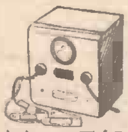

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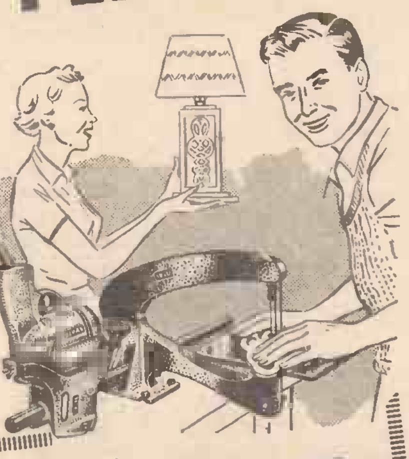

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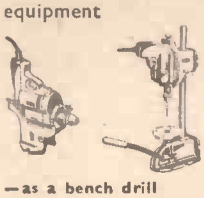

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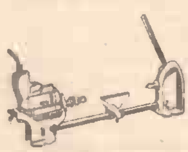

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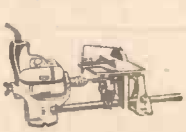

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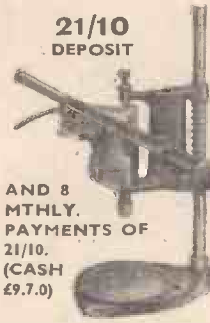

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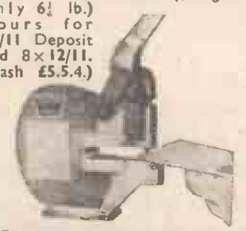

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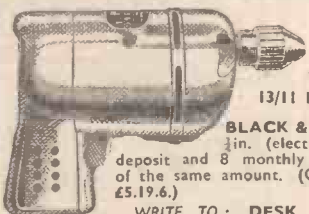

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FLYING SAUCERS

Facing Established Facts. The Contradiction of Those Facts by Certain Phenomena. The Question of Coincidence. Emergence of a Remarkable Hypothesis

By "THEORIST"

IT would seem appropriate at this stage in the "flying saucer" controversy to check a few salient points forming the nucleus of debate between the two opposing schools of thought.

These objects or phenomena are realities existing inside and/or outside our atmosphere. They are *not* hallucinations. Many hundreds of sightings are now on record, and in most cases have been witnessed by more than one person. Mass suggestion and mass hysteria are possible. The idea of mass hallucination verges on the ridiculous.

Fraud is ruled out, on the grounds that it would involve a wide scale conspiracy or falsification amongst people whose dispositions, both socially and intellectually, are entirely different.

The Evidence of Radar

Radar contact and tracking of unidentified objects has occurred. Whilst it is possible that a few atmospheric phenomena, such as special cloud forms or individual vortices, could convey the impression of solidity, the probability of such conditions being prevalent is very doubtful. Indeed, if such conditions were at all frequent, the utility of radar would be nullified.

Special atmospheric forms are not in the habit of racing back and forth across the sky in neat formation, nor of sudden ascent and descent, nor do they possess circular windows from which a strong steady blue light is emitted.

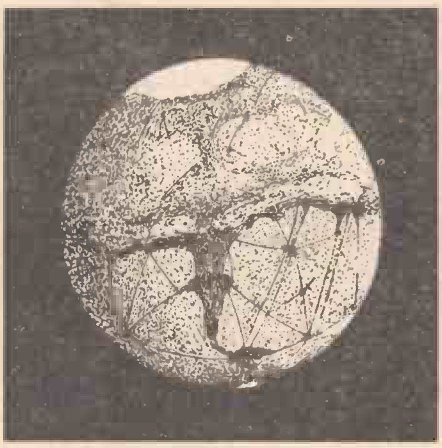
Radar hitherto has not recorded patches of reflected light, yet many people hold tenaciously to the idea that "saucers" are such patches. Their dilemma is obvious. They must either give up their "light saucers" and listen to the oracle of radar; or they must concede radar the ability to track the movement of reflected light. It is true, they may shift from one foot to the other, from light patches to atmospheric forms and vice versa, as the circumstances may demand; but, as a result, their hypotheses will take on the complexion of convenience first, with actuality a poor second. They will not convince themselves nor their listeners.

Meteors and Meteorites

Astronomical bodies in the form of meteors and meteorites enter the earth's atmosphere at great velocity and are either vaporised by air friction, or reduced drastically in size before crashing into the earth. Meteors are minute bodies similar in size to grains of sand. Their life in our atmosphere is one blaze of glory, extinguished in a few brief moments. They do *not* remain hovering over cities for lengthy periods. Meteorites, the much larger bodies, are somewhat longer lived. They may "clip" the atmospheric shell and escape, with little reduction in size due to vaporisation. To be capable of making such a passage, the meteorite must possess a tremendous initial velocity. In most cases, earth's gravity hauls the wanderer down in a curving path of flame, to his final resting place.

Meteors or meteorites do *not* possess return tickets, nor are they allowed to change their direction, once they are grasped by the gravitational force of our planet. They burn out or crash—and they do so quickly.

They do *not* play hide and seek around mountain tops, nor reverse their direction of travel alongside flying airliners. A stationary "mother" meteorite with a flock of mini-meteorites frisking about her and signalling to each other, is unknown to the science of astronomy.



Mars, the suspected habitation of sentient beings. It is fairly certain that life in some form, be it only vegetation, still exists on this planet. Parts of the "Canal" system have actually been photographed, thus confirming the reality of the lines witnessed by experienced observers. The polar caps, with their suggestion of ice and therefore possible water supply, are spectacular features of the planet. The Martian atmosphere possesses that all-important element —oxygen.

Some Interesting Happenings

Having looked at the reasonable limits to which natural and undirected phenomena may aspire, let us glance at two or three pieces of information, submitted in innocence by trained observers. These men, qualified in one of the most noble of the sciences, had no axe to grind, nor any pretensions towards becoming practical jokers or hoaxers. They witnessed these happenings, and faithfully recorded them.

On January 16th, 1818, Astronomer Loft, of Ipswich, observed a strange object near the sun's disc. It remained visible for close on four hours.

From September 6th to November 1st, 1831, Doctor Wartman and his observatory assistants recorded the presence of a luminous body. It was not observed in other parts of the world. This implies the close proximity of the object to the point of observation.

In March, 1868, Venus projected a narrow beam of light out into space. A similar phenomenon was witnessed by Webb during April. In June of the same year the staff of Radcliffe Observatory, Oxford, noticed a luminous object in the sky. It changed direction, halted, and behaved in general as though controlled by a reasoning being. Round about this time, Venus was near to the earth. It displayed a vivid red spot.

In June, 1873, apparent projection flashes from Mars were observed by Astronomer Galle, also by Doctor Sage, of Rybnik, Poland. An explosion occurred in our upper atmosphere. (Could this have been an unmanned experimental rocket from another planet? The odds against hitting a target the size of the earth, by sheer chance, at a distance of some 40,000,000 miles, are *truly* astronomical. It is comparable to taking a random shot at a tennis ball, situated a quarter of a mile away.)

There are many records of strange happenings out in space, long before this century dawned, and long before the era of high-flying aircraft and routine release of meteorological balloons. There are instances of bright objects leaving the moon and moving at great velocity out into space, long before present-day controversy over such assumptions. Many of these reports cannot be explained away by hiring terrestrial phenomena, or by the arrival of meteorites. To do so is asking too much of the overworked expression, "optical illusion."

Flying Saucer Landings

Editorial reviews are usually well reasoned and impartial. Such was the review given recently in PRACTICAL MECHANICS concerning the book "Flying Saucers Have Landed." This article in no way presumes to contradict or supersede that review. It is aimed solely at eliciting facts which cannot be ignored in speculating about "flying saucers" or similar phenomena.

The joint authors of the book referred to, Mr. Desmond Leslie and Mr. George Adamski, have come under heavy fire from all sides. Their integrity has been challenged, in so far as the space ship photographs are concerned. Nevertheless, it must be admitted that few inroads have been made on the convictions which they so stoutly defend. Discoverers and pioneers, or just ordinary mortals with an extraordinary tale to tell; all have met with doubt, ridicule and even worse, from the general public. It cannot be a pleasant position to be in. Certainly not one to strive for, at least.

A photograph of bright objects leaving the moon, or positioned between the camera and the moon, is claimed to have been taken by Adamski. Critics of its authenticity have pointed out that two of the objects do not come within the field of vision—therefore they give the impression of being *inside* the telescope. Why a person should strive for such a result is not mentioned. Neither is it mentioned that the two offending "saucers" appear very blurred compared with their companions. The lunar surface which forms the background to the line of objects, is very faint and is certainly *not* in true focus. Is it possible that the brightly shining objects *are* in correct focus—and much nearer to the earth than the moon?

The opinion that the Palomar observatory (Adamski lives in the vicinity), of all places, has never reported any "saucer" activity, whilst Adamski has been plagued with them, is amusing but misleading. The 200in. reflector has mightier game to hunt for than a few Solar System "saucers." Perhaps they may eventually tag on to an extra-galactic type—but nothing less!

Two sisters in a remote district of Europe encounter a strange man with long, dark hair reaching to his shoulders. They try to converse with him in two or three different languages. He does not understand them. He tries to explain himself by gestures and drawings. The girls do not know much about astronomy. Frustrated, the stranger reluctantly departs in a machine similar in form to the one reputedly photographed by Adamski.

Had these two young ladies just read a copy of "Flying Saucers Have Landed" and decided to play a practical joke? Only they know, but if they had never heard of Adamski or his visitor, then the case for a visitor from space is considerably strengthened.

A peculiar fact associated with "saucer" reports is that they often mention the machine as creating a noise similar to a large humming-top or an organ. No flying machine so far disclosed, has this characteristic.

A previous report in Europe made by a man and his child, the report by Adamski, and one other report originating in North America, all mention one thing in common about "flying saucers" encountered on terra firma. In each case these small ships appeared to be manned by a crew of *two*. Now whether *two* is a favourite number for practical jokers is highly questionable.

A Question of Mass

To continue our short experiment in factual analysis, let us for the moment grant the Palomar Venusian an existence and consider part of the evidence submitted by Mr. Adamski.

The main point, overlooked by most critics, is that relating to the footprints of the visitor (he apparently took great pains to communicate their importance to his host). Adamski asserts that the impressions left by the visitor were in all cases deeper than those left by himself. As the stranger was described as being slightly below average height and Adamski appears to be quite a heavily-built person, it suggests a marked difference in the physical constitution of the two men.

This difference, coupled with the stranger's clear assertion that he came from a planet in the second orbit, is held out as proof of the visitor's Venusian origin. It is assumed that an inhabitant of Venus (whose mass is 0.817 that of the earth), would automatically weigh more on the earth than a native. This in itself is a false premise from which to argue.

All matter possesses mass and is attracted to the earth with an acceleration of 32ft./sec./sec. This acceleration is usually termed *g*. The force with which the earth attracts an object is expressed as the object's mass *m* times *g*. This force is known as the *weight* of the object (*mg*). As the earth is an oblate spheroid in form (flattened slightly at the poles); the value of *g* varies from place to place on the earth's surface, being greater at the poles (983.216 cm./sec./sec.) than at the equator (978.03 cm./sec./sec.). The main cause for this difference is due naturally to the polar surface being nearer the earth's centre of gravity than the equatorial surface. Polar diameter: 7,900 miles. Equatorial diameter: 7,927 miles. A body weighed (by spring balance, of course) on the equator and then again at one of the poles, will register an increase in weight at the latter. The weight of a body varies with the value of *g*, *but not its mass*. The mass of a body is invariable and indestructible, whether the body be placed on the earth or any other planet in existence.

Venus at the crescent phase. It possesses a dense atmosphere composed largely of carbon dioxide, but the planetary surface has never been observed. High layers of white cloud appear as bulges at the limb of the planet and lower layers of dark cloud create apparent depressions at the limb. The irregular extension of the horns and the terminator (i.e. division between light and dark) is due to the diffusion of sunlight through the upper atmosphere.

If two beings, say a Venusian and an Earthling, are of the *same mass*, then provided they are weighed in the same place, their weights will be equal. If human beings anywhere in the Universe, are the *same density*, then Adamski's visitor, being the smaller man, should have been lighter than Adamski.

The idea that a Venusian possesses greater mass than an Earthling is incompatible with their respective planetary characteristics. The earth's mass is decidedly greater than that of Venus; therefore, if a difference in mass *did* exist between their inhabitants, it is logical to attribute the greater mass to the Earthling. Thus, on a second count, the Venusian's footprints should have been shallower than those of his temporary host.

The only alternative which meets the evidence submitted by Mr. Adamski is to concede the stranger a greater mass than an inhabitant of our planet, and thus originating from a planet of a larger mass than the earth. Mercury, Venus and Mars, are immediately ruled out. Uranus, with a mass 14.6 times that of the earth, seems to be the only reasonable proposition in the solar system. This planet, however, lies in the *seventh* orbit—not in the *second*, as the stranger apparently insisted.

Yes, we know, there must be a vast number of second orbit planets, scattered amongst the 100,000 million suns of our stellar universe. Many will possess just that sufficiently greater mass than the earth, to suit our rather startling hypothesis—but for the present, our speculations are confined to interplanetary not inter*stellar* possibilities.

The process of extracting and segregating the probable and impossible from the ever-growing accumulation of "flying saucer" stories is a difficult task—but well worth the effort involved. That there are phenomena occurring inside and outside our atmosphere cannot be denied.

Experimental Light Alloy Sledges

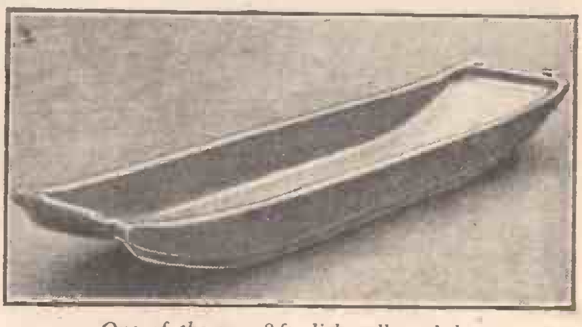
DETAILS have been announced of a revolutionary type of sledge—built in the shape of a punt and fabricated entirely from aluminium alloy—which was tested under actual working conditions by a British (Sherborne-Cambridge) Spitsbergen Expedition 1954.

The idea originated with the organiser of the expedition, Dr. G. T. Wright, M.A., and the sledges were hand-made from rough sketches by Elms Metals, Ltd., using various aluminium alloys supplied by James Booth and Co., Ltd.

Three sledges were constructed—one 12ft. long and two 8ft. long—the main shells each being formed from a single sheet of 16 s.w.g. thick M.G.5 alloy. They are each 2ft. wide and 8in. deep, and run on runners 2in. high and 2½in. deep, riveted to the main shell. The runners are constructed from Duralumin "H" extruded top-hat section.

A report on these experimental sledges says that for soft snow it may be advisable to fit aluminium-alloy ski-runners on 6in. pillars below the main shell.

A snag with Arctic camping is obtaining water, as melting snow or ice is a long process and also expensive in paraffin. The "boat" shape of the new sledges makes them suitable as water reservoirs and, each time the expedition camped in one place for any length of time, the sledges were filled with snow which the sun soon melted, through direct insolation and radiation from the aluminium. This saved countless hours, and facilitated rapid starts.



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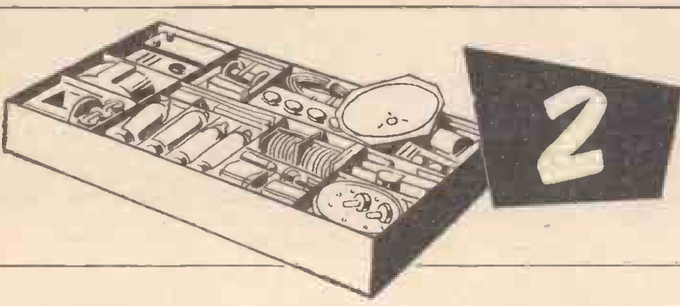

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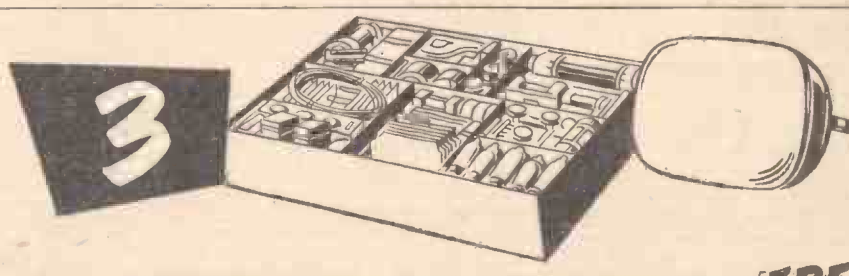

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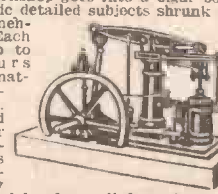

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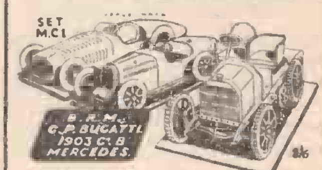

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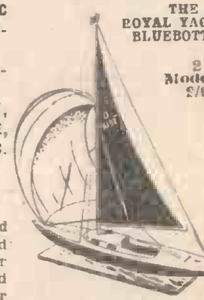

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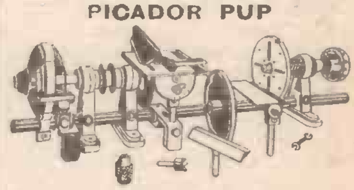

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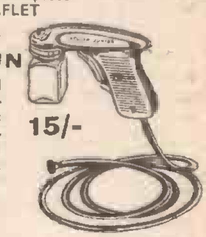

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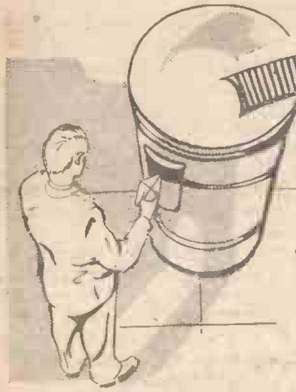
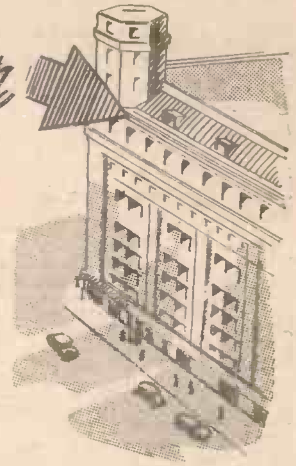


Letters to the Editor



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

The Optophone

SIR,—Mr. G. T. West enquires in the November issue of PRACTICAL MECHANICS for information about the Optophone which enabled the blind to "read" ordinary printed books.

The "reading" action of this machine was performed by a number of spots of light which scanned the printed page and operated mechanism to produce musical cadences and chords characteristic of the letters scanned.

A brief description of the device without any constructional details is given at page 53, in "Light and Colour," by R. A. Houston, published in 1923 by Longmans, Green and Co. A photograph of the machine is given at page 68 in the same book.

The machine was invented by Dr. Fournier d'Albe, in 1912, and was developed, greatly improved, and marketed by Messrs. Barr and Stroud, Ltd., of Anniesland, Glasgow, W.3, who could, no doubt, provide further details.—J. M. FERGUSON (Dunbartonshire).

The Art of Thatching: Making Firelighters

SIR,—Our attention has been drawn to a small article appearing on page 12 of "The Cyclist," November, 1954. It is part of an article by H. W. Eley, and is headed "The Art of Thatching."

I should like to correct the impression conveyed by the first sentence of this article which states:—

"I almost wrote the lost art, for there is not very much thatching done in our land to-day, and it is a pity, for in the old days the thatcher was indeed a skilled craftsman, and nothing was more delightful in the country scene than the evidence of his patient perfect work."

It may interest your readers to learn that there are at present between 700-800 thatchers at work in England, and that these thatchers are so fully occupied that there is a lot of work waiting to be done for which there is not enough time. Interest in this craft has been growing since the war, and hence the shortage of skilled men to perform it, but to suggest that it is a dying craft gives a very wrong impression.

Our attention has also been drawn to a reply to a letter in the November, 1954, issue, dealing with the making of firelighters.

At the end of the article it is stated that Leaflet No. 9 can be obtained from the Rural Industries Intelligence Bureau, 258-262, Westminster Bridge Road, London, S.E.1. The organisation referred to was in existence in the early 'thirties, but has since changed and expanded, and has now become the Rural Industries Bureau, 35, Camp Road, Wimbledon, S.W.19.

The leaflet you refer to dated from that period and has been long out of print, but we do have a stencilled leaflet which might fulfil the purpose of the previous one.—THE RURAL INDUSTRIES BUREAU (S.W.19).

[*We reprint the leaflet mentioned on page 202.—*ED.]

A Practical Workbench

SIR,—In reply to Mr. R. Wallace (Information Sought, November, 1954), from the timber merchants obtain "planed" wood of the following dimensions and quantities:—

3 pieces 4ft. × 8in. × 1in. for bench top (A).
2 pieces 4ft. × 7in. × 1in. for side supports (B).
4 pieces 2ft. × 4in. × 1 in. for bench top supports (G).
2 pieces 22in. × 6in. × 1in. for rails (D).
1 piece 4ft. 2in. × 4in. × 1in. for stretcher (E).
4 pieces 2ft. 6in. × 3in. × 2in. for legs (M).
Bolts, screws, nails, for assembly.

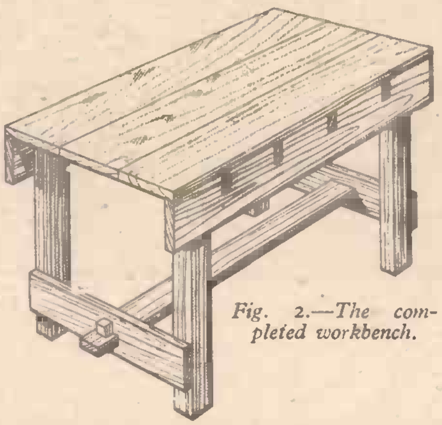


Fig. 2.—The completed workbench.

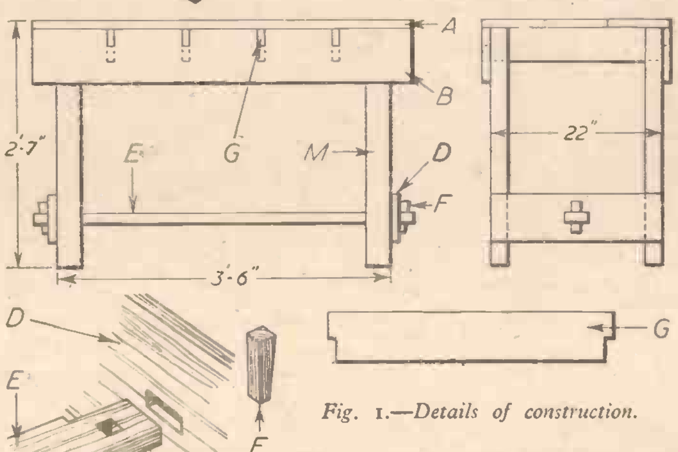


Fig. 1.—Details of construction.

Proceed as follows:—First make the end supports, using 2 pieces (M) in Fig. 1, to which nail or screw at the top one piece (G) with ends cut as shown. Lower rail (D) is "slotted" to receive ends of (E) which again is tongued and slotted as shown to receive key pegs (F). Having completed both end supports, now prepare side supports (B), cutting four slots at equal distances to take ends of (G). Make sure that slots on both sides are true. Having cut all slots and prepared all parts for assembly, place ends of stretcher in respective slots, turn frame on its side and screw on side support (B). Turn frame over and place the remaining two top supports (G) in position and lay the other piece (B) in place. Now screw together. Finally bring to upright position and place boards (A) on frame. These should be planed smoothly, fit snugly and be screwed where necessary for strength. The completed bench is shown in Fig. 2.

It will probably be found easier to buy and fit a carpenter's bench vice than to attempt to make one. A suitable vice may be obtained from Buck & Ryan, Ltd., 261, Edgware Road, London, W.2.—R. B. G. (Ilfracombe).

Electro Osmosis

SIR,—With reference to Mr. Parsons's query regarding "Electro Osmosis" (November, 1954, issue).

This system is properly known as "The Ernst Damp Proofing System." It consists, very briefly, of a series of electrodes in the walls and conductors in the earth. The electrodes, which are spirals of thick copper wire, penetrate the walls to be treated two-thirds of the thickness. The earth conductors are of the same material and penetrate the ground distances up to 6ft. according to the severity of the dampness.

A chase is made in the walls behind the skirtings in which the connecting wires are laid, afterwards being filled in with cement mortar to make the walls solid again. The principle of Electro Osmosis is that moisture flows between two conductors, but only in one direction, so that moisture will not leave the neighbourhood of the negative pole (buried in the ground) and so prevent the further supply of moisture to the walls.

This system is a positive cure for dampness, but, in my opinion, before resorting to it Mr. Parsons should repair the broken damp course, increase the ventilation under the floor, by installing more air-bricks, and hack off and renew any saturated plaster, this last being the cause of walls being damp even after the moisture has been prevented from rising. In conclusion, may I say, that Electro Osmosis is a job for the expert. The firm who do this work are Silicaseall, Ltd., of Newcastle-on-Tyne.—N. F. PRITCHARD (Birmingham).

A Novel Cycle Drive

SIR,—I have been studying the "Novel Cycle Drive," by Mr. D. V. Priest, illustrated in the December issue of the "Cyclist."

The writer claims that the rider has a choice of nine gears. Although nine combinations of gear positions are available, the actual number of ratios obtainable is five.

He stipulates the use of Sturmey-Archer A-W standard ratio three-speed hubs in which the ratios obtainable are as follows:

Middle gear—direct drive. High gear—

1.333 of middle gear. Low gear—.75 of middle gear.

Now suppose both hubs to be set to middle gear, i.e., input and output at equal velocity, then the overall " gear " obtained, assuming a 26in. diameter rear wheel, and using the sprocket sizes shown, is given by $\frac{46}{18}\times\frac{14}{14}\times\frac{20}{18}\times$ 26, which is 73.827. The overall ratios in all positions are now given as follows :

Hub "A"	Hub "B"		Final "gear"
High	High	73.827 × 1.333 × 1.333	131.248
High	Middle	73.827 × 1.333	98.436
High	Low	73.827 × 1.333 × .75	73.827
Middle	High	73.827 × 1.333	98.436
Middle	Middle	73.827	73.827
Middle	Low	73.827 × .75	55.371
Low	High	73.827 × .75 × 1.333	73.827
Low	Middle	73.827 × .75	55.371
Low	Low	73.827 × .75 × .75	41.529

Some juggling of the controls would appear to be necessary to obtain progressive increases or decreases of ratios, but the main objection seems to be the excessively wide differences in ratio at the upper and lower ends of the scale.

As these hubs are made in medium and close ratio types, careful selection would minimise the last-named objection, whilst the choice of two hubs of *different* ratios would provide the rider with a true range of nine speeds with closer ratios at the upper and lower ends of the range, thus improving riding comfort.

The only other point I have to make is that an improvement in appearance and compactness could be made by mounting hub " A " on the seat tube immediately below the free running shaft " C," also making for some reduction in weight owing to the shorter chains in use.—V. N. SPENCER (Bristol).

Visitors from Space

SIR,—The comment and review about visitors from space prompts me to write.

We on this planet have conquered flight for just over 50 years, and now contemplate space travel. Other beings on other worlds may have started their form of life thousands, or even millions, of years before our progress commenced. Space travel to them may be as flying around the globe is to us, and their interplanetary travel perfected beyond our dreams.

If, then, these visitors are so far advanced, maybe their outlook on life here can be compared with our looking at animals in a zoo.

What is the nature of their visitations ? Equally, what is the purpose of our going to Mars, or any other planet ? The answer is surely, curiosity—quite a common ailment !

Re. your comment about arresting the occupants of these craft, I do not think anyone would attempt such a fruitless effort, even if the visitors did come from this world, which is highly improbable.

About your review of Cedric Allingham's book, it looks suspiciously as though he has been influenced by Mr. Adamski.—G. R. ANDERSON (Liverpool, 14).

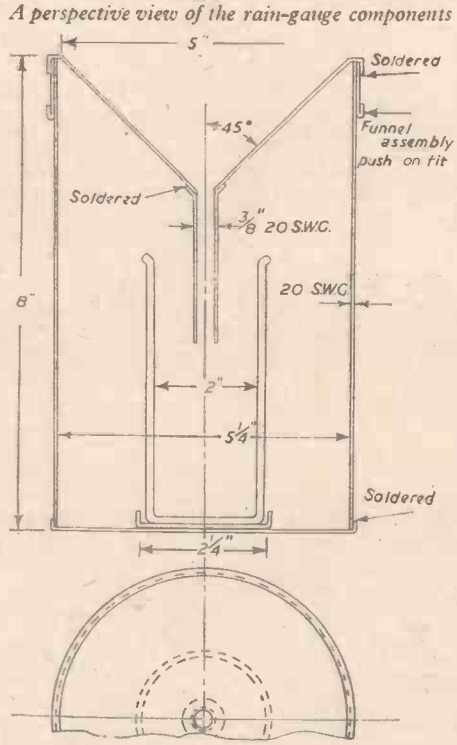
A Rain-gauge

SIR,—The purpose of a rain-gauge is to measure the depth of rain that has fallen over the whole of the surrounding area. As it is impracticable to make an instrument to do this literally, a small area is chosen and the rain falling on this is measured. In order to make the reading as accurate as possible, the graduations of the cylindrical glass measure must be carefully calculated to represent the rainfall over the mouth of the funnel, and every precaution must be taken to prevent evaporation of the contents.

The rain-gauge shown in the illustration is made from 20 s.w.g. copper sheet. This can be formed round a large tin and lap-jointed and soldered. The base can be hammered into shape over a wooden block of the correct diameter, after the copper has been softened.

The funnel is also made by cutting out a circle of copper sheet 7½in. in diameter and is also jointed by a lap-soldered joint. The tail-pipe is a piece of ⅜in. 20 s.w.g. copper tube

A perspective view of the rain-gauge components



Constructional details of a rain-gauge.

with end swaged and soldered on to the funnel.

In the bottom of the gauge is a glass beaker which is stood in a small copper dish to keep it central; the beaker will have to be whatever is to hand. A parallel-sided half-pint beer glass or something similar is suggested.

Note that the rain-gauge so described is manufactured from copper sheet. This is rather expensive material, and if a suitable can of similar dimensions is available, and a tinplate funnel fitted, I cannot see many objections except that of corrosion.

The graduations on the glass measure will be as follows : for a funnel of 5in. effective collecting diameter, as shown, a glass beaker of 2in. inside diameter must be graduated so that a height of liquid in the measure of 1.562in. represents a rainfall of ¼in.

It is suggested that in order to ensure that the readings are as accurate as possible the rain-gauge should be placed in the open as far away from buildings as possible and fitted into an open-topped, well-ventilated wooden case.—E. W. DEAN (Leeds).

Passing H.F. Current Through Water

SIR,—Further to your correspondent E. B. Hooper's letter in " Your Queries Answered " (December issue), concerning high-frequency current to be passed through water.

I agree with your remarks that low voltage, high amperage would be quite suitable, but, unfortunately, this method would probably prove somewhat expensive. It will be appreciated that to carry the heavy currents required the conductors must be sufficiently robust and copper being so expensive this may make this system uneconomical.

In the writer's opinion a better method would be to transform 50 c.p.s. current to whatever figure was thought desirable, and then to obtain high-frequency alternating current by way of a spark-gap in conjunction with a tuned circuit.

By this method many thousands of volts may be obtained, and by a suitable arrangement of the tuned circuit the current may be taken well out of the lethal range. For example, frequencies over ½ Megacycle being quite common.—G. V. WATSON (Birmingham, 31).

Making a Free Pendulum Electric Clock

(*Continued from page 212*)

the armature (N, Fig. 1) arrives above it, and the position of the counterbalance weight, bearing in mind that a good firm pressure at the two contacts is necessary for obvious reasons.

The lower contact is carried on a short strip of clock spring (Fig. 5 A) and supported by a separator and 6BA screw, screwed into the base. On the same screw a soldering tag forms one of the two poles of the switch, the other being provided by a soldering tag held by a 6BA screw which passes through the base into a 6BA hole tapped into the bottom of the pivot bearing. The back stop of the switch is provided by a further 6BA screw passing through the base which is tapped to receive it at the position shown in Fig. 5 A. A small piece of cycle valve tubing was fitted over this screw as a silencing device ; there is a loud click otherwise.

The whole switch is supported by a piece of ¼in. brass rod threaded 4BA, which is screwed into the base and gripped by a nut, this rod passing into a pillar formed by a 1in. length of ⅜in. brass rod drilled to accommodate it, and held by a set screw, the other end of this pillar being tapped 2BA and the whole supported by a countersunk 2BA screw passing through the platform. By this method the height of the P.M. and its proximity to the pendulum armature can easily be adjusted.

The motor coil is supported and adjusted in a similar manner and the sketch (Fig. 5) is self-explanatory. The value of the coil is approximate and the distance between the centres of the coil and the permanent magnet is the distance the pendulum will swing, though this point will be discussed again later.

(*To be continued*)

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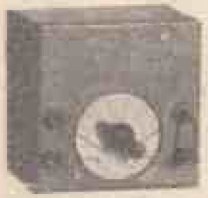

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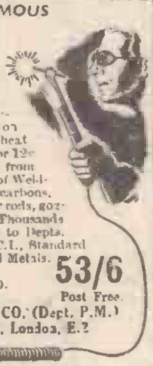

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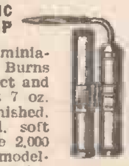

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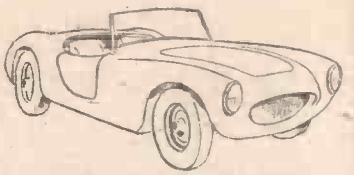

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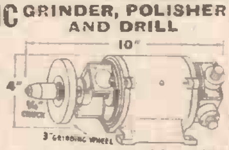

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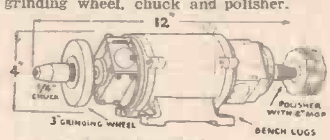

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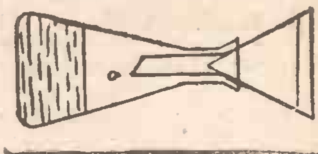

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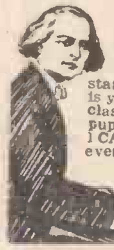

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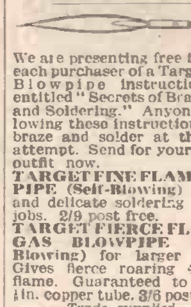


We are presenting free to each purchaser of a Target Blowpipe instructions entitled "Secrets of Brazing and Soldering." Anyone following these instructions can braze and solder at the first attempt. Send for your brazing outfit now.
TARGET FINE FLAME BLOWPIPE (Self-Blowing) for all fine and delicate soldering and brazing jobs. 2/9 post free.
TARGET FIERCE FLAME GAS BLOWPIPE (Self-Blowing) for larger jobs. Gives fierce roaring 4-inch flame. Guaranteed to melt ⅛in. copper tube. 3/6 post free.
Trade supplied.
TARGET MFG. CO. (P),
Wollaston, Wellingborough.

Price £9 15s. 0d. Carr. Extra

The 'Adept' Bench Hand Shaper
Length of stroke of ram 3½ins.
No. 2 Shaper, 6¼in. stroke.
Price £17 17s. 0d.
Ask your dealer
Machine Vice £1. 6s. 6d.

Price £6 0s. 0d.
The SUPER 'ADEPT' LATHE 1⅞in. centres, 6in. between centres.
Postage and packing 4/- (U.K.). The 'Adept' 2¼in. ⅜in. B.S.F. 4-Jaw Independent Chuck. Reversible Jaws, 40/-.
A good Range of Accessories is available
Manufactured by
F. W. PORTASS MACHINE TOOLS, LTD.
ADEPT WORKS, 55, MEADOW STREET, SHEFFIELD. 3.

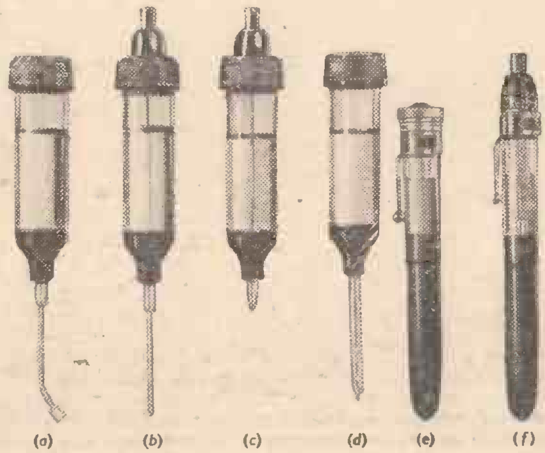
ACCURATE HARDHITTING
Webley AIR PISTOLS

AIR RIFLES · ACCESSORIES
Write for catalogue WEBLEY & SCOTT Ltd. 106, WEAMAN ST., BIRMINGHAM 4, ENGLAND

Trade Notes

"Superspeed" Soldering Iron

FROM Messrs. Enthoven Solders, Ltd., Enthoven House, 89, Upper Thames Street, London, E.C.4, we have received a leaflet describing their new soldering iron. Many advantages are claimed for it: it heats up from cold in six seconds and, when not in use, current is automatically switched off; it will work from a car battery and is more powerful than the conventional 150-watt iron. It is 10in. long, weighs 3½ oz., can be used on 2.5 to 6.3 volt supply. A four-volt transformer is normally supplied. The price of the iron is 39s. 6d., the transformer (optional) costs 31s. 6d., a replacement element is available at 1s. and a replacement copper bit at 10d. We have also received a catalogue listing other soldering products by this firm, including cored and solid wire solders, cored and solid solder preforms, various forms of solid solders, solder paints and fluxes, etc., etc. This catalogue and any further information is available from the above address.



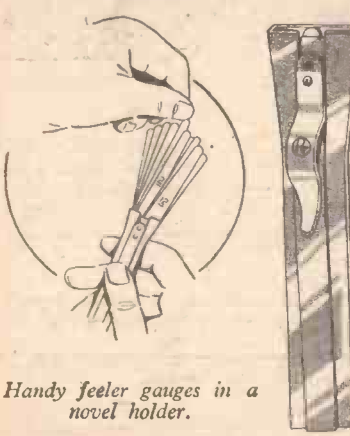
Examples of Ideal hand oilers.

New Micromodels

FROM Micromodels, Ltd., 3, Racquet Court, 114-115, Fleet Street, London, E.C.4, come details of their latest three-dimensional volumetric models in card. To their already extensive range of architectural, marine, locomotive, industrial and aeroplane models have been added the Capitol, Washington, at 4s. and the White House at 3s.

Feeler Gauge Sets

THE set of feeler gauges shown below is only a sample of the comprehensive range made by Rubert and Co., Ltd., Chapel Street, Levenshulme, Manchester, 19. The advantage of these gauges is that the blades are not easily damaged as the sets are not of the fan type, but if they do become bent or otherwise spoiled, they can be readily withdrawn for replacement.


Handy feeler gauges in a novel holder.

Loose blades may be obtained in 30 thicknesses and there are special sets of selected blades for motorists.

Ideal Hand Oilers

THESE oilers, which are made by the Ideal Machine Tool and Engineering Co., Ltd., 282, Kingsland Road, London, E.8, are provided with a transparent cylinder which reveals the amount of liquid available at any time. The types shown are very handy, and, as will be seen, some are equipped with a clip for the pocket.

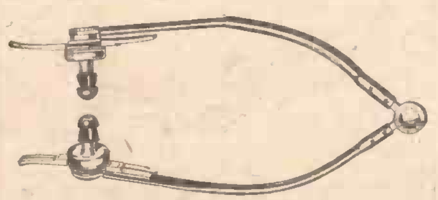
The types shown at *a*, *b*, *c* and *d* have a capacity of half fluid oz. and weigh approximately ¾oz. With *a*, after removing the ferrule, the required amount of liquid can be dispensed in drops by pressing on the rubber diaphragm. With types *b* and *c*, by pressing the plunger one drop is released every time and by pressing on the needle (in front of the spout) in type *d* a small drop is released. If, however, a larger amount is required the diaphragm on top of the oiler should be pressed at the same time. Type *e* is similar in design to type *d* but has a protecting screw cap, whilst type *f* is similar to type *c*, but also has a protecting screw cap. The capacity of the last two types is only 1/5oz.

Bassett Lowke Catalogues

WE have received the 1955 editions of these well-known publications from Messrs. Bassett Lowke, Ltd., 18-25, Kingswell Street, Northampton. The Model Railways catalogue contains the usual wide selection of model locomotives, rolling stock, track, stations and accessories and in addition lists designs and materials to interest the model-maker. Many more items of this description, however, are listed in the Model Shipping and Engineering Catalogue, which contains details of miscellaneous materials, components and designs available for all branches of model engineering.

Radio Stethoscope

THE stethoscope shown below has a variety of uses in the car as well as the home. Briefly, the Stethophone, as it is called, enables a wireless set to be heard individually without the need for connecting wires. Although they are entirely non-electrical in construction, a volume control is supplied for each earpiece and the total weight of the Stethophone is less than 2oz.


Ingenious headphones that allow for individual listening to the radio.

When used with a normal radio receiver a step-down transformer feeds a loop of wire round the inside of the room or car and the 'phones will pick up a signal from this wire although there is no direct connection. It is thus possible for individuals to listen to the radio without disturbing other people. Prices of the 'phones are two or three guineas for the standard and lorgnette types, respectively, and the matching transformer costs 12s 6d. Makers are The Magnetic Broadcasting Co., Ltd., Suffolk Hall, 1, Upper Richmond Road, London, S.W.15.

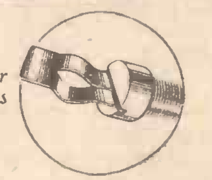
"Shirene" Plastic Piping

AN end to the damage and inconvenience caused by burst water pipes in winter may result from the introduction of a new range of virtually indestructible plastic tubing for domestic or industrial plumbing and for all cold liquid conveyance. Available from Shires & Company (London), Ltd., of Guiseley, Yorks, in all standard sizes up to 12in., it is claimed that the new "Shirene" piping possesses not only sufficient elasticity to withstand high pressures and the expansion of water into ice, but complete immunity to corrosion by acids, alkalis, salt water and chemical solution. Light, flexible and easy to handle, it enables long runs to be made without jointing at substantially lower material and installation costs.

The new tubing is supplied in two alternative gauges—normal and heavy. Standard screwed and compression joints may be used with the latter, but the normal gauge cannot be threaded, and compression sleeve jointing is, therefore, recommended. Alternatively, both gauges can be very easily butt welded by softening the ends near a source of radiant heat and pressing them together.

Useful Starting Screwdriver

THE small screwdriver shown on this page has many obvious advantages for starting screws and bolts in awkward places. The blade of the device is in two parts which are not parallel. The blade ends are pinched together and forced into the screw or bolt slot which is then tightly held by the blades pressing outward. Once the screw has been located, an orthodox screwdriver is used. The tool costs 9d. and is made by Elms Garage, Rednal Road, West Heath, Birmingham, 31.



A useful screwdriver for starting screws and bolts in awkward places.

Midget Fire Extinguisher

IT is a sensible precaution to carry a fire extinguisher on a car or a motor cycle, and it is always possible that it might be found useful in the home workshop. The Kwik miniature extinguisher is eminently suitable for dealing with smaller outbreaks of fire and occupies very little space. The Kwik is 5¼in. high and 1½in. in diameter, while its weight is only about 8oz. The extinguisher may be turned on and off at will and is guaranteed for 20 years. Refills are carried out by the suppliers. Price of the Kwik Midget is 39s., with other models costing up to 75s. Makers are the Savant Chemical Laboratories, Ltd., 32, Hamilton Avenue, Glasgow, S.1.

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.

The Dyeline Process

I WISH to make some prints of working drawings from tracings to mount on cardboard. In this way they could be varnished or treated to withstand considerable use and wear. I would prefer dark lines on a white background instead of the normal blueprint. The largest paper needed would probably be 11in. by 15in.

Can you give me details of some simple piece of apparatus for making a print from the tracing in the same way as a photo copying machine? Peter J. Wright (Cumberland).

THE process you require is known as the dyeline process. A light box will need to be constructed, slightly larger than the size you intend to work. The top should be fitted with a plate glass sheet on which is laid the tracing and then the sensitised paper (Hall & Harding, Kingsway, London); these two are pressed flat by means of a felt-faced board suitably clamped down. The lighting in the box, which should be ventilated, must be as powerful and even as possible. A series of blue fluorescent tubes should be used here.

The exposure time depends on the lighting used and you will have to arrive at this by trial and error.

Developing is done by placing the exposed print, loosely rolled up, in a fume-tight box in which is placed a dish of concentrated ammonia. A suitable preservative for your mounted prints would be white spirit varnish or clear cellulose lacquer.

Filling a Liquid Compass

PLEASE tell me how I can fill a liquid compass (type Pqm AFT), 4in. approx., cheaply and satisfactorily. I had thought of using surgical spirit introduced through the plug aperture with the aid of a hypodermic syringe, but I am not sure how to eliminate air content. —W. H. Starbuck (London, E.13).

SURGICAL spirit is the liquid used. Fill the casing to overflow, you should have no difficulty overcoming air, all air will be displaced by the alcohol. All compasses take apart. Merely unscrew the cover and fill up. You can immerse the whole casing in a cup of surgical spirit if you find this easier.

Finish for Duralumin

I HAVE constructed three model cabin type of motor-launches from duralumin sheet. Their hulls have been given various treatments prior to finishing painting, but I have had trouble with flaking. Can you help me?—A. Ridley (Newcastle-on-Tyne, 6).

ALUMINIUM and all aluminium alloys, such as duralumin, seem to oxidise on the surface even when protected with paint or lacquer, and the rougher the surface the more rapid the effect. Obviously, the oxide separates the paint from the plate, with the result that the paint flakes off. Differences in the ratio of expansion of the paint and the plate assist in the separation, too. The best suggestion which we can make is that you abolish the painting, also lacquering, and finish the model hulls in the bare metal. Bring the surface up to a brilliant polish; metal polish and finish with rouge if necessary. All metal will remain bright, even steel, if it is thus treated.

But if your hulls must be painted, and in certain colours, there seems to be no alternative to wood. Build up in yellow pine or obechi, bread-and-butter fashion, using 1in. thick planks cut out on jigsaw machine inside and out, and gluing together, after cutting, with casein glue. By this method there is very little work required to finish and no gouge work on the inside. But try out the bare polished metal duralumin first. Take a clean dry cloth when you sail a vessel to wipe it dry when taken from the water.

THE P.M. BLUE-PRINT SERVICE

12FT. ALL-WOOD CANOE. New Series. No. 1, 3s. 6d.*

10-WATT MOTOR. New Series. No. 2, 3s. 6d.*

COMPRESSED-AIR MODEL AERO ENGINE. New Series. No. 3, 5s.*

AIR RESERVOIR FOR COMPRESSED-AIR AERO ENGINE. New Series. No. 3a, 1s.

"SPORTS" PEDAL CAR. New Series. No. 4, 5s.*

F. J. CAMM'S FLASH STEAM PLANT. New Series. No. 5, 5s.*

SYNCHRONOUS ELECTRIC CLOCK. New Series. No. 6, 5s.*

ELECTRIC DOOR-CHIME. No. 7, 3s. 6d.*

ASTRONOMICAL TELESCOPE. New Series. Refractor. Object glass 3in. diam. Magnification x 80. No. 8 (2 sheets), 7s.*

CANVAS CANOE. New Series. No. 9, 3s. 6d.*

DIASCOPE. New Series. No. 10, 3s. 6d.*

EPISCOPE. New Series. No. 11, 3s. 6d.*

PANTOGRAPH. New Series. No. 12, 1s. 6d*.

COMPRESSED-AIR PAINT SPRAYING PLANT. New Series. No. 13, 7s. 6d.*

MASTER BATTERY CLOCK.* Blue-prints (2 sheets), 3s. 6d. Art board dial for above clock, 1s.

OUTBOARD SPEEDBOAT. 10s. 6d. per set of three sheets.

LIGHTWEIGHT MODEL MONOPLANE. Full-size blue-print, 3s. 6d.

P.M. TRAILER CARAVAN. Complete set, 10s. 6d.*

P.M. BATTERY SLAVE CLOCK, 2s.

"PRACTICAL TELEVISION" RECEIVER (3 sheets), 10s. 6d.

P.M. CABIN HIGHWING MONOPLANE. 1s.*

P.M. TAPE RECORDER (2 sheets), 5s.

The above blue-prints are obtainable, post free, from Messrs. George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

*An * denotes constructional details are available free with the blue-prints.*

Camera Queries

I WISH to make a small oval-shaped camera and would like to know if you could help me with the following points:—

(a) Has the shutter to be a certain distance from the film?

(b) Has the viewfinder to be in any particular position on the camera?

Can I get a blueprint or book on this subject?—J. McGregor (Belfast).

THE distance between shutter and film is in no way important. With simple single-glass lenses the shutter is usually placed immediately before or behind the lens. If a better lens with two or more glasses were used the shutter would normally be between the individual lenses, but this position is not essential.

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.

The distance between lens and film is, of course, very important. It may be found by holding a ground-glass screen in the position normally occupied by the film and discovering by trial the exact distance required for sharp focus. The usual "fixed focus" simple camera is focused at about 30ft. If it is desired to focus on near objects an adjustable lens mount is required. A lens of small aperture (F/16 to F/11) will, however, render all objects between about 8ft. and infinity sharply on the negative.

If a simple lens is used, a diaphragm with small hole should be placed close behind or in front of it to improve definition. If the diameter of this aperture is divided into the distance between lens and film this will give the F number, and a range of usual apertures can be arranged if desired.

The viewfinder position is not important for ordinary shots. It must embrace the same field of view as the lens.

Cold Resin Moulding

PLEASE send me details of cold resin moulding. I wish to reproduce a series of figures all to the same scale (6in. tall) and should be using rubber, metal and plaster moulds. Colour is not important, though an opaque casting would be preferred.—A. Kelk (Norfolk).

I.C.I., LTD., Plastics Division, Black Fan Road, Welwyn Garden City, Herts, are manufacturers of cold-setting resins and issue pamphlets dealing with their use. There is a special pamphlet on flexible moulding.

For supplies in small quantities you might contact Messrs. Scott Bader and Co., Ltd., 109, Kingsway, W.C.2, who also issue a considerable amount of data on these resins.

Dissolving Scrap Celluloid

I HAVE been trying to make clear varnish, using equal quantities of amyl acetate, acetone and scrap celluloid, but cannot get the celluloid to dissolve. It is the ends from Kodak and Ilford roll film.—J. Bonson (Abergele).

IF your film is really celluloid (and we think it is more than likely that this is so) and

(*Continued on page 228*)

SPECIAL OFFERS

VENTAXIA EXTRACTION FANS.—230-250 volts, 50 cycles. Bakelite cased, 6in. blades, silent running, 90/-. Post 2/6.

BLOWER MOTORS.—Dual voltage 12-24 volts. No. 10KB/115, recommended for car cooling or heating, 25/-. Post 2/-.

HEADPHONES HIGH RESISTANCE.—4,000 ohms. New, 12/6 pr., post 1/6.

AIR COMPRESSORS.—60 lbs./sq. in. Ex R.A.F. Brand new size 9in. x 5in., ½in. splined shaft, 37/6, post 2/6.

TERRY ANGLEPOISE LAMPS.—Complete with flex and S.B.C. holder, shade, etc. Will stay put in any position, wall or machine fixing, 35/-, post 2/6.

TELEPHONE HAND SETS.—Brand new with cord, 15/- each ; post 1/6.

WALL TELEPHONES.—" Call and reply." Perfectly made, robust and efficient, suitable for home or office. £5 per pair.

TELEPHONE UNITS. — Sound powered, suitable as receiver or microphone. These self-energised units will provide perfect 2-way communication without the use of batteries, 6/- each, another type 5/- each. Insets only 4/- each. Post 6d.

LOW VOLTAGE CIRCUIT TESTER.—A self-contained unit for making a complete and rapid check of the generator-battery circuit of a vehicle. Battery voltage, regulator and cut-out settings and generator performance can all be easily determined. American made. Complete with instruction book. £5/10/-, post 2/-.

BALL RACES.—No. EE2, ⅜in. x ⅞in., 3/-, 30/- doz., post free.

THRUST RACES.—13/16in. x ⅜in., also ⅜in. x ⅞in., 1/6, 15/- doz. Post free.

SWITCHES.—A row of 5 in a flush mounting bakelite moulding 5¾in. x 1¼in. x 2in. Ideal for model railways, etc., 5/6, post 9d.

THERMOSTAT.—For frost protection, on at 34 deg. F., off at 49 deg. F., 1½ amps, at 250 volts adjustable, 4/6, post 6d.

24-VOLT D.C. MOTORS with double ended shaft 2in. x 3in., 8/6, postage 1/-.

KLAXON GEARED MOTORS.—230 volt A.C. Induction type. No. IK5SB3-W7. Torque 15 lbs./in. 175 r.p.m. £10.

GEARED MAINS MOTORS.—Universal Series Type for 230 volt A.C./D.C. 100 r.p.m. torque 7 lbs./ins. Klaxon No. EK3UB1-W3 complete with control box to enable speed to be varied, 115/-, complete.

ELECTRO MAGNETIC COUNTERS.—Post Office type 11A, counting up to 9,999, 2 to 6 volts D.C., 3 ohm coil, 12/6 each, post 1/-. Many other types in stock. Lists sent with order or send S.A.E.

MECHANICAL COUNTERS to 99,999 only 7/6 each. Post 6d.

ROTARY CONVERTERS.—From 12 volt D.C. to 230 volt A.C. 100 watts, 92/6 each ; also available with 24 volt input, cge., 7/6.

AUTO CABLE for car wiring and all electrical purposes, waterproof. Single, 4/- doz. yds., 20/- 100 yds. Twin 3 core or single heavy, 5/- doz. yds., 37/6 100 yds. 5 core 6/- doz. yds., 45/- 100 yds.

VACUUM PUMPS or Rotary Blowers.—Ex R.A.F. Brand new, 7 cu. ft. per min. 10 lbs. per sq. inch at 1,200 r.p.m. Ideal for a brazing torch, etc. Size 6in. x 4in. x 4in., 2 x ½in. shaft, 22/6 each, post 2/-.

MASTER CONTACTOR. — A precision made clock movement, contact making and breaking twice per second, with regulator. Brand new in soundproof oak case. Many uses, blinking lights, etc. Only 12/6, post 2/-.

PORTABLE ELECTRIC BLOWER.—This unit is a powerful 220 watts electric motor, operating on 220-230 volts. Enclosed type with handle. 8ft. of metallic flexible hose and nozzle is included, also 7 yds. C.T.S. flex for connection to the mains, 130/- complete. Carriage 7/6.

INSPECTION LAMP. — Complete with Battery Case. Fits on forehead. Leaves both hands free, 7/6, post 1/-. Takes a standard Ever Ready battery. No. 1215, 2/9, post 6d.

MICROAMMETERS, 250 F.S.D. 3½in. FLUSH. MODEL S37. Specially scaled for test meters. Knife edge pointers, magnetic shield. Guaranteed. Brand new. Not Govt. surplus. Offered about half usual price, 55/-, post free.

VOLTMETERS.—0-300 volt A.C. 50 cycles, 2½in. flush moving coil, rectifier type, 30/- post 1/-.

VOLTMETERS for A.C. Mains 50 cy. reading 0 to 300 volt with clear 5in. dial only 60/- ; worth double.

VOLTMETERS.—0-300 Flush D.C. moving Coil 10/6 ; 0-20, 2in. Flush Moving Coil, 7/6 ; 0-40 2in. Flush M.C., 10/6, post 1/-.

AMMETERS.—2in. Flush 0/20, 10/6 ea. 20-0-20, 12/6 ea. Moving Coil D.C.

MOVING COIL METER with 1 M/A movement, 2½in. flush, rectifier type, scaled 0/100 volts A.C. Resistance 100k. ohms. A very useful basic meter, 30/-, post free.

LISTS AVAILABLE.—Motors, Meters, Telephone, Rectifiers, Relays, Potentiometers, Resistances. Send S.A.E.

WILCO ELECTRONICS

Dept. P.M.

204, LOWER ADDISCOMBE ROAD, CROYDON.

THE "FLUXITE QUINS" AT WORK

" This new gadget is second to none
Meet the Wizzo Egg Boiler, old son
Made throughout with FLUXITE
Every egg cooked just right
And they pop up as soon as they're done ! "

FLUXITE

SOLDERING **FLUID**

and its famous equal
THE SOLDERING PASTE

Simplify all Soldering!

The standard sizes of FLUXITE FLUID are :—

4 fluid ozs. 8 fluid ozs.
20 fluid ozs. 1 gallon cans.

FLUXITE LTD BERMONDSEY ST · LONDON S·E·1

TELEPHONE : HOP 2632

EXPORT ENQUIRIES INVITED

(GM.2.)

This is a H.S. Milling Cutter Bargain. All 1" bore, 3"-3½" dia., ½"-⅝" thick, including side and face cutters, plain and angle cutters. A most useful lot for any tool room, 6 ass. for 50/-. The present maker's price of the cheapest cutter in this selection is 40s. You must get this lot, remember you get same on approval against cash.

2,000 Small H.S. Twist Drills, approx. 1/32"-3/32", 4/- doz. approx. ; 1/16"-¼", 7/6 per doz. approx. ; 9/32"-15/32", six for 10/-.

All items brand new. £1 orders post paid. Prompt delivery. Inspection by appointment only. All items sent on approval against cheque or P.O. Refund without question if any item returned.

3,000 Circular Split Dies 1" dia. cutting ¼", 5/16", ⅜", 7/16", ½" Whit., B.S.F., also brass thread, 26 thread all sizes and American N.F., 12/- per set of 5 sizes, 2 sets 22/6, 4 sets 42/6. Taps to suit, 9/3 per set, either taper or second or plug. 1" die-stocks, 5/- each ; 3/16" to ½" tap wrenches, 12/6 each.

1,000 Hand Reamers, 5/16" and ⅜", 3/6 each.

1,000 High Speed Inserted Blades Expanding Reamers, 17/32" to 19/32" 14/-, 9/16" to ⅝" 16/-, 11/16" to ¾" 17/6, ¾" to 31/32" 18/6, 31/32" to 1⅛" 22/6 each.

7,000 Pratt & Whitney, circular split dies, superior quality precision ground cutting edges, 13/16" dia., suitable for machine or hand use. Sizes : 2, 4, 5, 6 B.A., 8/6 per set.

5,000 Ball Races, ⅜" bore, ⅞" o.d., ⅜" thick, 4/- pair ; ¼" bore, ¾" o.d., 7/32" thick, 4/- pair ; 6 mm. bore, 19 mm. o.d., 6 mm. thick, 4/- pair ; 9 mm. bore, 26 mm. o.d., 8 mm. thick, 4/- pair ; ⅜" bore, ⅞" o.d., 7/32" thick, 5/- pair.

4/9 Any LOT. Five lots, 22/6. 2 H.S. Tap or Reamer Fluting Cutters 1¼" dia., ⅜" hole, ⅛" and 3/16" thick, worth 7/6 each. Set 5/32", 3/16", 7/32", ¼", all in 40 thread, 13/16" Split Dies ; 8 assorted Centre Nail Pin and Belt Punches, total value 12/6 ; one H.S. Tap or Reamer Fluting Cutter, 2¼" dia., ⅜" thick, ¾" hole ; one ⅜" H.S. Hand Reamer, worth 10/-. Every item a good bargain.

500 **Sets Metal Figure Punches,** nine punches 0 to 8, the six is used reverse for nine ; size 5/64", 6/6 set, worth 15/- ; ditto ⅛" size, 8/6.

2,000 Files, 4" to 6" flats, half-rounds, rounds, squares, warding assorted, cuts, good general lot, 10/6 doz. ; three doz., 28/6.

600 **Circular Split Dies, B.T.D.** make 2½" dia., ⅝", ¾", ⅞", 1" Whit., ⅜" Gas ; worth 11/- each. Clear 7/6 each, new 2½" die-stock to suit, worth 30/- each, clear 10/- each.

200 **Boxes A to Z Steel Letter Stamps** for marking metal, 5/64" size, 17/6 set ; ditto ⅛" size, 22/6 set, worth treble this price.

2,000 Straight Shank End Mills, size ⅛", 5/32", 3/16", 7/32", ¼", 5/16", list price 30/- set, handy bargains, 15/- set, also ⅜", 5/16", ½" ditto, 12/6 set, all in makers' wrappings.

500 **H.S. 90° Countersinks,** body ⅜" dia., teeth cut to point. An essential tool for any workshop using c/s screws. Gift 5/- each.

1,000 Bevelled Wood Chisels, handled, ¼", 5/16", ⅜", ½", ⅝", ¾", ⅞", 1". Actual value 32/6. Gift 21/- set.

3,000 **High Speed Routing Cutters,** straight shank, two lip, as used for cutting slots in wood, sizes ⅜", ½" dia., clear 4/- each.

1,000 Toolmakers' Needle Files, good assortment of shapes and cuts, worth 1/9 to 2/6 each, 12/6 doz.

200 Ace Dial Gauges, 2¼" face, reads to 0.001", plus and minus, very useful instrument, worth 60/-, gift 45/-.

10,000 High Speed End Mills Straight Shank, 3/32" to 3/16" dia., some with teeth cutting both end but not standard sizes, clear 5 assorted, 10/-.

100 **doz. 6" Three square Saw Files,** 10/6 per dozen.

1,000 **" Leytool " Ratchet Spanners,** 3/16", ¼", 5/16", ⅜", 7/16", ½" Whit. Makers' price 70/- per set. Very useful bargain, 35/- per set.

1,000 **Semi High Speed Centre Drills,** Slocombe brand, 5/16" body dia., 3/32" point, 1/6 each, 16/6 per doz.

1,500 **H.S. Morse Taper Shank Twist Drills.** Brand new, Firth Speedicut, Balfour Capital, etc. All best quality drills, No. 1 and 2 Morse Taper shanks, sizes from approx. ⅜" dia. to approx. ⅞" dia. Five assorted £1, actual value £4. One dozen assorted, 42/6.

20,000 Small High Speed Milling Cutters, various shapes and styles. We want to clear these quickly, 12 assorted, 15/-.

800 Small Rotary Files, 3/32" shanks, various type heads, another clearance line, 4/9 per doz.

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(*Continued from page 226.*)

it is either an acetate or nitro-cellulose film, then it should be soluble in either acetone or amylacetate.

We suggest that you start afresh with scrap film, having removed the emulsion by soaking in water. Let the celluloid dry free from water and immerse in acetone. A certain cloudiness may appear from chemical contamination by silver salts, but this can be lessened by thorough washing, as first instanced. The addition of a little methyl-iso-butyl-ketone to the acetone may facilitate solubility. The above-mentioned ketone can be obtained from Messrs. Baird and Tatlock, Freshwater Road, Chadwell Heath.

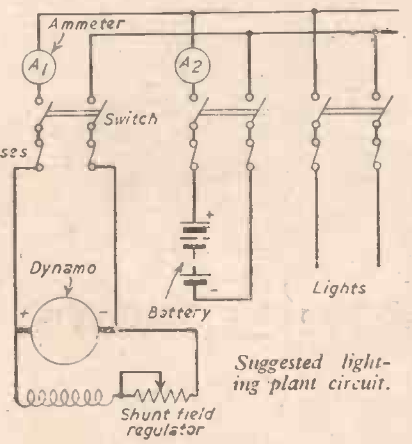
Installing a Lighting Plant

I WISH to install a lighting plant for a 10-roomed farmhouse. My idea is this: The current is supplied by two 12-volt and one six-volt car batteries. The batteries are charged by a generator (charging all batteries at once) powered by a paraffin or petrol engine.

Is there such a generator on the market and how powerful an engine must be used? What bulbs should I use?—O. E. Dayer (E. Transvaal).

MOTOR vehicle bulbs would be best for your purpose and we suggest that you adopt a suitable voltage so that you can use such bulbs; 12 or 24 volts would be satisfactory, preferably 24 volts.

It does not appear that there would be any advantage in charging a single battery at a time; it would be much better to charge all the batteries together. The dynamo used should be capable of generating about 2.75 volts for each cell of the lead-acid accumulators. Thus if you use a 24-volt battery the generator should have an output up to about 33 volts, the voltage being controlled by means of a variable resistor in the shunt field circuit of the dynamo. The size of engine required and the rating of the dynamo will depend on the rate of charging required, which will be governed to some extent by the load on the batteries. If you wished to charge a 60 amp.-hour battery in 10 hours, i.e., at 6 amps, the output of the dynamo should be 6 amps at 33 volts, i.e., approximately 200 watts. If the dynamo had an efficiency of 50 per cent. the electrical equivalent of the mechanical power required to drive the dynamo on full load would be 400 watts, or slightly over ½ h.p., which is the size of engine required.



Suggested lighting plant circuit.

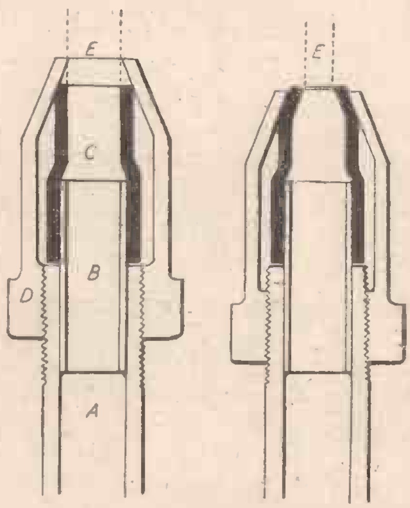
Dynamos are obtainable from the following firms: Batwin Electric Motors, Ltd., 302, Malden Road, New Malden, Surrey; City Electrical Co., Emerald Street, Theobalds Road, London, W.C.1; Croydon Engineering Co., Ltd., Commerce Way, Croydon; Newton Bros. (Derby), Ltd., Alfreton Road, Derby.

If it is not required to charge the batteries at the same time as they are supplying the lights the simple circuit shown in the sketch could be used.

Adjustable Fountain Jet

PLEASE give me details of how to make an adjustable jet for water fountain (I have a lathe for making the parts).—S. Harris (Stafford).

WE have no data on this subject, but much depends upon the range of jet diameter which is required. The scheme shown in the sketch might be satisfactory. The variation in diameter can be small and the jet can be of rubber tube, with a bevelled and screwed collar working over it, like a chuck on a hand drill or brace, the rubber tubular jet taking the place of the chuck jaws and being compressed by the collar. This for a small fountain would give a fair range in jet diameter. In the sketch A is the supply water pipe; B a brass tube, soldered in A; C is a short piece of rubber tube; and D is a coned collar screwed on the end of A. E-E shows the possible variation in the water jet diameter to be obtained by screwing down D and closing in the rubber tube aperture.



Scheme for an adjustable jet, working on the same principle as an adjustable hand drill or brace.

A very much bigger range could be obtained by means of an iris diaphragm, exactly similar to that fitted to the lenses of cameras for stopping down the aperture; in fact a camera diaphragm from a lens of about whole-plate size could be used or you might borrow one and copy the principle. The back of what is normally the lens mount could be filled in with a brass plate and the water pipe screwed or sweated in with solder.

Indicator Strand for Hygrometer

I HAD a hygrometer which relied on the twisting of a strand of material for its humidity indication. This was about ¼in. long, but was extremely sensitive, having about a half-turn movement total.

Can you let me know what the material is and where it can be obtained?—L. M. Moore (Norwich).

THE short length of material, namely, ¼in., surprises us, but we think that the substance must undoubtedly have been horsehair which had been freed from its natural grease. Such material is extremely hygroscopic and can be obtained from most fishing tackle shops. You would have to degrease the hair as purchased by immersion in ether or carbon tetrachloride.

Information Sought

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

Mr. D. Rubinstein, of Manchester, 18, asks: Can any reader give details from experience of making a chess clock from two ordinary alarm or non-alarm clocks?

Mr. D. Casserly, of Chesterton, asks: Would it be possible to assist me in constructing a vacuum impregnation unit using a fairly high impregnating pressure?

I require a practical layout, if possible incorporating vacuum and pressure pumps, gauges and valves, also bottle, if necessary.

From Mr. R. Facer, of Runcorn, comes the following: I am making a lean-to greenhouse, the pitch of which is 1 in 4½. Is there a method by which I can seal the 2in. overlap of the glass, so preventing the dirt from penetrating underneath?

From Mr. B. M. Smith, of Derby, comes the following: I believe there is a type of rubber latex on the market which solidifies, either on exposure to air or on the addition of an activating agent. I wish to experiment with this latex for the production of puppet heads from plaster moulds instead of the usual papier mâché.

Could you please let me have details as to how the substance is used and where it may be obtained?

Mr. R. Whitehead, of Devon, writes: I have recently acquired a foolscap sized letter copying press and seek practical instructions for converting this into a thermostatically controlled photographic dry mounting press. The important points, it seems to me, are those of insulation, even heat and resistance of the heating unit to pressure. "Insulation" would refer both to heat and electric current.

Any assistance you can give me would be appreciated.

Mr. W. J. Osborne, of Warwickshire, asks: Could you supply the necessary information for making a small bandsaw with 7in. wheels to cut timber up to 2in. thick?

From Stockport, Mr. J. P. Griffith writes: I have removed the glass bulb from a 120-watt mercury arc lamp and intend to use it as a sun-ray lamp. My problem is to cut out visible light, yet allow the ultra-violet light to reach the fluorescent powders.

The stage uses "black light lamps," having a deep purple envelope. Is there any easy cheap way of doing the same thing? I understand that glass cuts out ultra-violet. Dark blue Cinemoid, from Messrs. Strand Electric, still lets too much light through and does not seem to allow ultra-violet.

Mr. R. McDougall, of Greenock, writes: There is a shop window display device which consists of two rings about 6in. diameter. These revolve slowly without any apparent means of support. Could you please say where I could purchase one of these?

The following is part of a letter from Mr. R. J. Jones, of Berks: Can you or any of your readers give me an idea for the disposal of waste paper or cardboard?

What I had in mind was either burning direct in an incinerator or pulping down in water, mixing with coal dust and a third substance to bond it, forming it into blocks and using on an open fire.

For direct burning I would like a design for an incinerator to be built in brick with a suitable top to prevent pieces of burnt paper floating about.

D. Cowlishaw (Lancs) writes: "I should like to make a simple vibraphone. Could you give me some details of construction or supply me with an address where I can obtain them?"

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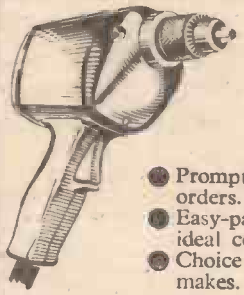

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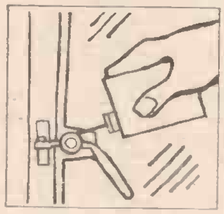

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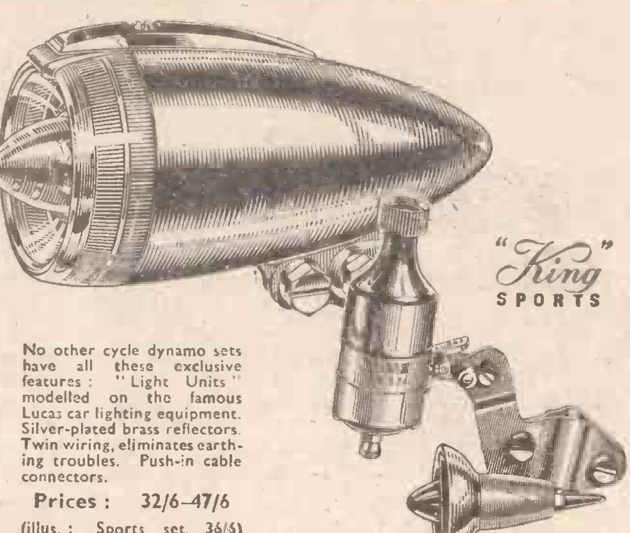

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THE Cyclist
Editor: F. J. CAMM
VOL. XXIII FEBRUARY, 1955 No. 393

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

COMMENTS OF THE MONTH By F. J. C.

Peace at Last?

THERE can be no doubt that road racing during 1955 will undergo a rapid metamorphosis. As we go to press, we learn of the N.C.U. proposal for an amalgamation with the B.L.R.C., and the British Cycle and Motor Cycle Manufacturers' Union announced that it has received an invitation from the organisers of the Tour de France for a full ten-man team to represent Great Britain in this classic continental event. There is a string attached, however, for the invitation comes with the proviso that there will be riders available of suitable calibre, and that a solution to the present domestic difficulties between the British National organisations responsible for the sport is reached in time to allow a suitable team to be selected and prepared for this event.

Early in January the B.L.R.C. stated that its 1955 race programme is virtually completed and that over 600 events will be promoted. Of this number, the largest in the League's history, there are no less than four events lasting three days, seven lasting two days, 15 events for professional and independent, and about 70 events for independent and amateur riders. The remainder are the three amateur categories.

This does not take into account the Amateur Circuit of Britain for the Quaker Oats Challenge Trophy, or the *Daily Express* Tour of Britain.

The N.C.U. by the time this issue is in print will have held a special meeting which will be asked to approve in principle certain plans. The first is that originated by T. Anderton under which track and circuit racing and cycling administration would be administered by the N.C.U., and road racing by the B.L.R.C.; the second is the plan propounded by the N.C.U. Finance and Management Committee, for amalgamation with the B.L.R.C. The third is the N.C.U. racing plan for 1955, which proposes increased professional racing on the track and on the road.

The B.L.R.C. has opposed in the past the plan for amalgamation, because they say that they would be outvoted by the very considerable N.C.U. non-racing membership, but the present plan proposes that racing should be separated from other activities, and be the subject of separate meetings.

In fact there is only room in the country for one overall body with its various departments to control each branch of the sport. Any continuation of the present friction between the three bodies will provide a solution to the problem which none of them would wish to come to pass—namely, the Ministry of Transport may step in and seek power which at present it does not possess.

The Road Traffic Bill

THE Road Traffic Bill, published recently, will introduce some radical changes in the law affecting all road users. As far as cyclists are concerned, one clause which will certainly be contested is that which will make cyclists liable to penalties for reckless, dangerous or careless cycling. Another clause proposes that pedestrians shall be brought under a measure of control, and we think that all cyclists, motor cyclists and motorists will agree that this measure is long overdue. Pedestrians often cause accidents by their carelessness in which they are not themselves involved.

There will undoubtedly be opposition from the Cyclists' Touring Club on the proposed changes, and no doubt a bleat or two from that quaint organisation known as the Pedestrians' Association, which we believe has a membership of less than 1,000, but yet claims to speak on behalf of pedestrians.

The Minister is seeking powers for compulsory vehicle tests, and the penalties for certain driving penalties are to be increased. No doubt when the Bill is discussed in Parliament some of the proposals will be modified.

A C.T.C. Stunt

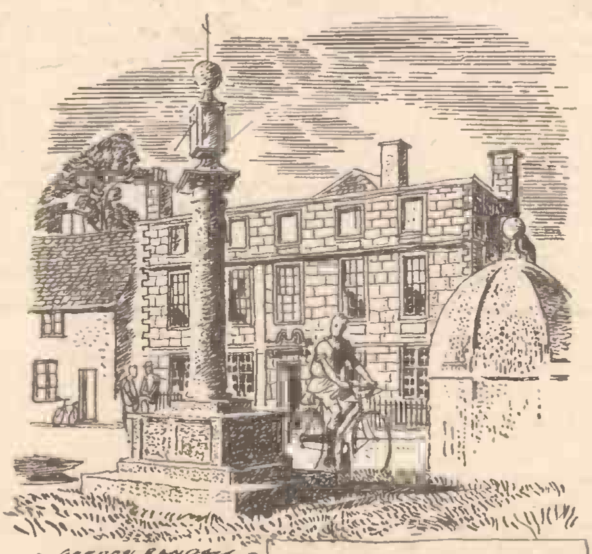
THE Cyclists' Touring Club announces a Cycling Adventure Course as part of its 1955 programme. The idea was evolved by E. T. Bannister, assistant secretary of the C.T.C., who will act as *locum parentis* and teacher during the week from May 28th to June 24th. The scheme applies to a *limited* number of young men within the age group of 16 to 21, and they will be invited to attend New Field Hall, Malhan, near Shipton, a part of the Yorkshire Dales National Park.

There this "limited number" will be instructed in cycle maintenance, riding style, experiments in gearing, camping and packing kit and camping. The students will be taught how to understand and care for their bicycles, and how to ride comfortably so that long distances can be covered without fatigue. They will be taught how to use maps and how to plan rides for themselves. There will be a daily run to some place of scenic and historic interest.

We are informed that it is hoped the week will provide *a contribution to the cause of cycling in general*, but perhaps we can drily observe that it is also hoped that it will help to swell the membership of the C.T.C.!

It is rubbish to suggest that such a course will help to teach these youths, "leadership in cycling." There are sufficient leaders in cycling already. We want more cyclists, not more militant leaders fomenting strife and teaching cyclists that they must forever be "fighting for cyclists' rights."

Each student will pay £5, which includes board and lodging for the week, and the course has been planned by the Central Council of Physical Recreation in collaboration with the C.T.C. We forecast that this *stunt* is foredoomed to failure. The whole scheme is altogether too puny and parochial to make even the mildest impact on the cause of cycling. It is, in effect, a stunt to popularise the C.T.C.



Steeple Ashton. Wiltshire.
The elegant village cross dates from 1679 and stands on the site of a much earlier one. To the right of the cross is an ancient lock-up.

One United Body

THE president of the National Cyclist's Union, in a contemporary, says that he has advocated one unified body, both publicly and privately, for many years. He goes on to say that memberships of the N.C.U. and the R.T.T.C. are, in the main, common, in other words, they are overlapping. Whilst the N.C.U. is recognised, the R.T.T.C. is not. The B.L.R.C., indeed, has greater international recognition than the R.T.T.C. A condominium of the three bodies is a desirable end, and we have advocated it on a number of occasions, with the proviso that there should be a complete purge in each of the three camps of all of the firebrands, trouble shooters, imitation Bidlakes, old fogies, those who think they are the proprietors of the sport because of long association with it and the rest of the humbugs, who have hamstrung the sport and hampered its development. For if they are allowed to remain in power in a combined body, instead of having rows in three camps, there will be one large rumpus in one camp. The clash of personalities would continue.

If we are to have a unified body, in other words a united body, it must not be divided against itself, and it is necessary, therefore, to remove all those known to be disruptive influences including the self-styled "Legislators."

Checking Cycle Alignment

Some Faults Which Will Cause a Cycle to Run Out of Track and How to Find Them

A BICYCLE in proper adjustment and alignment when travelling in a straight line, should make a single track on the road—one wheel following directly in the track of the other. Unless this condition is complied with, the going will be harder than it should be and skidding will be more probable, while, when negotiating tram tracks the risk of a spill will be greatly increased.

The diagrams show how a maladjustment, or a slight damage to the frame, may put the two wheels out of track and cause the dangers alluded to.

Steering a Straight Course

It must be properly appreciated that the cycle is automatic in the way it disposes its two wheels relative to each other when the rider is steering a straight course. Fig. 1 shows this. The line AB passes through the points of road contact of both wheels, and as the direction is straight ahead this line will also be in the plane of both wheels. Such a condition requires that the position of the back wheel in the rear forks should be central at the bracket end of the forks at C; but if the wheel is a little to the side, as at C in Fig. 2, the back wheel will not line up with the front wheel, as shown by the line CD, and if the latter were kept straight with the frame, the cycle would move in a circle. But the rider, in order to keep a straight course would bring the front wheel round to the left, as in Fig. 3, and then the direction would be that of the line AB, determined by the position of the front wheel, and the rear wheel would follow on the line CD, thus giving the machine two tracks on the road surface parallel with each other, AB and CD. This would make riding hard and increase the risk of side-slip on a greasy road. It would also double the risk of puncture.

In the case shown in Figs. 2 and 3, the malalignment is due to the rear wheel not being straight in the rear forks and not to any deformation of the frame, which may be as correctly aligned as it was when it left the factory test bench. But if the cycle has met with a collision, the frame may have been pushed out of track; or if a chain has mounted the rear sprocket-teeth—or even the chain-wheel teeth—the rear forks may have been pulled round to the chain side. This sometimes happens without the rider becoming aware of the damage.

Then the position will be the same as in Figs. 2 and 3, except that the wheel will be central in the forks, but, since the forks themselves have been pulled round, the wheel has been pulled out of the plane in which it and the front wheel should both lie when the cycle is travelling in a straight line.

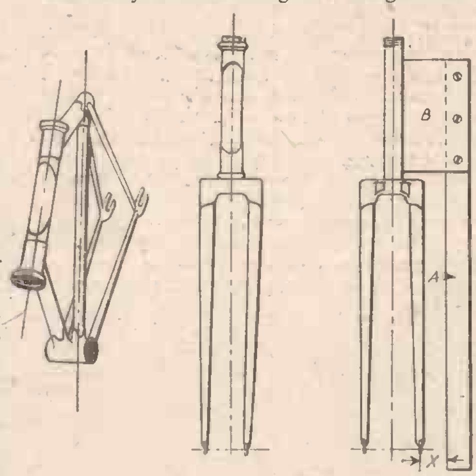


Fig. 6 (left).—Shows a twisted frame. Fig. 7 (middle) forks set sideways; and Fig. 8 (right) checking forks for truth.

This is shown in Fig. 4, and to steer the cycle on a straight course, the front wheel will have to be put round as in Fig. 5, and we get again the two tracks AB and CD instead of the single track.

Two Tracks

Two tracks can be made with a frame which is twisted so that the head (looking at the machine from the front), Fig. 6, is not vertically parallel with the rear (seat) tube, or the forks are set sideways and not in line with the head, as in Fig. 7. This will have the same effect as in the other cases in making the wheels, when running in a straight path, follow two different tracks.

To track up a machine for the defect shown in Fig. 2, a straight-edge should be placed along the side of the hub chain sprocket. The end of the straight-edge should line up with the side of the bracket chain wheel. To track up for the defect shown in Fig. 4, a straight-edge should be placed against, and touching the centre at one side of the frame, i.e., the centre of the head tube and the seat tube; and from its edge at the rear the distance from it to the inside of the rear fork ends should be measured. When the same test is applied at the other side of the frame the distance of the other fork end from the edge of the straight-edge should coincide.

To look for the defect shown in Fig. 6, line up the head tube with the seat tube. If their edges, as seen by the eye, do not coincide with each other, the frame is twisted. This may be seen more plainly if the tubes are extended by inserting broom handles in the head and seat tubes. To test for the defect shown in Fig. 7, take a straight-edge as at A, Fig. 8, with a parallel piece nailed on at B, and holding it first one side and then the other and parallel with the column tube, measure the distance X. This should be the same when applied either side.

In all cases, of course, the wheels should both stand vertical, i.e., in the same plane with each other.

Bracket Chain Wheel Out of Truth

In the case of the defect shown in Fig. 4, a test can be made by holding a straight-edge along the side of the bracket chain wheel. It should line up with the side of the hub sprocket. But as bracket chain wheels sometimes run out of truth, and bracket axle bearings are sometimes loose, it is necessary, before making this test, to adjust the bracket bearings so that it is a little tight, or at least has no shake at any part of a revolution, and also to see that the rim of the chain wheel runs dead true. A trifle out of truth here will put the straight-edge about four times more out of line further out at the end where it touches the hub sprocket, and so will nullify the measurement. Make sure that the straight-edge is straight. Do not use string or cord, as there is too much liability of error in making the test.

Remember that the head tube and the seat tube may be of different diameters. This does not matter if the test for the defect shown in Fig. 4 is made from both sides. Only by checking up all the tests mentioned here can one be sure that the machine will run dead true as a single track machine.

Fig. 1.—Correct alignment.

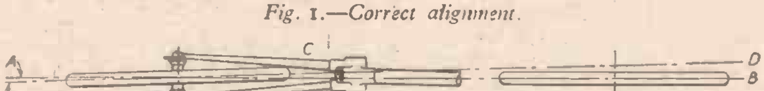


Fig. 2.—The rear wheel is out of alignment.

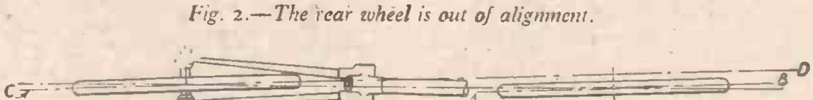


Fig. 3.—How the cycle would have to be steered.

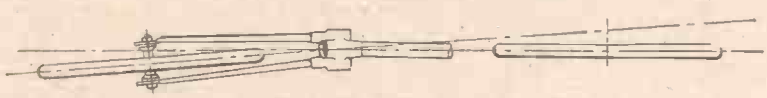


Fig. 4.—A twisted rear triangle causes bad alignment of the rear wheel.

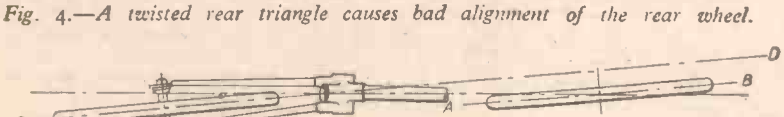


Fig. 5.—A cycle bent as in Fig. 4 would have to be steered like this.

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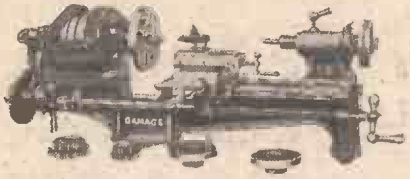

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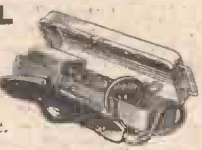

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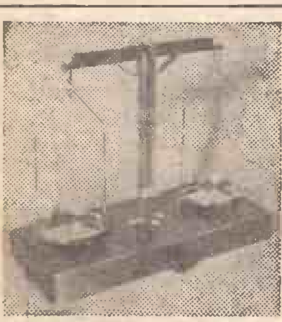

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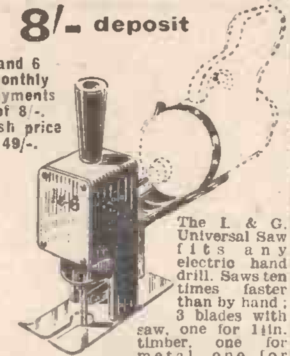

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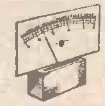

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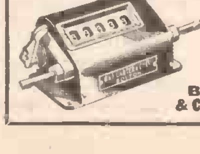

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AROUND THE WHEELWORLD

By ICARUS

How Old is a Bicycle ?

IT is considered by some that the average life of a bicycle is from eight to 10 years, and that when a man parts with his machine after that lapse of time it enters the second-hand market and thus destroys sale. These arguments are sometimes put forward by those who purport to advance the cause of cycling. Now the cause of cycling is not concerned with the age of a machine, nor should it concern itself whether the owner has bought it new or second-hand. The only matter which counts is that a man *has* a bicycle. But, in any case, there are those who, if they could not buy a second-hand machine at a reasonably low price, would not be able to afford a new one.

The suggestion that dealers should take old machines in part exchange and then have them destroyed, the cost being shared by the manufacturer and retailer, is absurd. If it is true that there are between 400,000 and 500,000 second-hand bicycles on the market, that is all to the good, for it means that there is that number of cyclists within the fold who otherwise would not be. In any case, they purchase accessories such as tyres. Any plan which forces a man to buy a new product is commercially dishonest.

The Road Traffic Bill

I DO not think that many of us will quarrel with the extra responsibilities we are called upon to bear in the new Road Transport Bill, if and when it becomes law.

The move to bring stupid pedestrians under control is a good one, and it will make them realise that they, too, have responsibilities to other road users. The Minister is seeking powers to examine vehicles for road-worthiness, and this includes bicycles. Here, again, we do not think that cyclists, even of the "fight for our rights" type, will object to this. Whether they do nor not, the Minister intends to press on with his plans and I do not blame him. Cyclists have in the past been very vocal in insisting on changes in the law relating to other road vehicles, and cannot complain if the tables are turned on them. In the early part of this century the C.T.C. was loud-mouthedly vociferous in demanding lights on horse-drawn vehicles. There had been one or two accidents where the cyclists had ridden into the back of unlighted carts. As soon as it was suggested, however, that cyclists should be compelled to carry rear-lights the C.T.C. organised opposition to it. However, cyclists to-day carry rear lamps and none of them seems to object to doing so. I am pleased that the new Bill proposes to make it an offence for a bicycle to be ridden carelessly. It is true that the degree of carelessness will be a matter well within the discretion of any particular constable, and that there is no real yardstick by which one can manage carelessness. I do not think, however, that the police are likely to abuse these powers.

Tissington.

Considered to be the loveliest of all the Derbyshire villages

The sketch shows part of the grounds and Manor House. The village is recorded in the Domesday Survey.

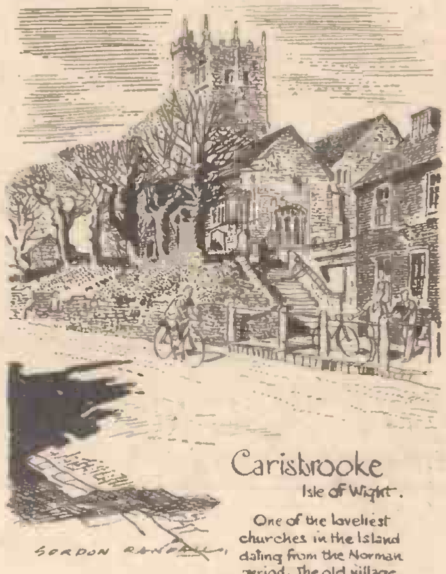
The Late B. W. Best

BENJAMIN WOLFE BEST, for a short time on the staff of the *Cyclist*, passed away towards the end of last year. He was a most extraordinary character, with a wide knowledge of cycling sport, but very little of cycles generally.

I found him abysmally ignorant on the technical side of cycles, and in some respects he achieved an undeserved reputation for a prodigious memory of record figures by trotting out some particular time on occasions when his statements could not be checked. On one or two occasions, when I have checked up on his figures, I have found him wrong, as indeed I did in the case of H. W. Bartleet the press cutting historian.

Best was an independent thinker, of untidy appearance, and of weird ways. He endeavoured to impose his will by subterranean methods, and in this way made himself a large number of enemies. He had been trained in the militant school of cycling, that is to say, he was trained to find imaginary grievances and to believe that cyclists' rights were always being attacked.

He was, of course, well known as a time-keeper and here again achieved an undeserved reputation for his knowledge of watches, which I have every reason for knowing was practically nil. I have a fairly considerable knowledge myself and so I am well able to judge. Whilst it would be true to say that he did a lot of good in the sporting realm of cycling it would be equally true to say that he sometimes did much harm. He did not have a distinguished career in cycle racing. He was a member of a comparatively unimportant club—the Century—which owed its existence to a newspaper. To become a member you must have covered a century of miles in one ride. Like many others, he operated through the Bidlake idiom and liked it to be thought that Bidlake's mantle had fallen upon him. Although he was official R.R.A. timekeeper, he was notoriously bad at keeping appointments—if he kept them at all ! His personal idiosyncrasies caused great fun. There was one occasion when he desired to become an R.T.T.C. delegate but could not find a club to sponsor him. He promptly formed the Hornchurch Wheelers, had notepaper printed and appointed himself as delegate !



Carisbrooke Isle of Wight.

One of the loveliest churches in the Island dating from the Norman period. The old village lies below its famous castle . . . .

His personal dislikes often landed him into trouble, and on many occasions he did not exhibit that impartiality of comment which is the making of the true free-lance journalist. For although Best served for a number of years on a contemporary and for a very short time on this journal, it was quite obvious that he was quite unsuited to inside work.

But he will be missed in the cycling world if only for the very reasons I have given above, for in spite of his many intrigues and *sub-rosa* methods, he was soon found out and no one was really deceived. The cycling world is poorer for his passing.

Flying Bicycles

IT may come as a surprise to many cyclists to know that they can take their machines to the Continent for as little as 2s. 6d. The latest Silver City Airways tariff shows that the cost of transporting a solo or tandem from Lydd (Ferryfield) to Calais and Le Touquet is only 2s. 6d., while the most expensive flight (from Lydd to Ostend) is only 5s. With a sidecar the prices are increased to 7s. 6d. and 10s. respectively. The time taken for these flights is about half an hour and the saving effected (taking into account food and other such items on a sea voyage) is so obvious that it is no wonder that the service is so popular.

Wayside Thoughts

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

Derwentwater.
Looking back towards Skiddaw (3054 ft), with Keswick lying at its foot

The First Plunge

THERE is nothing very joyful when the cold rain wails in the wood and the fallen leaves in the lane are trampled and swiftly return to their mother the earth. A bright fire, a good companion or a book seem to be more desirable to the elderly man, when he can be warm and comfortable and talk in memory of those faraway days of his youth and be content. Those are the feelings that overtake most fellows at seventy odd when anyone suggests a ride, and I am bound to agree they sometimes make me shy away from the outdoor conditions.

Then a week at work in an atmosphere usually too hot because other folk like it so suggests that an hour or so of fresh air comfortably pumped through your lungs by way of exercise is not only wisdom, but, strange as it may seem, enjoyment. Often I go on such jaunts—a lonely wanderer swathed in macs—and in twenty miles of very quiet riding wonder why I ever shy from the dampness and the clammy cold, for I enjoy it as a refreshment of the spirit and the body. The countryside is still very lovely in its winter setting, even seen through the grey mists of rain; and I return home to that fire and that book a far more delightful individual than if idleness had overtaken me.

I mention this curiosity in our human make-up because it affects so many people; they are left with a grumpy feeling if they give way to the weather and let it dictate the terms of their inactivity. After all we go to work whatever the conditions; why not play our games as joyfully as the elements will let us when we have the chance ?

A Good Habit

I HAVE a couple of very kindly friends, both near my years, who frequently make these Sunday morning trips a kind of ritual, and we know a dozen little lane routes that circle our home area varying in mileage from eighteen to thirty, just the right little rides, with half an hour break for the usual tea. The teahouses generally have a fire to welcome us and to enliven a talk which never lacks interest because it is usually about men and the machines they rode long ago, the adventures, the scrapes in which we were involved and frequently the remarkable changes that have occurred since the turn of the century to roads, to bicycles and to the people who ride them. Naturally, we think we have not changed much, until that little solecism is exploded by a glance in the mirror, or more forcibly by the hill we once romped up and now climb so sedately. But we climb it, and we go on riding because we enjoy the movement and find — sometimes with surprise — how very good it is to be active without being athletic. The tempo, perhaps, is a little different when I travel lonely both in pace and outlook, for often enough I ride with ghosts, the boys and men of yesteryear whose happiness awheel is part of my inheritance.

Our Wavy Paths

I DO not always make my journey to work by bicycle when the day is wet for the simple reason that the streets—crowded with motor traffic—present risks to an ancient rider, particularly in the way of skidding, that I do not feel confident in taking as in the bygone days. Then I call up the car and go as a passenger; but I do not enjoy that journey in the manner I enjoy my ride when the roads are dry and firm, for then the press of traffic presents no nervous tensions. Candidly, I believe a lot of folk would be better in health—and temper in these days of road congestion—if they cycled to work and home whenever the weather conditions were reasonable, and this applies to the professional man as well as the factory worker. It would certainly ease the traffic problem, save quite a considerable amount of money and in many cases a lot of time. It is merely an unconscious form of snobbery that makes a man spend money on cars or bus fares rather than use a bicycle, still the handiest form of personal transport in existence.

The Greatest Improvement

THE other day I spent a short time overlooking my bicycles and except for oil application and a little rust removal no other job awaited attention. What a change compared with fifty years ago ! This freedom from adjustment and attention is to me the greatest single improvement in the machinery of the bicycle after the pneumatic tyre and the variable speed gears, and it is one that is scarcely noticed by the modern rider. Even on the best models bearings were always an adjustment problem in the old days, and the toolbag was a necessity when on tour, for bearings frequently ran loose in wheels, bracket and head, and a few hundred miles made attention desirable if not necessary. Now I seldom need to make an adjustment, and on most of my mounts never remember touching the bracket bearings. This is something for which I give credit to the bearing makers and those unknown fellows who supply the steel.

I believe there was last year a crop of complaints about head bearings working loose, but this was a fault in the locking device and not the bearing itself and is now remedied. In the old days we frequently had a lot of adjustment troubles with pedals—one of the most important bearings in the bicycle's make-up, for it takes the first muscular thrust—but now we just oil them and think no more. Yet people say there has been no major improvement in bicycles for half a century; don't you believe it !

Resilion Returns

I AM very glad to see the Resilion brake has returned to the market for it was, and still is, the best rim brake. J. A. Phillips & Co., Ltd., have purchased the Resilion rights, and in their expert hands I have no doubt the brake will become more popular than ever on good-class machines. I saw the brake on some Phillips models at the Show, and talking later to one of the firm's executives was told they mean to make it closely following the old pattern. It will not be cheap in the sense of comparison with the crown-pin calliper, but that is just as well, for the best things cannot be made and marketed on a purely competitive basis. I shall now be able to fit one or two of my modern bicycles with the new Resilion and feel I have under hand a powerful means of retardation.

You and I know there are hundreds, possibly thousands of machines in daily use on which the braking features are deplorable, some, indeed, non-existent, and though I hate any kind of interference I am bound to confess I am not sorry the police have power to test brakes on bicycles. The " don't care " cyclist, the fellow who thinks he is clever enough to dodge all the road troubles on a poorly-braked bicycle, has asked for this, and we who care for ourselves and our machinery and the other fellow must suffer the little inconvenience imposed by examination, if and when it occurs. See that your braking system is in order, and if the machine needs new brakes, then fit good ones.

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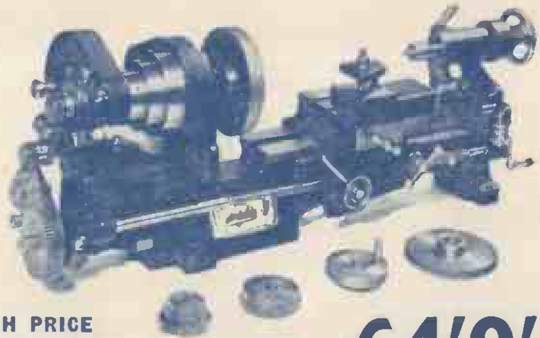

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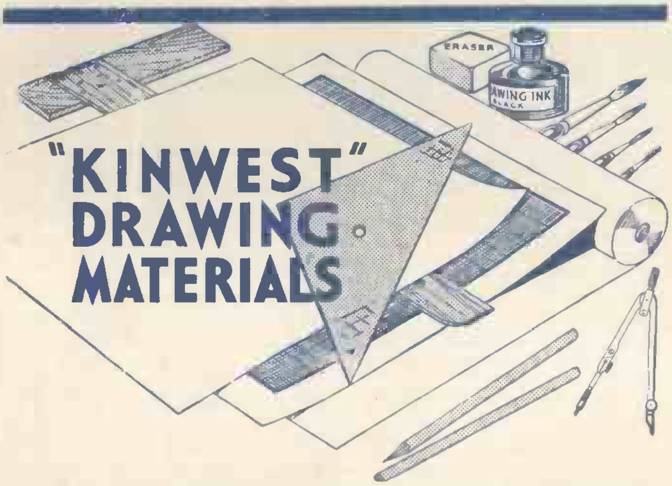

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