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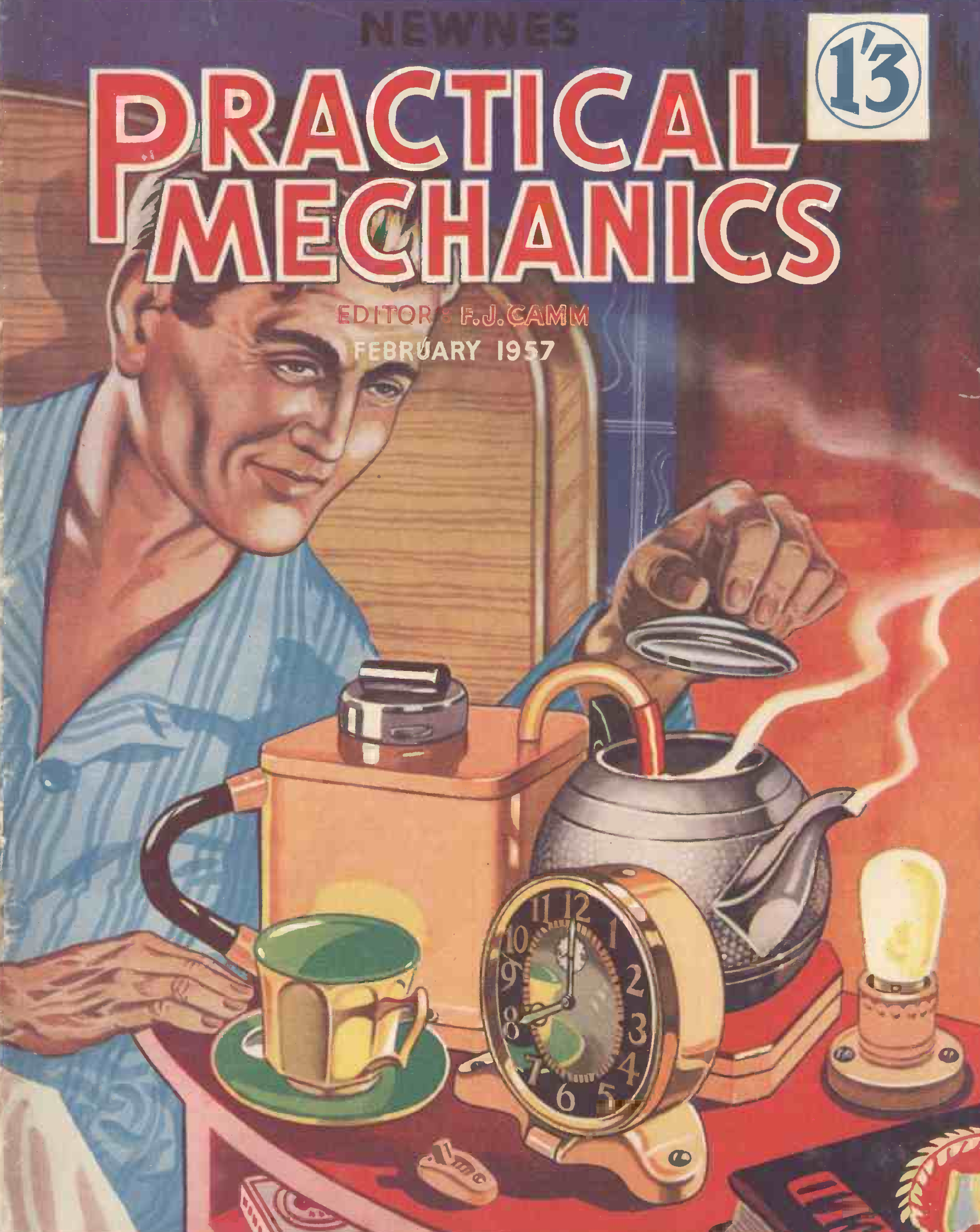

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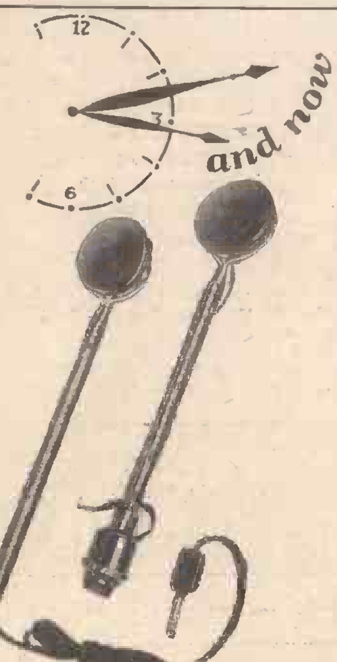

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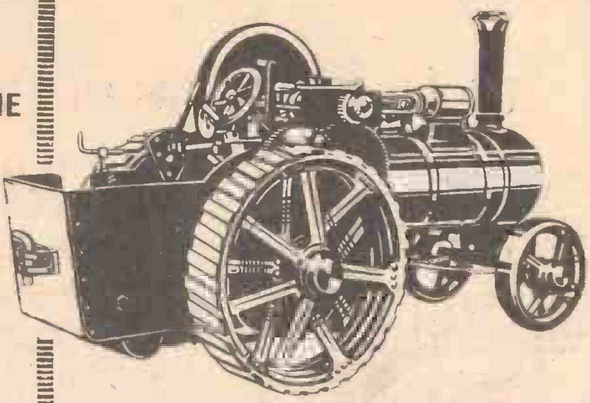

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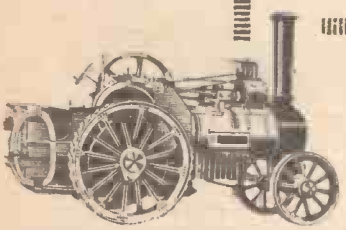

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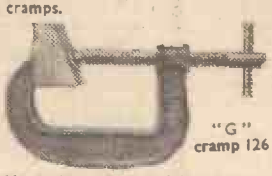

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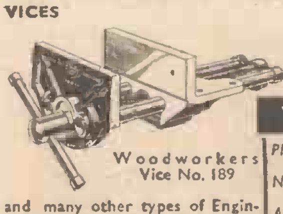

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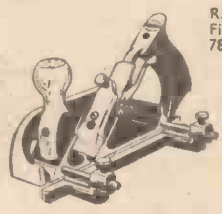

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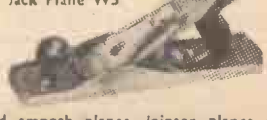

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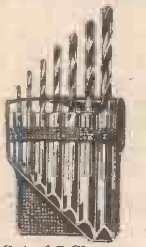

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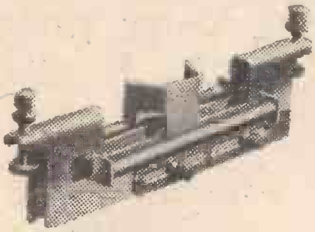

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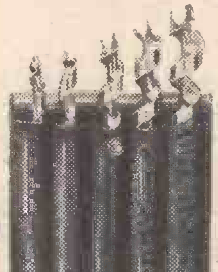

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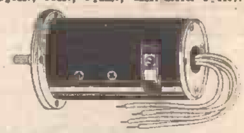

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Practical Mechanics

Vol. XXIV. No. 276 FEBRUARY, 1957

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

FAIR COMMENT
by the Editor

The City and Guilds of London Institute

THE City and Guilds of London Institute has recently been honoured by a grant of arms from the College of Arms. The Institute was founded in 1878 by the Corporation of London, who, in 1880, together with 16 of the livery companies, subscribed to the incorporation of the Institute, and the Coat of Arms honours its founders and the Royal Patent, which is of long endurance. The St. George's Cross alludes to England and appears in the arms of the City of London; the sun stands for the diffusion of light and knowledge and the 16 points to the 16 livery companies associated with the Institute. The lion gorged with a Naval Crown in the Chief, alludes to the Royal Family, in particular to H.R.H. The Duke of Edinburgh, the President, one of whose armorial supporters it resembles.

The shield is completed by a crest surmounting an esquire's helmet, and by supporters. The crest is a cubit arm, wearing a sleeve of red and white livery in allusion to the livery companies, and holding a sword enfiled with a mural crown, both alluding to the City of London.

The letters A.C.G.I. after a name indicate that the person concerned has passed a very rigid examination in one of the dozens of different crafts classes encouraged by the Guild, and, indeed, it is a recognised honour.

To-day, when so many opportunities are available to the young for education and study, it is important that they should be well informed about the new opportunities opened up by technological advance and that they should be encouraged to take full advantage of further education so that they may develop their own talents. It is equally important that all branches of industry should know of the facilities for the further education of their young employees and those branches which have no system of part-time education and do not provide opportunities for it should have their interests stimulated. The Institute gives a great deal of attention to this matter. Visits are made by senior staff to industrial firms, technical colleges and schools, and lectures are given all over the country. The Institute's schemes are adopted by many firms. For those undecided as to a career or as to a particular course of study, I would suggest communicating with the Institute.

Petrol or Steam ?

LAST month I briefly referred to the possibility of the steam car returning. All motor car manufacturers agree that a steam car has undoubted advantages over the internal combustion engine and it, therefore, seems strange that none of them has attempted to produce one. There is no shortage of water and it is unlikely that it will ever be rationed. Such cars would make us absolutely independent of the Suez Canal or oil wells since we have our own natural sources of heat producers for converting the water into steam, apart from the other undoubted advantages of steam power.

Moreover, comparatively little experiment has been conducted on the subject of obtaining free fuels from water. Hydrocarbon fuels such as petrol are natural resources located vast distances from England and a great deal of work and labour has to be expended in order to get it here. This work has to be paid for in the price of the petrol and is indeed a considerable part of the total cost. The petrol has to be raised out of the ground, processed and transported. Water lies all around us and there remains the problem of constructing engines to use it. A gallon of water contains sufficient oxygen and hydrogen to produce, when chemically combined, almost one-third as much energy as is obtained when a gallon of petrol is burnt. To produce fuel out of water it is only necessary to extract the hydrogen, and wind power could be used for this purpose. The wind power would drive dynamos, the power from which could be used to electrolise the water. Thus it will be seen that a small windmill driving a dynamo and a simple electrolising tank with hydrogen storage plant could provide the country with enough gas for all of the road vehicles now in use. In fact, a motorist could himself quite easily make such a plant. Properly developed, this system could make this country completely independent of oil and would eliminate the great risks attaching to our fuel supply by reason of ever-changing foreign political issues.

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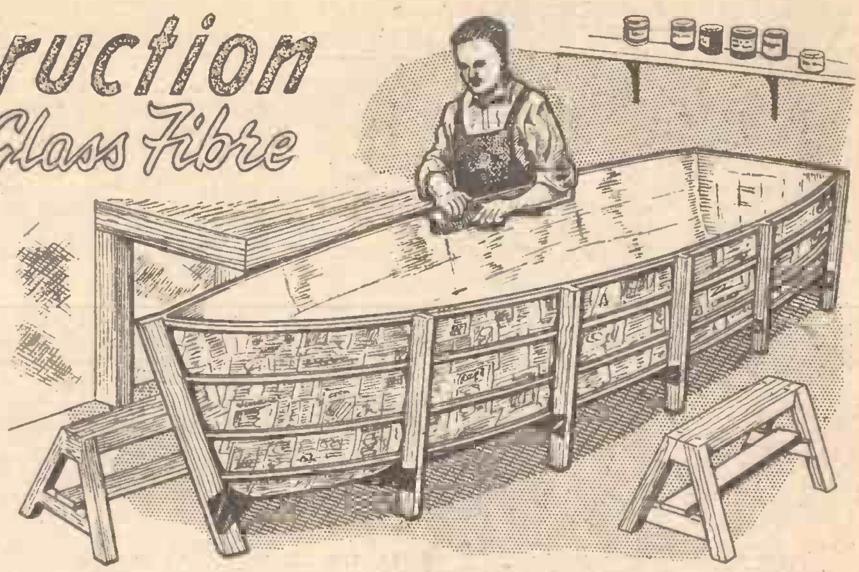
Video Tape Recorders

THE first public demonstration of video tape recorders for television took place in America in December, 1953, both colour and black and white pictures being shown. Plastic tape was used with five tracks, three for primary colours, one for synchronising signals and one for sound. Unfortunately the speed of the tape is so great that a 17in. spool of it will run for only four minutes on this system. Another American company says that it will have tape-recording for television on sale to the public in 1957. This means that you will be able to purchase a spool of tape as you now buy a gramophone record and record your own television programmes.

In this latter system the video frequencies are broken into 15 frequency bands on different tracks, the playing speed is therefore very much slower, a 15in. reel giving 16 minutes of playing time. This should considerably cheapen the cost of producing television programmes, repeat performances of which either have to be live or recorded on telefilm.—F. J. C.

Boat Construction in Resin Bonded Glass Fibre



How to Employ this Modern Method at Home

By G. F. WALLACE, A.F.R.Ae.S., A.M.I.W.

OF the various materials available to the amateur boat builder, polyester resin reinforced with glass fibre is one of the most suitable. It requires less skill to work than wood or metal and anyone who can paper a room can make a fibreglass-resin boat. It is also an almost noiseless operation, an important point for people living in built-up areas. Fibreglass-resin provides a completely watertight hull which remains so for the life of the boat. If damaged it is easy to repair. Round bilge boats are as easy to construct as hard chine boats, whereas round bilge construction in wood or metal is beyond most amateurs. Finally, a fibreglass-resin boat can be made in half the time required to make a metal boat and in considerably less than a wood boat.

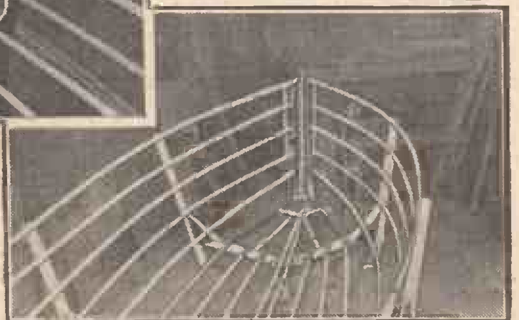


Fig. 1.—Two views of the framework of a mould with some of the paper in place.

Fibreglass-resin, however, has some disadvantages. Construction cannot be carried out in the open air—a warm dry shed is essential as the resin will not cure in temperatures below 65 deg. F. This means artificial heat must be used in winter. In addition, the materials are expensive and a fibreglass-resin boat costs more than one in wood or aluminium alloy. A mould is necessary for building a fibreglass-resin boat. Boat builders normally use plaster, wood or fibreglass-resin moulds, but the cost of one of these for building one boat would make the total cost of the boat prohibitive.

A Cheap Mould

A system has been developed, however, in which the cost of the mould for a " one off " boat is reduced to a fraction of the cost of a permanent mould. This consists of making the mould of a light framework covered with a papier mâché made by pasting on layers of paper, or with hardboard. The use of hardboard makes the mould more expensive, but gives a better finish ; it can only be used for hard chine boats.

Figs. 1 and 2 show the framework of a mould with some of the paper in place. If the stringers of the mould are spaced as at A in Fig. 3 the paper curves between the stringer, giving the skin of the boat slight corrugations running fore and aft. These add greatly to the strength and stiffness of the boat without adding much to the resistance of the hull through the water. These corrugations can be seen in Fig. 4. When the hull has been completed the mould is broken up and the timber can be used for burden boards, seats, rubbing strips, etc.

In moulding fibreglass-resin boats, the surface in contact with the mould is smooth, whereas the opposing surface is rough and can only be made smooth with a lot of subsequent rubbing down and filing

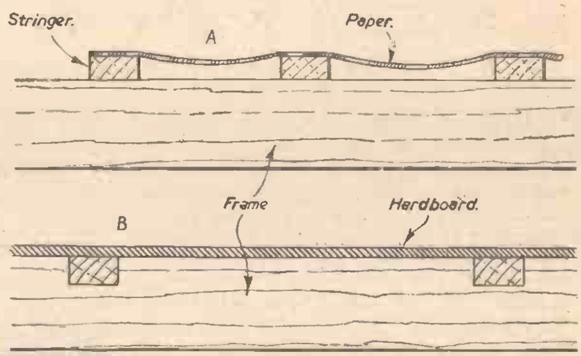


Fig. 3.—(A) Hull with corrugations. (B)—Hardboard method.

which is wasteful of time and material. It is, therefore, usual to make a boat in a concave or female mould so that the outside of the boat has the smooth surface.

A Suitable Design

Any boat designed for construction in wood can be made in fibreglass-resin and there are many such designs available in all sizes from 7ft. 6in. dinghies to 25ft. cabin cruisers. These are mainly by

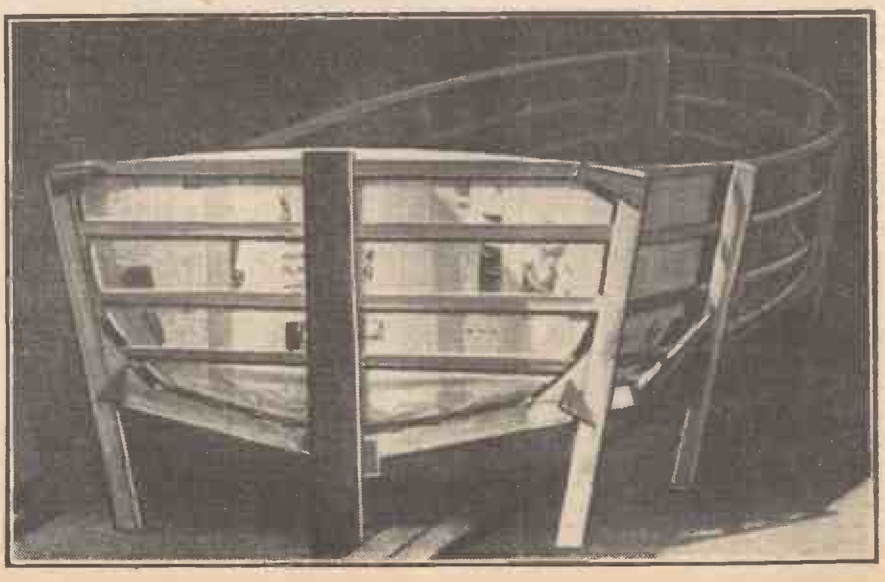


Fig. 2 (Right).—A further view of the mould framework.

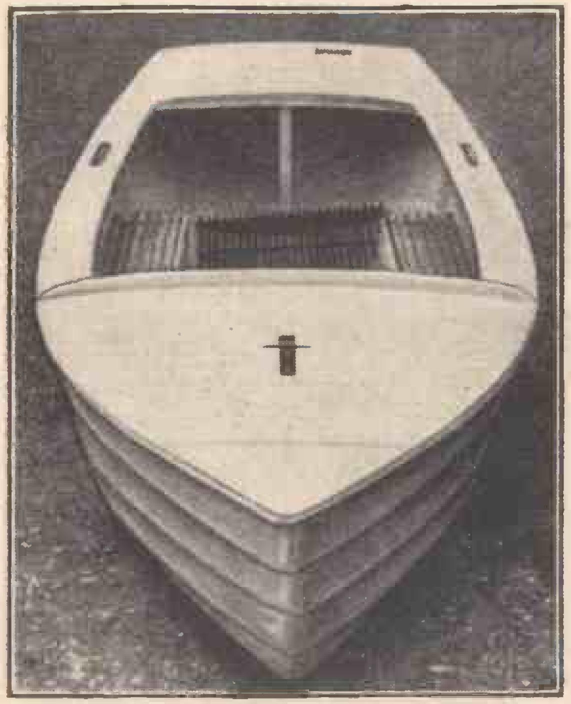


Fig. 4.—A completed hull showing "corrugations."

professional designers and there is no point in the amateur attempting to design his own boat.

Having settled on a design the next step is to write to the various firms supplying polyester resin and glassfibre mat who can supply full instructions on the use and handling of these materials. Incidentally, the method used for boats of this type is known in the trade as the "Wet lay-up method." The following is a list of firms supplying suitable materials :—

Glass Mat—Fibreglass Ltd., St. Helens, Lancs ; Glass Yarn & Deeside Fabrics Ltd., 121, Kingsway, London, W.C.2.

Resin—British Industrial Plastics, Oldbury, Birmingham ; British Resin Products Ltd., Devonshire House, Piccadilly, London, W.1 ; Beck, Koller & Co. Ltd., Beckacite House, Speke, Liverpool.

Stain Colour—J. W. & T. A. Smith Ltd., Maryland Road, Stratford, London, E.15.

Pigments—Blythe Colours Ltd., Stoke-on-Trent.

The Frames

The next job is to purchase timber for the frames and stringers of the mould. If the mould is to be covered with hardboard, fewer stringers are required. For boats up to 14ft. long the frames can be made from 2in. by 1in. deal, and the stringers from 1in. by ½in. parana pine or other knot-free timber.

The frames are now made up in accordance with the drawings and a typical frame is shown in Fig. 5. In this type of mould, the boat is built *inside* the frames and not with the frames inside the boat as in plywood construction, so this must be allowed for in laying out the frames. In Fig. 5, the dotted line represents the frame dimensions given on the drawing and the distance "A" represents the thickness of the stringers in a papier mâché mould. For a hardboard covered mould the stringers must be flush with the frames and "A" is the thickness of the hardboard as shown at B in Fig. 3.

The frames are now set up on the floor in their correct relative positions and the stringers nailed on, resulting in a framework as shown in Fig. 1. For those parts of the boat that have easy curves, such as the topsides and aft sections of the bottom, the spacing of the stringers for papier mâché can be 6in., but for the lower forward sections and the turn of the bilge this must be reduced to from 3in. to 4in. For hardboard-covered hulls, stringers are only required at the gunwhale, chine and keel. Sharp corners should be avoided in fibreglass-resin and the bow, transom and chine need special treatment. The bow is formed as shown in Fig. 6, and the transom as in Fig. 7 ; it should be noted that, unlike the frames, the *outside* edge of the transom corresponds to the dotted line in Fig. 5, and the stringers are nailed to the outside edge, and not the inside edge as for the frames. The chine is formed as shown in Fig. 8.

Covering the Mould

The mould is now ready for covering. If hardboard is used it is nailed to frames and stringers with gimp pins. For a papier mâché covering, newspaper and magazines of similar quality are useless because their strength when wet is very low. The best paper is from the "glossy" magazines.

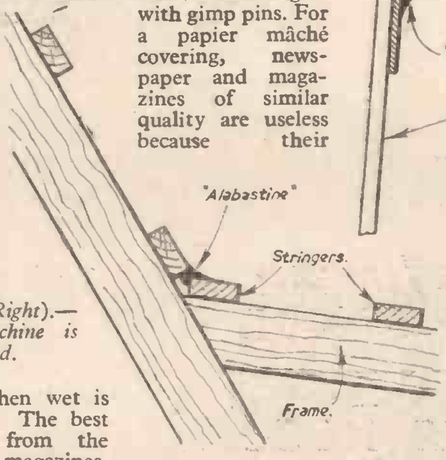


Fig. 8 (Right).—How the chine is formed.

The magazines are first separated into single sheets, and then soaked in a bucket of water ; for the first layer they should not be soaked too long. The wet paper is taken from the bucket, laid on a flat, smooth surface, and the surplus water squeezed out with a roller. The paper is then glued to the stringers, the glue being applied to the stringers and not to the paper. This must be allowed to dry and then a second layer is pasted on to the first, the paste being applied to the wet paper. This is repeated until five or six layers of paper have been built up. Great care must be taken with the first and second layers as the wet paper is easily torn and it is essential that the first and second layers should be dry before proceeding. For subsequent layers this is not essential, as the paper is easier to put on without damaging the layers underneath. When putting on the last two layers great care must be taken to see that there are no wrinkles or trapped air spaces, as these will appear on the surface of the boat.

Fig. 5.—A typical frame.

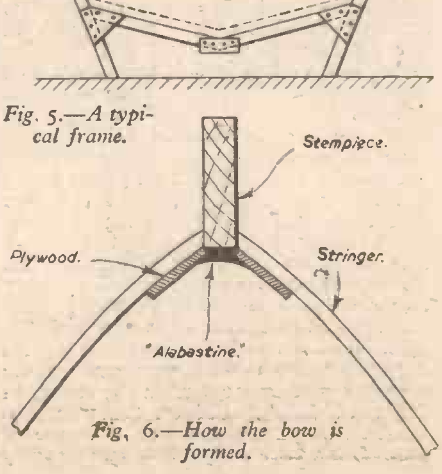


Fig. 6.—How the bow is formed.

When the papering is complete the mould is given a coating of size. The surface is then smoothed off with fine glasspaper and polished with a wax furniture polish. If the boat has a deck, a similar mould must be made for it, as shown in Fig. 9. The width of the deck mould should be slightly greater than the boat and the edge turned over for ¾in. When the deck is laid on the hull a gap is left between the edge of the deck and the hull ; this should be filled with resin, thereby welding the deck to the hull, as shown in Fig. 10.

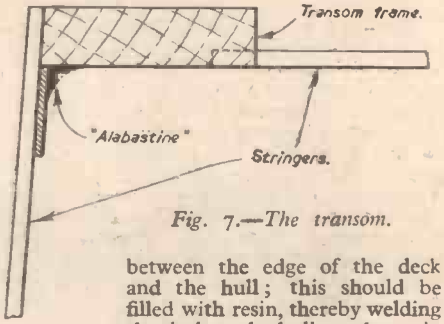


Fig. 7.—The transom.

Forming the Hull

The moulds are now ready for laying up the glass-fibre mat. The mixing and handling of the resin is fully described in the manufacturer's literature, but the following remarks will be useful in addition.

For boats up to 14ft. long, two thicknesses of 2 oz. mat are sufficient, giving a finished thickness of ⅛in. For craft from 15ft. to 20ft., three thicknesses should be used. When estimating the amount of resin required, allow 3 lb. of resin for every 1 lb. of glass mat.

The roller used for rolling in the resin is best made of rubber as this is the easiest material to clean. A suitable roller can be made of rubber tap washers as shown in Fig. 11. When mixed for use the resin has a very short pot life in large quantities. Experience shows that about 3lb. is the maximum that can be easily handled at a time. The mat should also be divided into easily handled pieces ; the boat illustrated was laid up with pieces 3ft. by 4ft., as it was found that a piece this size, was easy to handle and absorbed about 3lb. of resin. Lap joints in the mat actually add to the strength of the boat as they double the thickness at the point of lap. At the bow and edges of the transom the mat should be lapped to give double thickness. It is most important that the resin is thoroughly pressed into the mat with the roller, otherwise porosity will result. If possible, the two or three layers should be laid up in one operation, i.e., the second and third layers should be put on while the under layer is still wet or tacky. This is not essential, but it allows more economical use of the resin.

For boats up to 14ft. long it should be possible to complete the lay-up of the hull in one day, if two people work on it. All the mat must be cut to size and shape the previous day, then one person applies the resin with a brush while the second person rolls it in with the roller.

Fillers and Colouring

A controversial point is the use of fillers and colouring in the resin. Fillers extend the resin and as they are cheaper than resin their use makes for a cheaper boat. In reasonable quantities, they increase the compression, strength and stiffness of the resin. The resin will absorb nearly 100 per cent. of filler by weight and still remain fluid, but in these quantities it is more difficult to work into the mat. For practical purposes 30 per cent. is considered the maximum amount of filler.

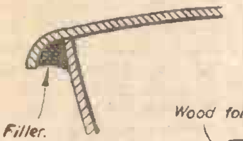


Fig. 10 (Left).—Welding the deck to the hull.

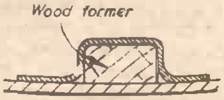


Fig. 12.—Method of providing local stiffening.

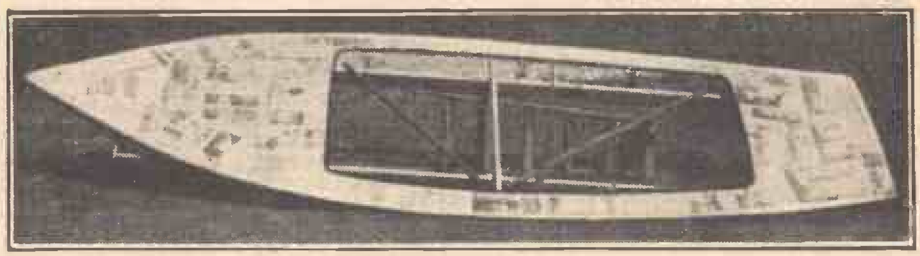


Fig. 9.—The mould for the deck.

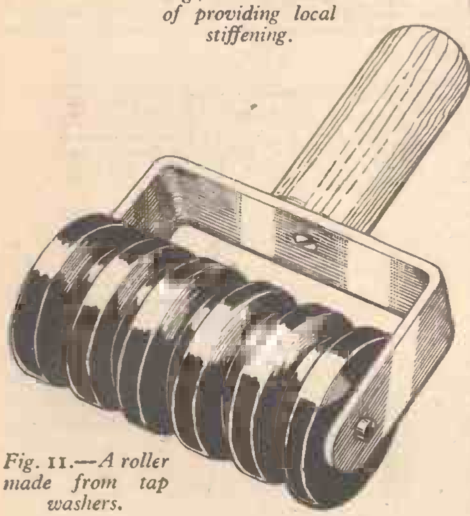


Fig. 11.—A roller made from tap washers.

For filling in corners and gaps such as shown in Fig. 10, sufficient filler can be added to the resin to turn it into a stiff paste. Colour can be added to the resin by means of either pigments or stain, and it is claimed as one of the advantages of fibreglass-resin construction that resin so coloured needs no painting. Resin, however, is a new material for boat construction and we have little experience of its durability. Although not subject to corrosion, it is possible that in common with other organic materials it deteriorates under prolonged exposure to sea water and sunlight. In the present state of knowledge it is considered wiser to paint fibreglass-resin boats in the normal way. Not only does the paint give protection, but it tends to cover up small defects in workmanship.

Warm soap and water is the best medium for cleaning hands, brushes and rollers, but it must be done immediately after use, before the resin has started to set.

Owing to the high cost of fibreglass-resin, it should be used for the hull and decking only. Although such items as skegs, coamings, rubbing strips, etc., could be moulded in fibreglass-resin, it is more economical to make them of wood in the ordinary way. The fibreglass-resin is easily drilled and the above items can be glued and screwed on, the resin being used as an adhesive.

As fibreglass-resin hulls are moulded in one piece, they are stiffer than other forms of construction and do not need the same number of stringers, etc. If some local stiffening is necessary it can be provided by laying-up a piece of fibreglass mat over a wood core as shown in Fig. 12.

When the hull is complete it is best removed from the mould by dismantling the latter. The surface should be carefully examined for pin holes and other irregularities and these should be filled with resin paste. Rough edges are easily trimmed with a hack-saw, plane or file as appropriate.

Books Received

"Ordinary Level Applied Mathematics," by J. E. C. Gliddon, M.Sc. 491 Pages. Crown Octavo. 423 illustrations. 11s. 6d. net. Published by University Tutorial Press Ltd.

THIS is a companion book to "Advanced Level Applied Mathematics," by S. L. Green, M.Sc., issued by the same publishers, and it has been written to meet the needs of candidates, offering mechanics and hydrostatics at the ordinary level of the General Certificate of Education, either as a separate subject or as part of additional mathematics. It will be found useful as an introductory book in the 6th form for students preparing for applied mathematics at the advanced level.

Its contents include velocity, uniform acceleration formulae, vertical motion under gravity, the vector triangle, relative velocity, projectiles, force, forces and vector quantities, triangle of forces, resolution of forces, moments, friction, problems of three forces, couples, systems of coplanar forces, work, machines, centre of gravity, Newton's law of motion, work, energy, and power, momentum, Archimedes' principle, floating bodies, hydrostatic pressure, the atmosphere, and Boyle's law.

"Automobile Engine Testing and Tuning," by S. G. Mundy, M.I.Mech.E. 264 pp., demi-octavo, 229 illustrations, 35s. net. Published by George Newnes Ltd.

THIS book provides a very practical source on the subject embodied in its title. It is, in fact, divided into six sections—fundamental principles, engine vacuum, engine compression, carburation, ignition and the charging circuits (generators and voltage regulation). Other chapters deal with testing procedure, scientific engine diagnosis and deals with the various instruments required for complete automobile engine diagnosis. The book is intended for the mechanic and for the individual owner.

"The Brabazon Story," by Lord Brabazon of Tara, G.B.E., M.C., P.C. 227 pp., demi-octavo, 25s. net. Published by Heinemann and Co.

NO reader needs to be told of the versatility of Lord Brabazon. From his school-days, he has been interested in all forms of transport. He is the holder of pilot licence No. 1, has held many prominent positions, such as Minister of Transport, and of Aircraft Production, and occupies many important posts in large business undertakings. On top of this he is one of the greatest sportsmen living to-day, and in this book he has set down, in a most entertaining manner, his reminiscences, and drawn freely upon this rich store of anecdotes. Whilst still at university he went up in balloons. He was one of our earliest racing motorists and certainly a pioneer of flying. He was a pilot in World War I and made an important invention in air photography. He was one of our leading amateur golfers and has won the Cresta Run many times. A glance at the index will whet the appetite. It includes Prime Ministers, keen sportsmen, business men, ordinary politicians — and hosts of names which are household words. It deals with the very early days of flying and motoring and, indeed, also with Lord Brabazon's very early days, when he was employed by Rolls-Royce. He deals with the Royal Aero Club, his experiences on the ground and in the air, on the golf course, and in the Army, in politics, on holiday and on the water, in business, in America, and in the House of Lords. It is a fascinating narrative, extremely humorous and well written. It is a book which everyone interested in aviation or motoring should read.

"Golden Wings," by Alison King. 191 pp., illustrated with numerous half tones, 15s. net. Published by C. Arthur Pearson, Ltd.

APROPOS to Lord Brabazon's story is this book by Alison King, which tells the story of some of the women ferry pilots of the air transport auxiliary. It contains a foreword by Lord Brabazon, who was, of course, at one time the chief of A.T.A. The story of these women pilots who delivered all types of aircraft, from factory assembly lines to Royal Air Force stations, has not hitherto been told, but it is a story of courage and efficiency and an interesting account of the organisation. Alison King gives most interesting portraits of the pilots, both on duty and off. The book shows that what men can do, women can do just as well. Here you will find the story of Amy Johnson, who lost her life as a ferry pilot, and of Diana, Margo, Rose, Winnie, Mona, Joan, "Chilie," Virginia, Grace and Wendy. There are interesting details of the early days at Hatfield. "The nation," as Lord Brabazon says in his foreword, "is indebted to the A.T.A."

"The Amateur Rod Maker," by C. W. Taylor, 64 pp., 28 illustrations, 4s. 6d. net. Published by the Model Aeronautical Press, Ltd.

A FURTHER field in which the "do it yourself" technique may be applied is fully described in this book. In addition to details for constructing various types of rod, there are chapters on tools and materials, fittings and sundries, care and maintenance of the rod and making wood and light alloy reels and accessories.

Making a Camping Trailer

Drawings and Notes on the Construction of a Unit Which Opens Out from the Towing Position in Use

By W. A. HOUGH

(*Concluded from page 198, January issue.*)

Beds, Roof and Sides

APART from the roof the trailer is made up of panels faced both sides with hardboard. A layout and assembly of the beds are shown in Fig. 9. These are placed on to the lower part of the trailer in their closed position and are hinged on the outside. To keep out draught when in use, and rain when towing, a strip of canvas 7ft. × 1½in. is then tacked over the hinges. Four 7ft. lengths of 1in. half-round beading are then marked off and recessed for each hinge, then screwed over the canvas (Fig. 11) after applying a good weather-sealing compound such as Sealastik.

The beds are held in the open position by means of two aluminium tubular stays to each side. These are inserted into a 7ft. length of 2in. × 1¼in. Perana pine so forming one complete stay, see Fig. 10. The stays are held to the beds by five 6in. T hinges. A recessed oak block is screwed at the lowest possible position on the trailer side and central with each aluminium stay, so forming a resting point to hold the beds in position.

The roof and fittings to hold it up were dealt with next. With the trailer closed the roof was made to measure, making it a flush fit with the sides and ends of the beds. Fitting aluminium T-section all around its lower outer edge, so that one side of the T overlapped the beds, stopped any rain getting into the trailer when towing. Sealastik was used to seal the T-section to the roof. Four clips were fitted, one at each corner, to hold the roof on; these were of the type used on ammunition boxes.

In making the roof consideration had to be given to allow enough room between the beds and roof ribs, to house the side panels; this is shown in Fig. 11.

Owing to the sheet of hardboard covering the roof being only 4ft. wide, it was necessary to build up the sides of the roof on a double side basis (Fig. 11). It will be appreciated that when curving a sheet of hardboard over a 2in. rise as in this case, its covering width is under 4ft. The whole roof frame is screwed and glued, and the hardboard sheet is glued and panel pinned. A good waterproof glue is necessary, and "Cascamite" was used which is a powdered resin glue used with water. This can be bought at most good class ironmongers or woodwork hobby shops.

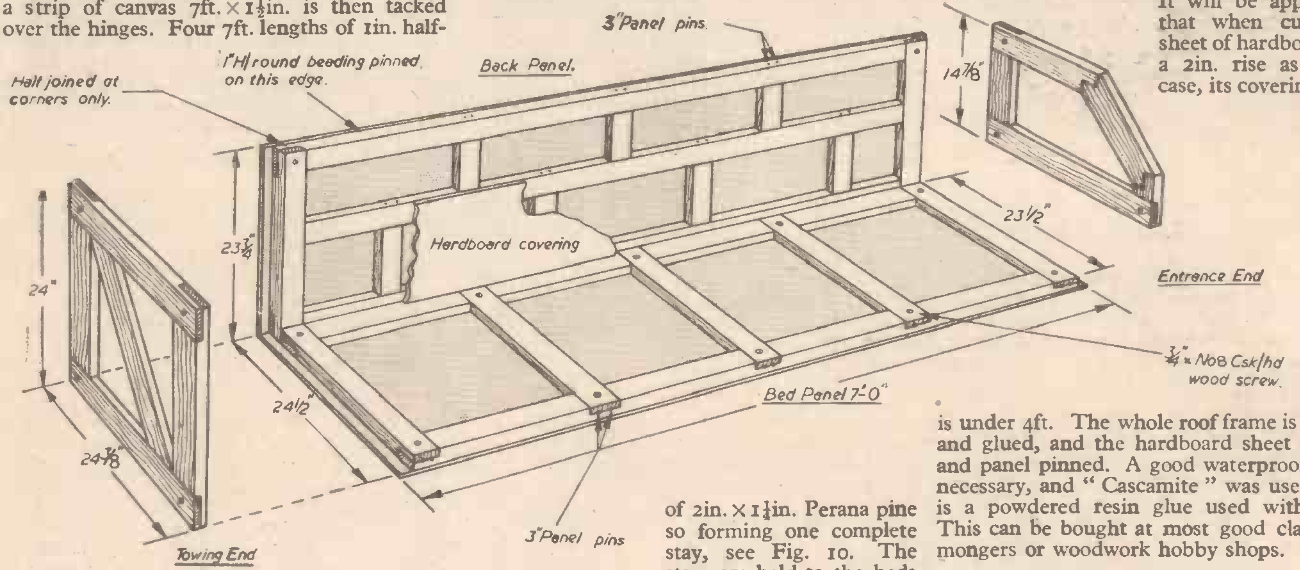


Fig. 9.—Framework of bed sections, faced both sides with hardboard.

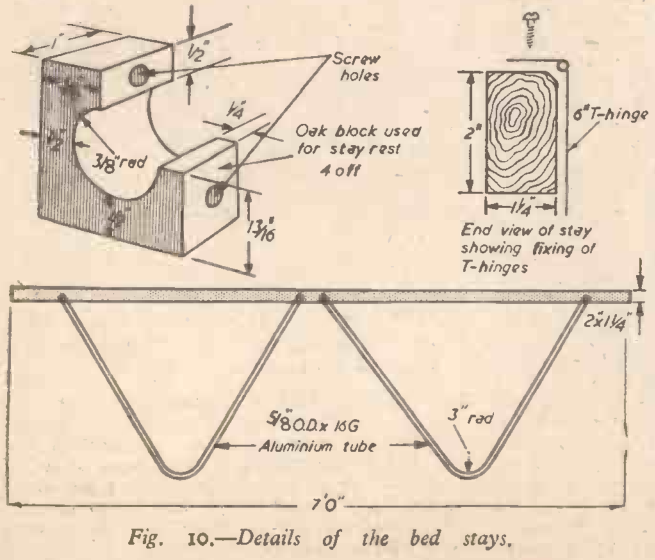


Fig. 10.—Details of the bed stays.

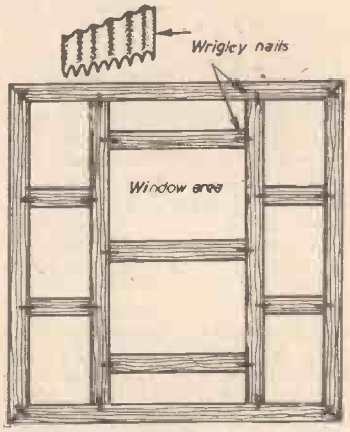


Fig. 12.—Framework of sloping sides (2 off per side of trailer).

To hold the roof up four 6ft. × ⅝in. diameter × 16g. aluminium tubes are used, held in position on the lower part of the trailer by two saddle clips to each tube. The clips are placed about 10in. apart, and a hole drilled

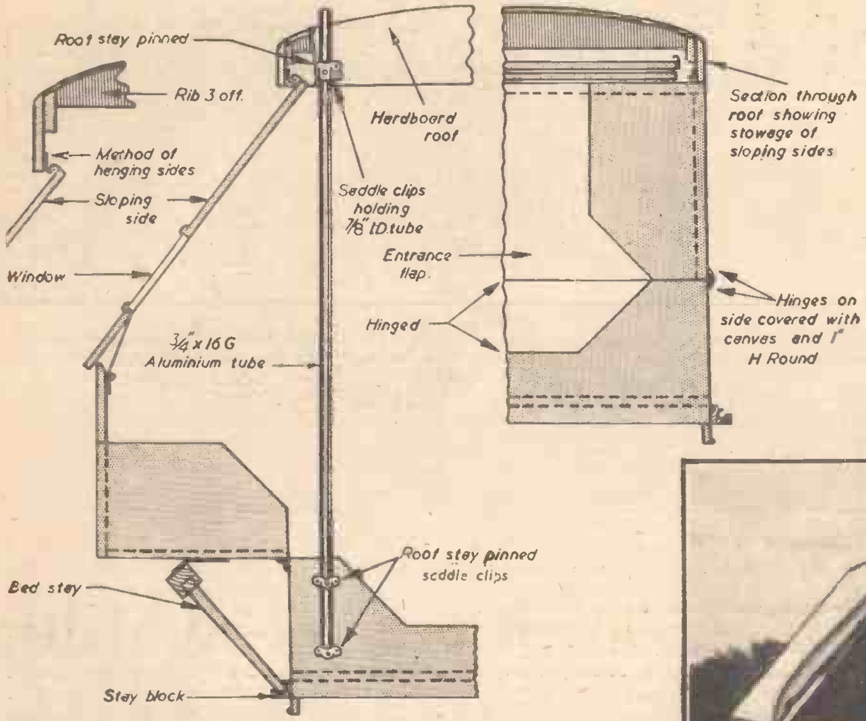


Fig. 11.—The entrance end in open and closed positions.

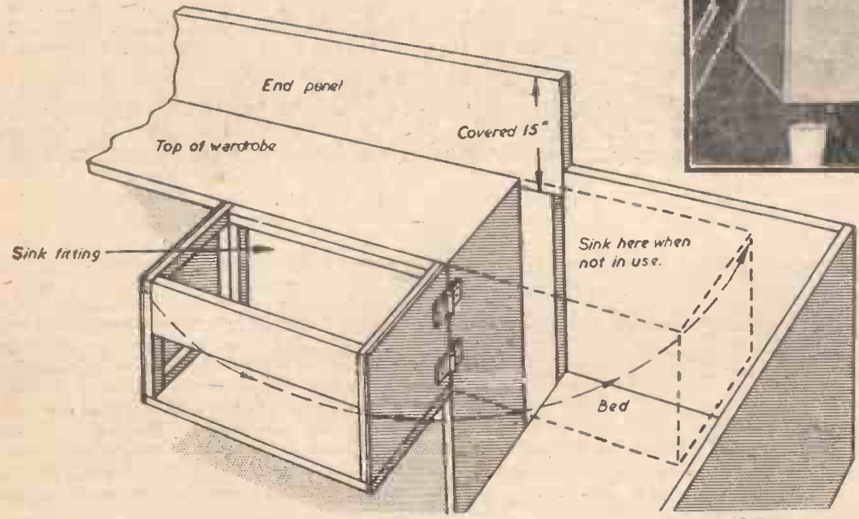


Fig. 13.—Details of the sink fitting.

through one clip and the tube, facilitated holding the tube in position by means of a $\frac{3}{16}$in. diameter pin. On the roof four 2in. lengths of $\frac{7}{8}$in. inside diameter tubes are used, held to the roof with two saddle clips to each one, and again drilling through to enable pinning of the roof at the required height (see Fig. 11).

The sloping sides consist of two panels to each side, each panel made of 30ft. of $\frac{5}{8}$in. × $1\frac{1}{2}$in. prepared pine and faced both sides with hardboard which is glued and pinned, the same glue being used as on the roof. Fig. 12 shows the framework of these panels and how they are held together. The panels are held to the roof by means of aluminium "J" section, positioned one length on the roof and one on the panel, so as to allow one to hook into the other.

Canvas Ends

Canvas for the ends was cheapened by buying two 10ft. × 6ft. new green tarpaulins costing £2 2s. each. These were purchased from The Moorland Trading Co., Ltd., St. Pancras Way, London, N.W.1. Leaving one canvas out in the rain, proved that it shrunk when wet, so care was taken to make the ends on the large side. The canvas is tacked to the sloping sides, and hooked to the inside of the roof. They are overlapped 6in. down the centre, roped and eyed to enable them to be laced up.

End Panel, Wardrobe and Sink

When the trailer is opened up for use a gap is made between the beds at the towing end behind the wardrobe. This gap is closed by a panel made of a framework of 1in. × 1in. and fully faced on the outside only, inside is faced on the top 15in. only, to give a flush finish above and behind the wardrobe (Figs. 13 and 14). Extending this panel above the wardrobe has many uses, but the main reason is to keep flames away from the canvas when cooking.

Fig. 14.—A rear view showing end panel.

The final panel for fitting is the flap entrance at the rear of trailer, this being made to measure to fit in the opening when the trailer is closed. This flap is hinged to the piece previously mentioned, which is hinged to the trailer. To seal against weather when closed, all meeting points of panels are covered with $1\frac{1}{2}$in. covering, this being treated with Sealastik before screwing to the beds and entrance flap.

The wardrobe (exploded view, Fig. 15), is made as shown in seven separate pieces, each on a framework of 1in. × $\frac{3}{4}$in. and faced one side only. After assembly the

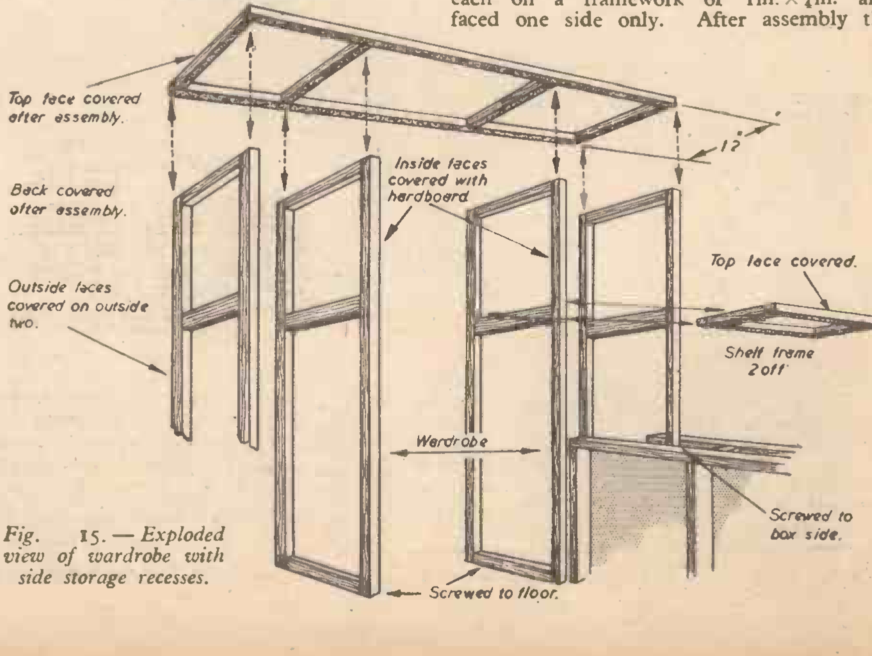


Fig. 15.—Exploded view of wardrobe with side storage recesses.

whole front is edged with $\frac{1}{2}$in. half-round beading. A cutlery drawer is fitted under one shelf.

The curtains covering the wardrobe are mounted on wire frames, which are hinged to the wardrobe side, so forming double doors, giving easy access. The side curtains covering the storage recesses are hung from curtain wires, and are weighted at the bottom to keep them in position.

The sink unit is simply a box made on the same style as the wardrobe, i.e., in separate sides and base. The front is only half covered to give access to toilet requisites. A small plastic sink bought at any caravan equipment specialists fits into the top. For drainage a flexible plastic tube passes through a hole in the base of the sink unit, and then put through a hole in the floor when required. Hinging the sink makes it a firm enough fixture, and enables it to be swung away over the bed when not in use.

Finishing

All outer corners are covered with 20g. aluminium angle, using a good measure of Seelastik before pinning with 1in. brassed roundhead pins. A 1ft. 4in. × 4ft. sheet of 20g. aluminium was cut into 2in. strips along its 4ft. length and bent to make 1in. angle at a local engineering works for a few shillings. Aluminium sheet can be bought at builders' merchants and engineers' shops or as advertised in the PRACTICAL MECHANICS and *Practical Householder*. Half-inch half-round aluminium moulding, also obtained from these sources, is screwed with "Parker Calon" screws to the side of the lower section of the trailer, following the edge.

Fig. 16.—The trailer in the closed position, with the flap down.

The outside was painted with I.C.I. Dulux. Note: In Figs. 1 and 8 (Jan. issue) the $79\frac{1}{2}$in. dimension should be $82\frac{1}{2}$in.

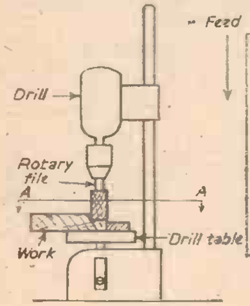
Using a Vertical Bench Drill as a Wood Miller

Some Modifications to Extend the Usefulness of a Power Drill

By D. F. KNIGHT

THE following modifications have been carried out on a Wolf Cub bench drill, but the method is adaptable for use with any similar bench drill. These modifications make it possible to utilise the drill as a wood miller, capable of performing intricate operations with considerable accuracy.

The drill is set up in its normal position on a bench and after removing the table actuating lever in order to provide free access to the table, the screw which passes through the slot in the drill base is locked so that the table is in its lowest position. A rotary file, flat



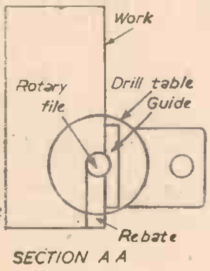


Fig. 1 (Top left)—How the wood miller is set up.

Fig. 2 (Top right)—Section on AA in Fig. 1.

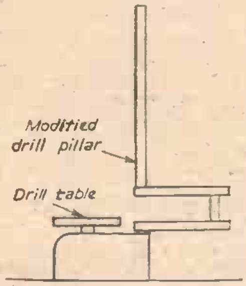


Fig. 3 (Left)—The modified drill pillar.

ended for normal operations, is fastened firmly in the drill chuck, care being taken to ensure that the shank of the file is pushed as far as possible into the chuck in order to maintain an accurate depth of cut. The wood miller may then be utilised to perform various operations.

Cutting Rebates

If it is desired to cut a rebate along a straight piece of timber a guide should be set up on the drill table. This consists of a piece of hardwood, fastened to the drill table by means of wood screws (see Figs. 1 and 2). The bottom of the rotary file is positioned at the appropriate distance above the drill table, to give a rebate of the required depth. The drill is started and the workpiece is fed into the tool, pressing it against the guide and the table. Care should be taken not to exert too great a pressure on the wood being cut, otherwise the lateral pressure may cause an excessive strain on the bearings of the drill.

Cutting a Rebate of Irregular Contour

In the event of a rebate being required to follow an irregular contour it should be marked out in pencil, the guide removed from the table and the work fed under the tool by hand. It will be found to be a considerable aid if the suction end of a vacuum cleaner is clamped near to the drill table, thereby keeping the work free from wood dust, so making it possible to see the pencil line at all times. This method is so accurate that it is possible to remove single layers from plywood, keeping the cut at the glue joint.

Finishing Recesses

If a recess of accurately controlled depth is required this may be produced by removing the bulk of the wood to the appropriate depth by drilling and then finishing off the cavity so formed by the use of the miller. It should be noted that the rotary file will cut both on the side and on the end and both cutting edges may be used in this application. In addition, by using a round-ended file it is possible to produce a radius at the junction of the sides and base of a recess.

Finishing Joints

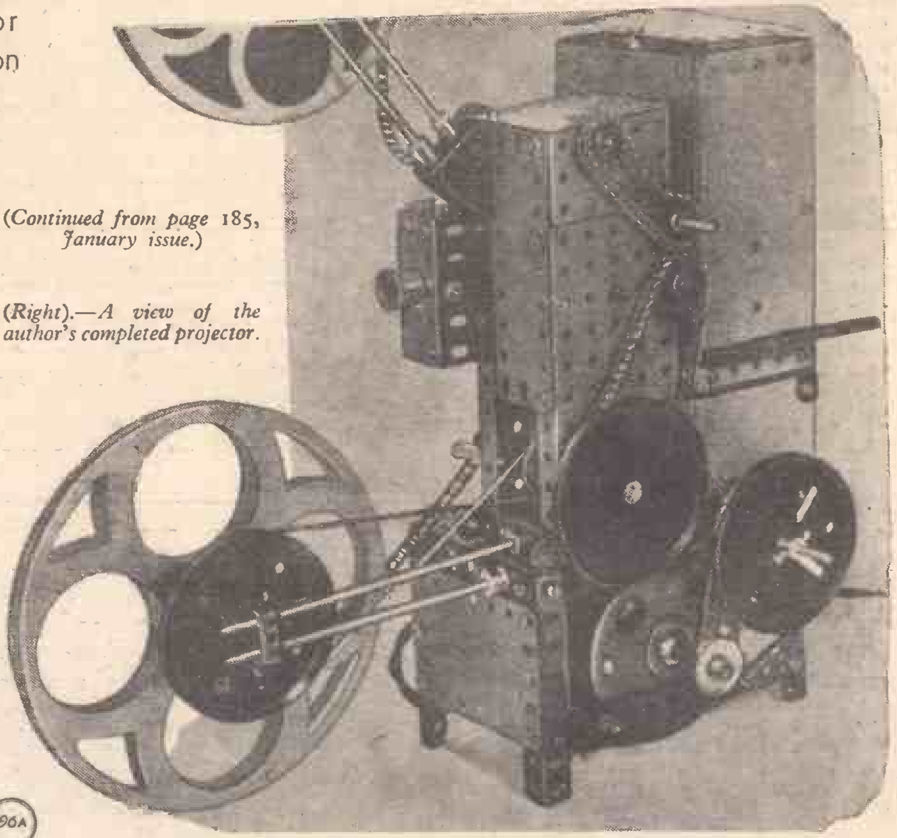
When a series of joints are to be cut, particularly halving joints and housing joints, these may be finished very successfully with the wood miller. Using the standard drill pillar, however, limitations are imposed by the somewhat restricted distance between the centre line of the drill table and the pillar. This can be overcome by making a modified pillar as shown in Fig. 3, which will permit the handling of wide pieces of wood and will be very suitable for dealing with housing joints for shelves, etc.

MAKING A 9.5MM. CINÉ PROJECTOR

Full Constructional Details for Making Apparatus for the Projection of 9.5mm. Silent Films

By L. COGSWELL

(*Continued from page 185, January issue.*)



(*Right*).—*A view of the author's completed projector.*

The Intermittent Movement

THIS should be assembled on the picture head in the position indicated in Fig. 10. Slide back the gate bracket and backplate as far as the compression springs will permit and leave the assembly lightly fastened to the picture headplate for the time being. Mount a " bush bearing " (component No. 62B) to the inside face of the picture headplate as a journal for the cam wheel spindle. Set the cam wheel and cam on the spindle, ensuring that the wheel face is dead flush with the .061in. shoulder face, as shown at B in Fig. 12. Mount a 2-3in. diameter pulley temporarily on the opposite end of the spindle, leaving sufficient clearance for the spindle to rotate freely as the pulley is turned. Pivot the follower arm to the picture headplate, 2in. below the cam wheel centre, with the components shown in Fig. 18. Place the square follower track on the cam periphery and set the shutter to the cam wheel with an 8 B.A. screw.

The movement may be operated by inching the pulley temporarily fitted at the end of the cam wheel spindle. The .002in. difference in thickness between the cam and follower should permit the latter to rise and fall freely on the rotating cam periphery. Should the movement be sticky in operation, the assembly should be dismantled and the thicknesses checked. The radii at both extremities of the pivot slot should also be checked to ensure that there is sufficient clearance to accommodate the highest and lowest positions of the follower arm as it rises and falls. It is essential that the follower track rotates freely around the cam periphery and the follower arm oscillates freely on its pivot.

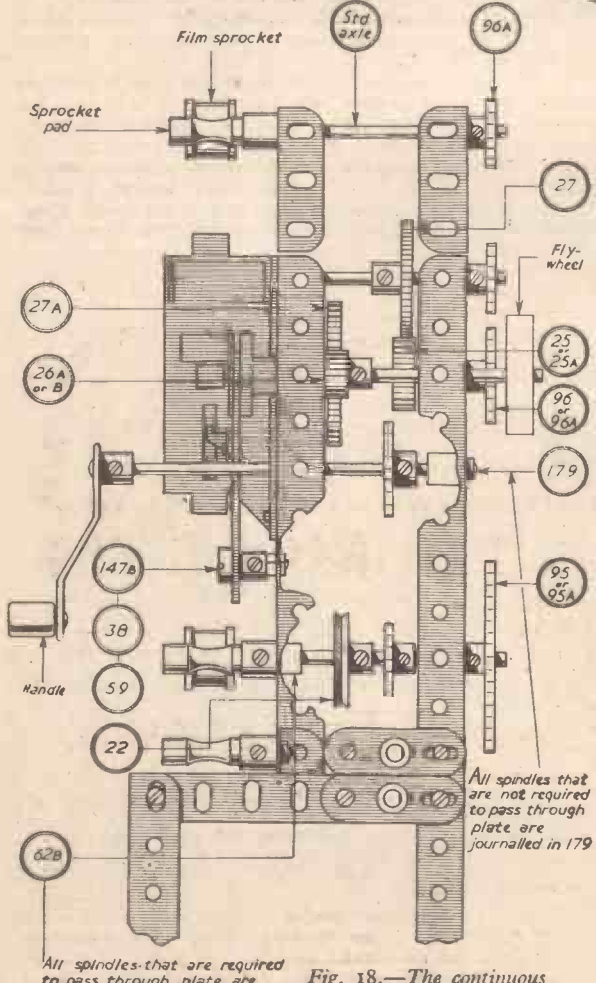


Fig. 18.—The continuous mechanism.

THE CONTINUOUS MECHANISM		
Item	**Description**	**Quantity**
22	Pulley 1in. dia. with boss	1
25	Pinion ¾in. dia., 25 teeth	1
26	Pinion ½in. dia., 19 teeth	1
27	Gear wheel 1¼in. dia., 50 teeth	1
27A	Gear wheel 1½in. dia., 57 teeth	1
37	Nut and bolt	As required
38	Washer	As required
59	Collar	As required
62B	Double arm crank	As required
96	Chain sprocket 1in. dia., 18 teeth	2
96A	Chain sprocket ¾in. dia., 14 teeth	3
95	Chain sprocket 2in. dia., 36 teeth	1
94	Sprocket chain	40in. length
179	Rod socket	As required
	Std. axle	As required
	6 tooth film sprocket	2
	Sprocket pads	5
	Flywheel, 4 oz.	1
	Handle	1

THE FOLLOWER PIVOT		
Item	**Description**	**Quantity**
38	Washer	1
59	Collar	1
147B	Pivot bolt with 2 nuts	1

Adjustment

A short length of film—about 6in.—should be placed in the guide with one frame squarely at rest in the gate aperture and the cam wheel turned until the shutter is in an identical position to that shown at B in Fig. 11. Fasten the claw bracket lightly to the follower arm, midway along the slot, with an 8 B.A. screw, ensuring that the vertical centre line of the claw bracket is in line with the vertical centre line of the arm. Ease the gate bracket forward gradually without disturbing either the film or claw positions until the claw tip is in line with the film surface. The position of the claw tip relative to the perforation should be checked and, if necessary, the claw bracket raised or lowered on the follower arm, so that both claw tip and perforation are in line. Bring the gate bracket to its final position—that is, to a position where the claw tip projects .015in.-.020in. through the perforation. Tighten the gate and claw brackets, taking care not to disturb their positions, and advance the film one frame by inching the standard pulley. If the setting is correct, the successive frame of film will come to rest at full rack in the aperture and, if the pulley is turned continuously, the subsequent frames should also register correctly. Should the perforations or part of the perforations come to rest in the aperture, the racking may be corrected by raising or lowering the claw bracket.

When correctly set, the gate and claw brackets should be finally tightened. The claw bracket may later be riveted to the follower arm in two diagonally opposite places. (The claw bracket should not be permanently set until projection tests have been made, as different pad pressures affect the racking.) Two ⅛in. diameter holes may be drilled through the long tab of the gate bracket and the picture headplate (see Fig. 10) which, when used in conjunction with ⅛in. diameter drifts, would serve as a re-location in event of the removal of the gate bracket.

The Top Picture Head

The main frame of this unit was constructed by connecting two 2½in. x 1½in. plates with 2in. long angle strips in the positions shown in the perspective sketch (Fig. 4).

The plates were aligned with drift rods by the same method used for lining up the picture headplates.

The take-off spool arm bracket, the construction of which is also shown in Fig. 4, was mounted in position prior to assembling the top picture head to the main picture head.

The standard components used in the construction of the unit are listed in the relevant table in Fig. 4.

The Continuous Mechanism

As previously mentioned the film is fed continuously into the guide. In operation a constant loop of free film is maintained between the sprockets and guide, to accommodate the differential of linear motion set up in the film between the intermittent and continuous movements.

The elevation in Fig. 10 shows the upper and lower film loops between the sprockets and guide. The sprockets rotate continuously at the same speed, but in opposite directions, as indicated by the arrows. As six-toothed sprockets are used, the gearing has been arranged to impart a 6 : 1 cam-wheel-to-sprocket ratio. The mechanism, fitted with a temporary hand-drive, is shown in the front view in Fig. 18.

No doubt constructors who have specific standard gears available could arrange other combinations to give the same cam-wheel-to-sprocket ratio. Consideration must, however, be given to the direction of rotation and positions of the sprockets, if other arrangements are to be used.

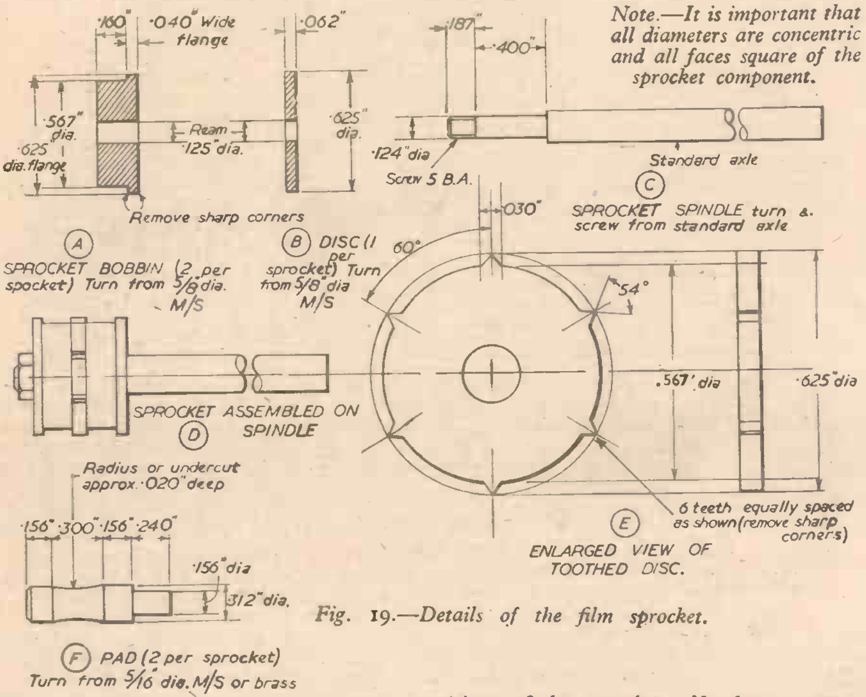


Fig. 19.—Details of the film sprocket.

All gears, spindles, chain sprockets and pulleys employed in the mechanism are standard components and should be readily obtainable. The only items that the constructor may encounter difficulty in obtaining are the sprockets. Occasionally these items are advertised in current photographic and accessory lists and, at times, may be obtained from ciné-supply stores. Smaller or larger sprockets could be used (although a sprocket smaller than a six-toothed would be inclined to stress the film rather tightly), in which case a different gear train from that illustrated at Fig. 18 would be required to give the correct ratio.

Secondhand sprockets should be closely inspected before purchasing to ascertain that they are not worn; a well-used sprocket may be detected by grooves worn in the flanks of the teeth and the purchase of sprockets in such condition should be avoided. Sub-standard machines are generally fitted with hardened, or hard, chrome-plated sprocket teeth. To meet the high standard of reliability that constant usage demands, many theatre projectors are fitted with sapphire-toothed sprockets.

As ready-made sprockets could not be obtained by the author when they were required, sprockets were "built-up," as shown at D in Fig. 19, and also in the photograph, Fig. 21, with the component parts shown at A, B and C. The constructor with access to the requisite machine tools could readily produce a similar sprocket and spindle. It should be noted, however, that with each component part the faces must be square to the bore and the diameter concentric to the bore.

TAKE-UP CARRIER

Item	Description	Quantity
20A	Pulley, 2in. diameter	1
24B	Bush wheel, 1⅛in. diameter	1 per arm
38	Washer	As req.
59	Collar	As req.
63	Coupling	1 per arm
115	Pin	1 per arm
120B	Compression spring	1 per arm
	Sleeve	1 per arm
	Standard axle	As req.

Turn the sprocket "halves," or bobbins, and the toothed disc from ⅝in. diameter mild steel and drill and ream the bores of the components to ⅛in. diameter. In view of the required dimensional accuracy it would be preferable to machine cut the sprocket teeth of the disc, or the teeth could be spline cut the width of the tooth root to the .567in. tooth root diameter (i.e., $\frac{7.54\text{mm.} \times 6}{\pi}$), according to the type of machine tool available. In the latter case the tooth form should be accurately marked off and the teeth brought to final shape with needle files.

Turn and screw the sprocket spindles from standard axles, as shown at C in Fig. 19, taking care not to distort the axles, and turn the sprocket pads shown at F in Fig. 19. The pads should be smoothly finished and, if possible, chromium plated.

Mount the sprocket assemblies to the picture head, using Part No. 62B as "bush bearings" for the spindles. This component is fitted to the inside face of the picture head plate where all spindles are required to pass through the plate. Where spindles are not required to pass through the plate they are journalled in sockets (Part No. 179, see Fig. 18). It may be found necessary to file a flat on the sockets supporting the 50- and 57-teeth gear spindles, to clear the buffer bracket bolts.

Elongate the hole each side of the sprockets so that the pads mounted in sockets (Part No. 179) can be brought to within .010in. of the sprocket flanges. A further pad should be fitted to the edge of the base plate, as shown in Fig. 18.

All gears, chain drives and sprockets should run quietly and smoothly. A true running flywheel (about 4 oz.) should be fitted to the cam wheel spindle to smooth out ripple. At this stage a suitable motor (a blower motor, if possible) could be fitted beneath the base plate of the machine and, if necessary, speed reduction pulleys arranged at convenient

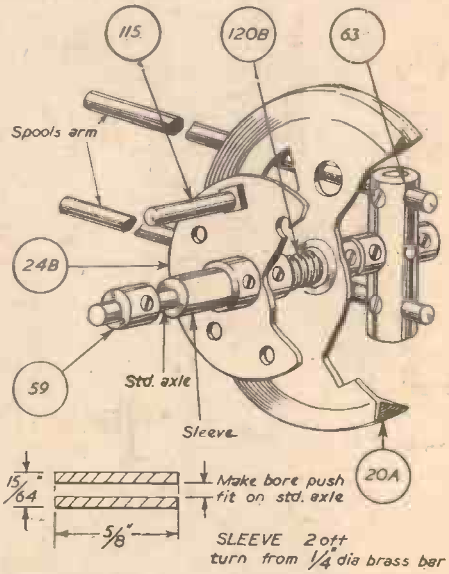


Fig. 20.—Perspective view of take-up carrier. The spindle is driven by 2in. diameter pulley; carrier wheel is free to revolve on spindle. Arrangement for take-off carrier is identical, except that spindle is fixed and 2in. diameter pulley if not required. Make spool arms from standard axles and locate in sockets (part No. 179) fitted to frame of the machine (see Figs. 4 and 18).

positions on the base side members. The temporary hand-drive should be retained, however, for the trial run, with the spool arms fitted.

Spool Arms and Carriers

It should be noted that in operation the take-up spool revolves gradually to a slower speed, as the amount of film wound on the spool increases. Conversely, the take-off spool revolves to a progressively greater speed as the amount of film decreases thereon. The take-off spool is free to revolve at the rate that the transported film demands and does not, as a rule, present the problems associated with the take-up spool, which is driven. The writer has experienced many tiresome setbacks with take-up spools that " snatch " and " tug " or, on the other hand, refuse to wind up. One arrangement which has proved to be quite reliable when used with spools up to 400ft. capacity is illustrated in Fig. 20.

The upper and lower spool arms were made by connecting two 6in. long rods at their ends with a coupling (Part No. 63). The opposite ends of the rods were inserted into sockets mounted on the machine, as shown at the perspective view at Fig. 4 for the take-off arm, and at Fig. 18 for the take-up arm.

The 2in. diameter take-up pulley and axle is driven by a crossed spring band from a 1in. diameter pulley fitted to the take-up sprocket spindle. The spool carriers are 1⅜in. dia. wheels to which dog pins (Part No. 115) are fitted, to engage in the spool dog holes. One hole of each wheel was elongated to enable the pins to be set in the correct position.

The take-up carrier is free to revolve on the spindle and is driven by a compression spring (Part No. 120B) interposed at approximately half its compressible length between the 2in. diameter pulley and the carrier. A compression spring is also fitted adjacent to the carrier on the fixed take-off axle, to prevent " whirling " of the take-off spool. Sleeves are fitted to both axles and the spools retained to the axles with collars.

As all the required components (except the sleeves) are standard items, the constructor could readily assemble the arrangement. A preliminary run may then be made to assess the mechanical performance of the machine, prior to fitting the illuminant and lenses.

Much damaged film will be avoided if a few points are observed before attempting the trial. First, the position of the carriers should be checked to ensure that the spools will be in line with the sprockets. Secondly, check that the spools to be used are not buckled. The film may be pulled off the sprockets with disastrous results if either of the foregoing points are unobserved. Finally, check that the trial film is not brittle or torn, as a fair assessment of the machine's performance cannot be made with damaged film.

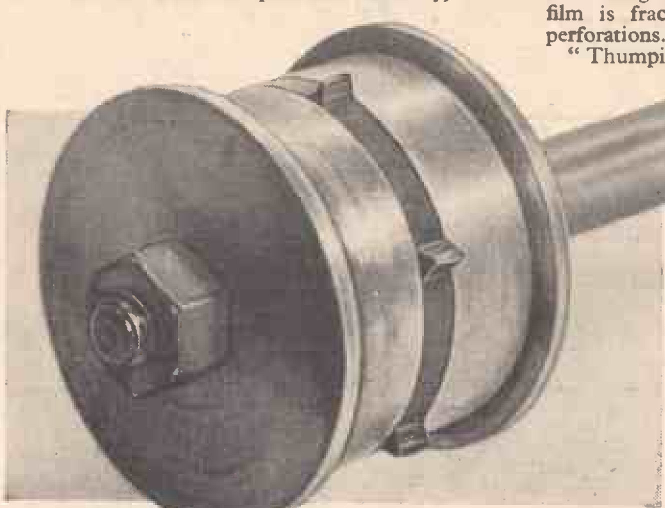


Fig. 21.—The film sprocket.

Lace the film, leaving a generous loop (about 10 frames) between the take-off sprocket and guide, and as large a loop as possible between the guide and take-up sprocket and check that the loops are not touching the machine. Insert the free end of the film on the take-up spool clip and inch the machine (using the temporary handle to) ensure that claw and sprockets are correctly engaging with the film. The machine may then be cranked continuously. The film should maintain a gentle, even tension between sprockets and spools. Should any tugging occur between these points, the machine should be stopped and the relevant compression spring eased. The spring tension should not be released entirely at the take-up carrier, as the carrier would not revolve. The correct adjustment should be obtained without any difficulty and the arrangement found to function satisfactorily.

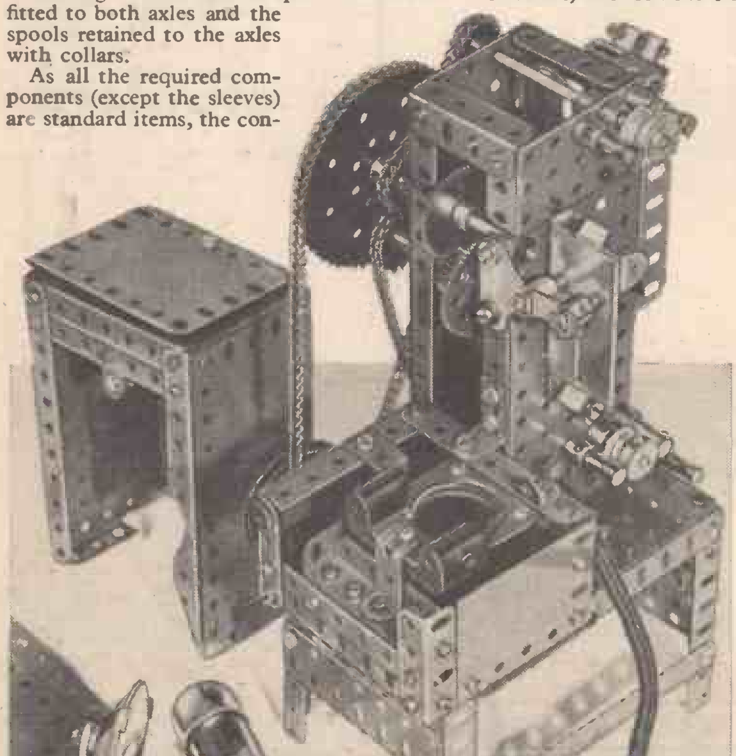


Fig. 22 (Left).—The lighting unit.

" Flapping " of the film either side of the sprockets indicates a " bad tooth " or teeth, in which case the sprocket should be removed and the offending teeth corrected before the film is fractured throughout at the perforations.

" Thumping " at the pull-down indicates that the guide pads are exerting too much pressure on the film. To relieve the pressure, a separator (which could be .002 to .003in. paper or tape) may be fixed, either on the gate bracket or back plate faces. The claw should " flick " the film down smoothly and quietly at the pull-down. It should be noted that, as the guide on the machine described is longer than the conventional type of guide, the pad pressure is distributed over a greater film area. For this reason, it may be found that in operation the film is quite stable in the guide under negative pressure from the pads; that is, with the guide pads barely touching the film.

When all aspects of the mechanism are functioning to the constructor's satisfaction, the motor may be connected to the machine. The trial film should, however, be examined frequently to ascertain that it is not fractured or scratched.

Illumination and Lenses

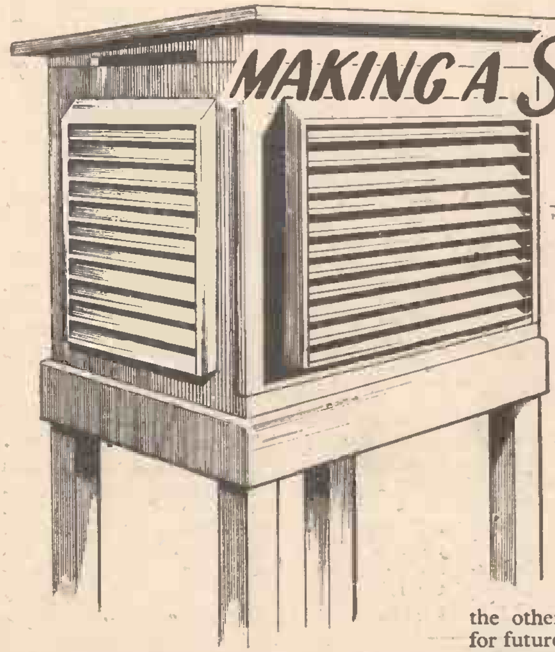
Much light is lost in the conventional cinematograph by the shutter interception at the frame advance and the frame rest. Optimum optical efficiency may only be obtained if the pull-down is extremely rapid, permitting the maximum frame rest period and thereby permitting the maximum amount of light to reach the screen.

Recapitulating on the intermittent mechanism, the pull-down on the machine described takes approximately one-third of the complete cam revolution. The movement would contribute more to the optical efficiency of the machine if the pull-down were effected in, say, one-sixth of the cam revolution, whilst a further improvement in the lighting would be a light cut off of less duration at the frame rest than at the frame advance.

The fabrication of a rapid pull-down movement involves the making of additional cams and linkages and the manufacture of the more complex mechanism may be beyond the resources of the home constructor. The pull-down mechanism of the machine described, although not " extremely rapid," embodies few moving parts and, if used in conjunction with a suitable lamp and reflector, good quality condenser and objective lenses, will give a satisfactory result.

For the illuminant, low tension lamps are preferable to the higher voltage types, as they possess rugged filaments and emit a white light from a point source. The type used is a Philips Class A1-4 projection lamp, 6067C P.28 cap, 12 volts 100 watts, supplied from the mains via a transformer giving an output of 12 volts 9 amps. The lamp is the pre-focus type and is used with the " Quickset Minor " lighting unit, shown in Fig. 22.

(To be concluded.)



MAKING A STEVENSON SCREEN

A Device for Housing Meteorological Instruments

By M. M. DAWES

A STEVENSON screen is the device most usually employed to shield thermometers from all external radiation and at the same time allow all the winds from any direction to pass freely about the enclosed thermometers. To do this job effectively the screen is made in the form of a box with double louvred sides, each side having two sets of louvres, one inside, the other outside, with all louvres sloping downwards. There is a double roof and the bottom of the box is made with three over-lapping sections, this further assisting the free circulation of air. The screen is mounted on four legs, wood or metal, so that its base is about 3ft. 6in. above the ground and the whole erection is painted white.

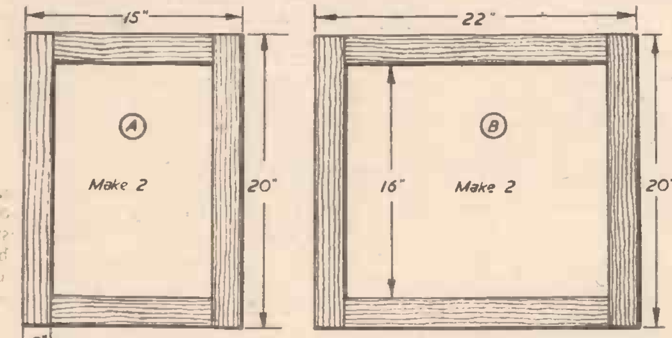
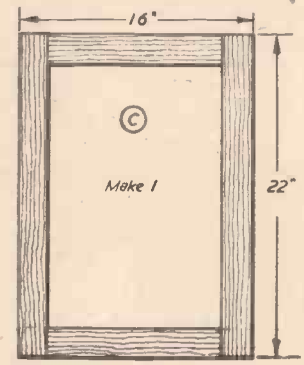


Fig. 1.—Details of the frames.



The Frames

Procure some wood of ½in. × 2in. section and make up five frames, two measuring 15in. × 20in., two 22in. × 20in. and one 16in. × 22in., as in A, B and C, Fig. 1. One of the wide frames (B) should have a long side divided into two lengths, each 1in. × 22in. The frame concerned is made up with one length, the other being kept on one side for future use. They will finally be connected by hinges, this arrangement constituting the door, which drops down when opened.

The Louvre Holders

Now cut eight pieces of wood to the shape and dimensions shown in Fig. 2, using wood of ½in. thickness.

Wood of ½in. thickness is used throughout, apart from the legs, louvres and roof supports.

On each piece draw down the middle two lines ½in. apart. Divide each into 12 equal parts and mark out 11 slots measuring 2in. × ¼in., sloping at an angle of 30 deg. from the vertical. Chisel out these slots to a depth of ¼in. and screw two of the finished pieces opposite each other to the inside edges of each of the four side frames (A and B in Fig. 1).

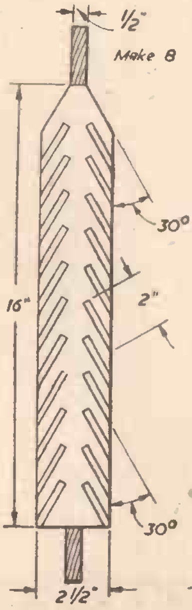


Fig. 2.—The louvre holders.

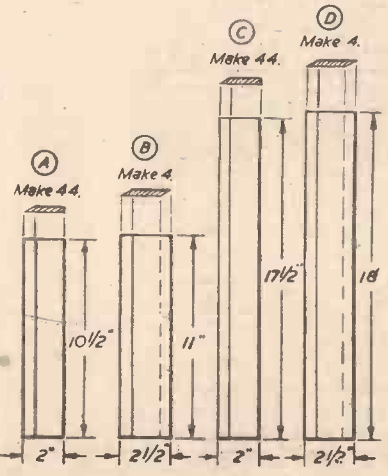


Fig. 3.—The four sizes of louvre.

The Louvres

The louvres should be cut from wood of ¼in. thickness. There are four types, as detailed in Fig. 3. There are 44 of type A, 2in. × 10½in., each one having a single edge bevelled at 30 deg. These fit into the slots of the louvre holders on the two narrow side frames (A in Fig. 1).

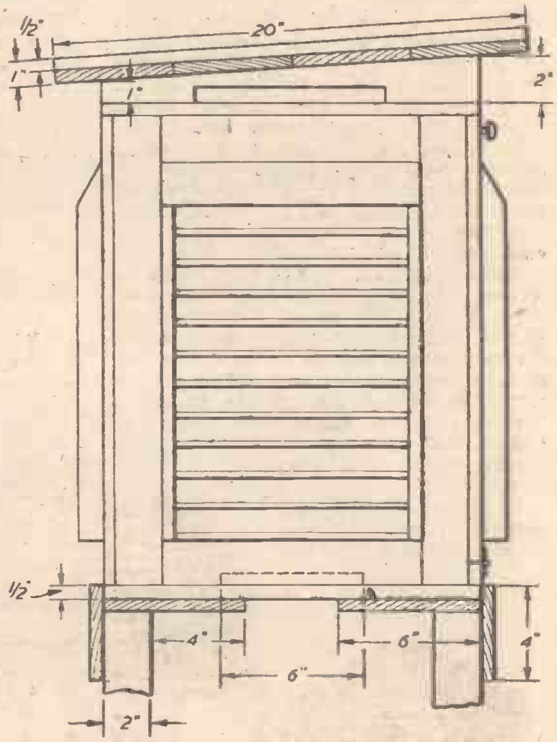


Fig. 4.—A side view of the completed screen.

Make four of type B, 2½in. × 11in., and bevel both edges of each one, also at 30 deg. These slightly longer ones do not fit into slots, but are screwed directly on to the sloping tops of the louvre holders.

Next, 44 louvres of type C, 17½in. × 2in., are cut out and bevelled on one edge. These fit into the louvre holders on the wide frames (B in Fig. 1).

The four type D louvres, 18in. × 2½in., have two edges, each bevelled at 30 deg., and are screwed to the sloping tops of the louvre holders on the wide frames.

Types B and D louvres may be found to be too wide, as the measurements are only approximate, but they are easily planed down if necessary.

Before finally fixing the louvres they should be painted on their insides, as they cannot be reached afterwards.

The Bottom Frame

This frame (C in Fig. 1) simply has three overlapping pieces of wood screwed to it, two on the underside, one on the upper, as shown in Fig. 4. All three pieces measure 21in. × 6in.

The Double Roof

This consists first of the top of the screen itself, which measures 16in. × 22in. It can be any reasonable thickness, either in separate planks or a single sheet. Several ¼in. diameter holes should be bored through this, through which short pieces of brass tubing are pushed, to prevent rain running into them.

The roof proper slopes backwards and is supported at the sides by pieces of wood shaped as in Fig. 4, 1in. high at the back, 2in. high in front. The front and back edges are supported by blocks of wood 3in. long. All these roof supports are made 1in. thick. The roof itself measures 20in. × 26in., and is made up of two layers of wood, well glued together, the grain of one layer running at right angles to the grain of the other. This prevents warping.

Assembling

The back and two sides of the screen are screwed together and the bottom and top added. Now take the 1in. × 22in. length of wood laid aside earlier and fix it along the bottom of the front. Fix the door to this with hinges and attach chains so that it will drop to a horizontal position when opened.

The sloping roof and its supports are fixed with waterproof glue, but before adding the sloping roof itself the top of the screen should be painted.

The Legs

These are four lengths of 2in × 2in. wood, each being long enough to be sunk into the ground about 18in. and to carry the screen with its base at a height of 3ft. 6in. above the ground, making a 5ft. length for each leg. With short planks of wood about 4in. wide the legs are joined at the tops, middles and bottoms to form a stand. The planks joining the tops of the legs should project about 1in. above the legs themselves (see Fig. 4), thus making a seating into which the screen can fit and be screwed in place.

The whole thing should now receive three coats of white paint, the underground parts being creosoted.

Arranging the Thermometers

In arranging the thermometers, the following points should be borne in mind:

1. There should be a space of at least 3in. between the bulbs of the thermometers and the top, bottom or sides of the screen.
2. The thermometers should be so arranged that all parts of their scales can be read without the necessity for moving any one of them or for viewing the stems at an angle.
3. The maximum and minimum thermometers should be arranged so that strong winds cannot shake them, as jolting often leads to displacement of the indices. The instruments require to be moved once a day for setting and, therefore, cannot be permanently fixed in position.
4. The maximum and minimum thermometers are arranged horizontally; the wet and dry bulb vertically. If a grass minimum is possessed, when not in use it leans, bulb down, in a corner of the screen.

Interior Fittings

The precise method of fixing the thermometers in accordance with the conditions laid out depends on the type of instruments used. Usually there is a wooden upright, running from top to bottom of the screen, with two horizontal cross pieces attached about 1ft. apart. However, a suitable fixture to suit his own instruments will readily suggest itself to the constructor.

Cutting Perspex Discs

Details Received from C. W. Tinson in Reply to a Query Published in "Information Sought"

ASSUMING that your correspondent wants a scheme of the simplest possible sort, the following will not require the purchase of any special tools or aids, and the material necessary is likely to be at hand. It is for the production of discs in Perspex 1/16in. thick.

The Die

A die (1 in the sketch) is made of wood, preferably hard wood, say 4in. square, and in the centre of this a hole 1½in. diameter is cut. A piece of sheet metal (2), say 16 s.w.g. or thicker, has a hole exactly 1½in. diameter in the centre which is made by drilling a ring of holes, nibbling out with a small file, and finishing to size with a half-round file.

This plate is drilled and countersunk for woodscrews so that it can be secured to one surface of the die block (1), with its hole exactly coinciding with the hole in the block.

The Guide

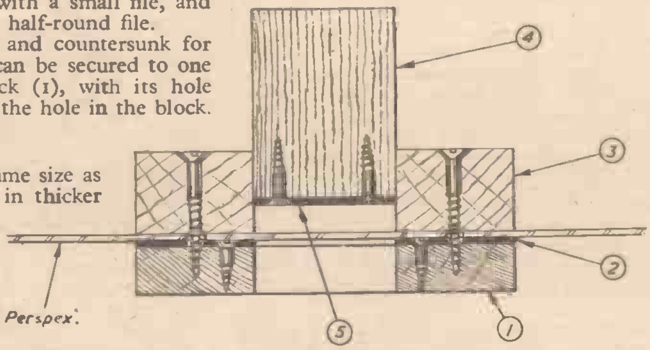
A guide (3), of the same size as the die but preferably in thicker material, to give a good lead for the punch, is made in hard wood, with a hole 1½in. diameter in its centre. It is drilled and countersunk for woodscrews positioned to miss those which attach (2) to (1). Holes must be drilled in the same locations through the plate (2), which will be removed temporarily to allow this operation.

The Punch

A punch (4), of suitable length, is required and preferably is made in metal. A piece of 1½in. diameter tube, say 17 s.w.g., can be used, but if this is not available, a wood punch faced with a piece of sheet steel, as illustrated in the sketch, can be used, provided that the metal disc—which is the cutting part of the punch—is carefully shaped true to diameter. It should only just pass through the hole in the metal facing (2) of the die. This is secured to the end of the punch by woodscrews which are countersunk perfectly flush. Fill the slots in the screws with solder and rub down to obtain a really level surface, in order to avoid marking the Perspex during the operation of stamping.

Assembly

Attach the guide to the die with woodscrews. To ensure correct registration, the punch should be put through to act as a locator while the operation of screwing the two together is being done. Alternatively, dowels could be used to locate and the two clamped together while actually stamping.



Device for cutting Perspex discs.

Operation

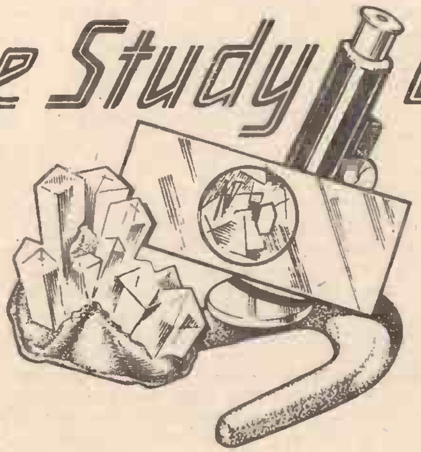
If screws are used to unite the two components, and if these are not set apart sufficiently to clear the strip of Perspex to be stamped, it will be necessary to drill holes in the Perspex to allow the clamping woodscrews to pass, of course. When the Perspex is in position and is firmly clamped between, the punch can be driven down by a hammer blow or by putting the assembly in a vice.

For Thicker Perspex

The method previously described will not do if the Perspex is thicker. If, for example, it is required to make discs or other shapes out of ⅛in. or 3/16in. material I find the only satisfactory way, after marking out the required shape, is to drill a hole just outside the shape and cut as closely to the line as possible with a fine saw. I use one of those fretwork-like saws which can be obtained from the chain stores. Cutting with this is both easy and rapid. One can keep close to the line so that very little work has to be done to finish. File down to the line, then smooth with a finer file, after which emery cloth is used until all the file marks have disappeared. The edge can now be finish-polished with metal polish, such as Dura-glit.

Discs or ellipses made in this way are excellent to interpose between an ornament, such as a flower vase, and the polished top of a table.

Aids in the Study of Geology



No. 3.—The Technique of Preparing Rocks for Microscopic Study

By E. J. WILKINSON

THAT a fragment of rock can be ground thin enough to become translucent is a matter for surprise to many people who have had little to do with geology. But this fact enables a detailed study of rocks to be made under the microscope; a study known as micro-petrology.

Materials Required

Three sheets of ¼in. thick plate glass about 10in. square.

Three grades of carborundum powder: 600 (fine), 220 (medium) and 90 (coarse). These can be obtained in ½lb. tins and will last some time if correctly used.

Three basins about 6in. diameter.

Three small jars of water each with a nasal dropper.

Canada balsam (filtered).

Canada balsam in xylol (or benzol).

A number of 3in. × 1in. No. 2 micro slips.

A number of cover glasses (1½in. × ⅞in. is a useful size).

One Bunsen burner (though a small burner on the gas cooker has been successfully used).

One hot-plate (a sketch of this easily made item is given).

One pair of forceps.

One or two mounting needles.

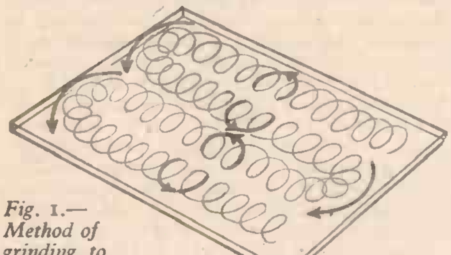


Fig. 1.—Method of grinding to distribute wear.

The Specimen

It will be assumed that slides are to be made from rock chips struck from a parent block by judicious use of a hammer. It is wise to place the rock to be chipped on, say, a folded sack to provide some absorption for the blows. A cold chisel is a useful aid, while in time lines of weakness within the rock itself will be easily picked out and made use of. The ideal piece of rock to start work with is a slice as thin as the nature of the material will permit and having two parallel faces. Such specimens can only very rarely be obtained by chipping. The softer rocks can be cut into slices by using a hacksaw, but the beginner would be well advised to make a start on harder specimens in which the mineral particles are more securely bonded or locked together. Having obtained a suitable fragment of rock (which will most likely be wedge shaped) about 1in. square—no smaller as a general rule, for some pieces may be lost from the edges during grinding—a perfectly flat side must be produced.

Preparation for Mounting

Using one of the water "droppers" place a small quantity of water on one of the glass plates and sprinkle some of the coarse carborundum powder on the water. The author keeps his abrasives in suitably marked talcum powder tins. The correct amounts of water and powder can easily be judged with experience. Too much water in relation to powder will cause the individual grains of carborundum to float about and fail to "bite" the rock: too little water will result in a "dry" mixture which, with powdered rock soon added to it will make for hard work.

The rock chip should be worked systematically over the plate in row upon row of small overlapping circles, as shown in Figs. 1 and 2, so as to extend the life of the glass, for the glass as well as the rock will be defaced. During grinding the abrasive mixture will tend to become dry owing to the rock flour being added to it, so small additions of water will be necessary from time to time.

To check on how the work is progressing rinse the chip in water contained in one of the basins and examine the surface being treated.

As soon as all cavities have disappeared, thoroughly clean hands and specimen under running water, using a nail brush if necessary. It is important that no trace of a carborundum powder should find its way into the process employing a finer grade of powder, for when the rock is nearing its finished thickness—only a few thousandths of an inch—one grain of coarse powder can easily ruin the specimen. For this reason the three glass plates and basins should be marked so that they will always be used with the same grade of abrasive. The water droppers become contaminated, for it is not practicable to be cleansing one's hands too frequently, therefore one is kept for each plate. Basins, plates and droppers should be so placed as to prevent the possibility of contamination by splashing.

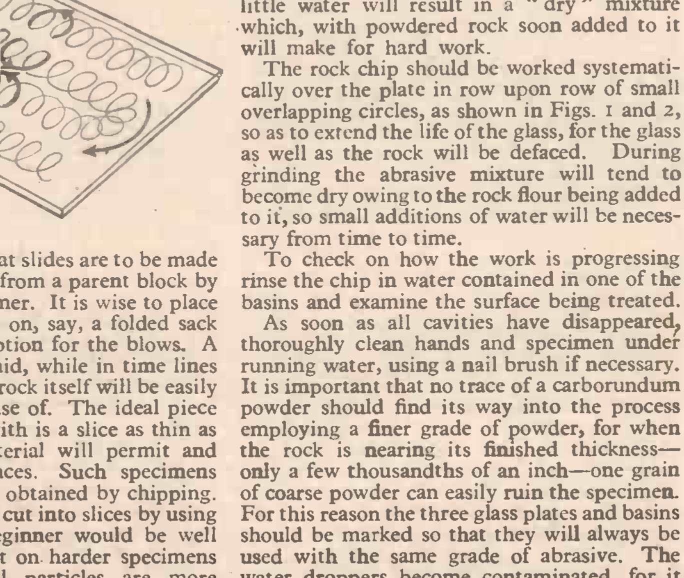


Fig. 2.—Grinding in progress.

Next repeat the grinding on the medium plate. Only a few rubs will be necessary to erase from the rock surface the deeper scratches left on by the coarse powder.

Thoroughly clean again and then grind on the fine plate. This will leave a surface suitable for microscope work.

Mounting

After cleaning, the rock should be put on the hot-plate to dry. This can be easily made from a ¼in. thick piece of brass and four pieces of mild steel rod. A pinch clip is necessary on the supply pipe to control the Bunsen flame. If a small flame is lit before the fine grinding is commenced, there will be no waiting. A clean glass slip should also be put on the plate to warm and some Canada balsam (filtered) placed centrally on it. The Bunsen flame may be increased a little, but excessive heat can ruin the balsam.

As the balsam becomes really fluid it should be examined for air bubbles—a great source of trouble at this stage. It must be remembered that under the microscope these, as well as the rock, are magnified and therefore can spoil an otherwise good slide. Odd bubbles can be punctured with a mounting needle, or, if numerous, driven out of the balsam by the application of a red-hot nail suitably mounted in a wooden handle.

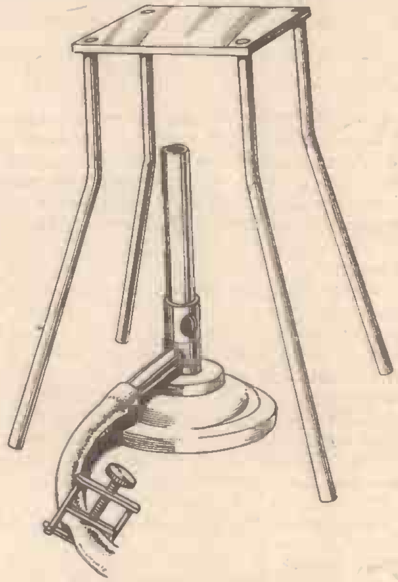


Fig 3.—The hot-plate.

To test if the balsam has "cooked," take a small portion between the points of a pair of forceps and then allow the two arms of the latter to open. The balsam will be stretched out in a thread which, if correctly "cooked," will snap in two. If insufficiently heated the thread will not snap; if over-cooked it will crumble. If the latter is the case start again with a fresh slip, for the over-cooked balsam would in all probability disintegrate during later grinding.

When ready for mounting the rock, build up the balsam to one side of the glass slip, as shown at A in Fig. 4. Using the heated nail, lay one edge of the rock in the balsam at that side and gently lower. The balsam will then be squeezed along under the rock and emerge at the opposite side and will tend to carry out any stray air bubbles (B in Fig. 4). Remove the whole from the hot-plate and place a weight (a large hexagon nut will do) on the rock. The balsam will quickly harden and can then be examined on the underside of the slip for bubbles.

Look, too, for small patches of trapped air which display Newton's rings—bands of colour like those seen when oil lies on water. These often show only when the light is striking the slide at a critical angle. Any such serious inclusions must be removed by reheating and working out by gentle pressure in the right direction or, if that fails, by remounting the specimen on a fresh slip. This may sound rather drastic, but unless the rock is securely cemented to the glass the danger of its lifting completely away at a later stage when little can be done to recover it is very great.

Should remounting be necessary, the surface of the rock should, when cold, be reground on the fine plate in order to remove the film of balsam adhering to it.

When the specimen is successfully mounted, bring the nail to red heat and work up the excess balsam which has set on the glass slip around the edges of the rock to give added strength for the grinding which follows.

Grinding of Second Side

As the chip still possesses a rough face yet to be ground, great care must be taken from the start to develop a flat on it which is as near parallel to the opposite face as possible. It is not always easy to correct a wedge shape.

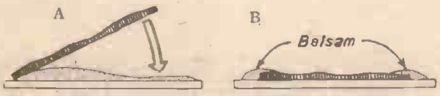


Fig. 4.—Two stages in mounting rock section.

Commence on the coarse plate—a steady and unhurried motion is by far the best one—holding the slip firmly but not applying undue pressure. As a flat develops the work will become easier and the motion can be imparted to the slide simply by the pressure of one or two finger tips placed on the glass directly over the rock.

Wash and examine regularly, and as the carborundum becomes rather feeble in its action, liven it up by adding a little fresh of the same grade.

Should one side of the rock show signs of grinding thinner than the other, endeavour to correct this at once by applying the operating finger directly over the thicker portion of the rock and maintaining the pressure there until level again. Another method of truing up the surface is to work the slide backwards and forwards on the edge of the plate with the thinner portion of the rock overhanging and therefore not being ground. This method is the best when the rock slice is getting very thin, and is shown in Fig. 5.

Grinding on the coarse carborundum should not be overdone as the strain imposed upon the mounted specimen is great and with increasing thinness the rock becomes more fragile. No definite stage at which a change should be made to the medium powder can be laid down, for rocks vary so greatly in character and each requires individual consideration. As a rough guide the author would suggest down to 1/10in. and then cleanse and transfer to the medium plate. The bite of the 220 powder will be less severe.

If any foreign body—a piece of grit or a detached fragment of the rock itself—which is larger than the grade of powder being used finds its way into the grinding mixture it will soon make its presence known. In such an event do not hesitate to wash both slide and plate and recommence grinding with a fresh supply of powder.

The rock can now be examined from time to time against the light and its degree of transparency watched. As soon as a fair amount of light is able to pass through it, it must be watched under the microscope.

A lower power objective—about 1in.—is best so as to give a more general view of the specimen as a whole. Both polariser and analyser (see article dealing with the adaptation of a microscope for geological work) should be in position and crossed, so that when the stage is empty, and the mirror correctly adjusted, no light reaches the eye. This is referred to technically as using crossed nicols.

On placing the slide on the stage—providing it has reached the point where it will transmit light—small patches of colour will be seen through the ocular. These colours are due to interference of the light waves by the minerals on the slide (perhaps the most interesting specimens in this connection are the igneous rocks having large crystals, such as granite). All the mineral fragments present will not show these colours as some will be in extinction and appear as black areas. If the specimen is slowly rotated, however, those crystals at extinction will show interference colours while the others will move into extinction. The presence here and there of patches of colour will be satisfactory for the moment.

These interference colours now act as a guide to the thickness of the rock slice. As the mineral quartz is present in most rocks and felspar to a lesser degree, these are used as "index" minerals for gauging the thickness at which the grinding must cease.

Rubbing down on the medium plate should be continued until the red, green and blue interference colours of quartz and felspar appear, then after cleansing, transfer to the fine plate.

Grinding must proceed until the fragments of one or both index minerals show interference colours no higher than yellowish-white of the first order in Newton's Scale of Polarisation Colours. Some fragments will show various shades of grey.

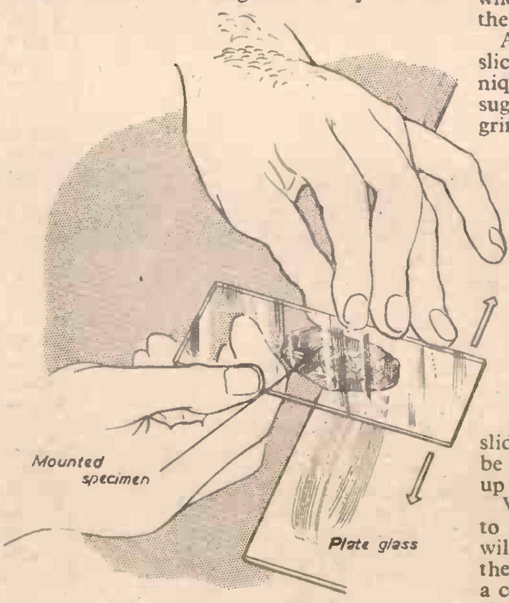


Fig. 5.—Correcting wedge shape.

Newton's Scale

Messrs. James Swift, of London, have published a Polarisation Colour Scale, while the very instructive little volume "Minerals and the Microscope" by H. G. Smith (Thomas Murby & Co.), has a colour plate of Newton's Scale as a frontispiece. The intending slide-maker would be well advised to obtain some print or another of the Scale.

First Order { Dark Grey, Light Grey, Greyish White, Yellow, Orange, Red

Second Order { Violet, Blue, Green, Yellow, Pinkish Red

Third Order { Blue, Green, Yellow, Pink

Higher Orders { Pale Greens, Brownish Pinks

The first order colours are the strongest growing fainter with increasingly higher orders.

This system enables slides of uniform thickness to be made, and uniformity of thickness is important to the student for it is one of three factors which determine the interference or polarisation colours of the minerals under examination. These colours play an important part in the subsequent identification of the various minerals present in any specimen.

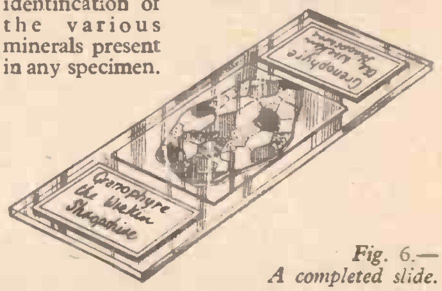


Fig. 6.—A completed slide.

It also follows from the above that if the rock has been ground slightly wedge-shaped, the polarisation colours of the quartz and felspar crystals distributed throughout the whole will not be uniform. If this is the case the fault should be corrected.

As the gauging of the thickness of the rock slice is an added difficulty where a new technique is being mastered, the author would suggest making the first trial mountings and grindings on, say, pieces of fossiliferous limestone. Small fossil corals are well suited.

As the structure of the fossil or fossils is of paramount importance in such specimens, the mineral content can be ignored and the slice simply ground until it will transmit sufficient *ordinary* light (not using the crossed nicols) to make the various details of the fossil clear. An added advantage is that the slice does not have to be taken as thin as when it is to be studied for its mineral composition.

Completing the Slide

Should it be impossible to bring the slide to this final stage in one session, it should be kept in water until the work can be taken up again.

When satisfied that the rock has been ground to the correct thickness (in some cases it will look little more than a dirty smear on the glass slip !) all that remains is to attach a cover glass and label. A completed slide is shown in Fig. 6.

Before covering, all excess balsam around the slice should be carefully scraped away with an old razor blade. At the same time it will usually be found that one has somewhat less than the original specimen, pieces have broken away from the edges during grinding, and if desired the edges of the rock can be trimmed up to give a more pleasing appearance to the finished slide.

Wash away all loosened fragments of balsam and rock then dry in *gentle* heat. If allowed to get too warm the balsam between the slice and the glass slip will soften and the specimen most likely begin to shift from its central position or, worse still, split up and the fragments drift apart. Next a quantity of Canada balsam in xylol (or benzol) should be placed on the centre of the rock (do not

(*Concluded at foot of page 255*)

RECTIFYING VERTICALS DURING ENLARGING

By A. H. TOMS, B.Sc., A.M.I.C.E.

The Theory and Technique of Avoiding "Toppling" Buildings, etc.

THE human eye when scanning a building of which the various corners constitute a series of vertical lines has been accustomed by use and convention to register mentally that these lines are, in fact, parallel. Only the "modernists" and those who revel in "angle" shots for their own sake will readily accept a print, resulting from an ordinary camera tilted upwards or downwards, in which these vertical lines converge to a vanishing point either above or below the print.

If an observer standing on the ground looks upward at part of a parallel-sided building at some elevation above the ground, he should receive an identical retinal impression from a print hung vertically on a wall at the same angle of elevation of his gaze, provided that the sides of the building are represented on the print by parallel vertical lines subtending the same angles at the eye as did the sides of the original building. This is illustrated in Fig. 1.

Alternatively, the print can be held at right angles to the upward line of sight, as shown in Fig. 4. In this case the lines on the print representing the sides of the building would have to have an inward inclination towards the top of the print in order to convey the same impression.

The latter method of viewing and print presentation would be both unorthodox and unsatisfactory. The most satisfactory presentation of verticals on the print is as parallel lines, and for best effect the print should be of such a size and suspended vertically at such an angle of elevation above the viewer's eye and such a distance that all parts of the image subtend the same angles at the eye as the original object did at the camera position when the exposure was made.

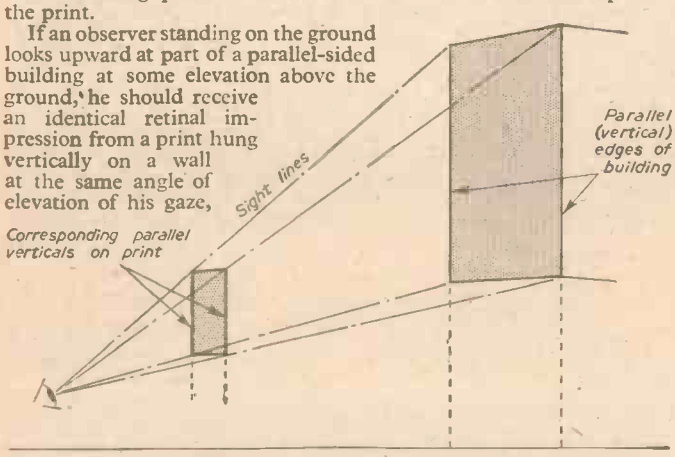


Fig. 1.—The same impression is received from a print hung vertically, having parallel verticals, as is received from the building itself.

The simplest way to produce a negative for straight printing to satisfy these requirements is to use a camera with rising front or wide-angle lens, the baseboard being kept horizontal and the lens panel and film or plate remaining vertical. This condition is shown in Fig. 5, and it will be seen that verticals on the original will then record as parallels on the negative.

Few amateurs, however, possess cameras with sufficient rise of front to be of any real use with the normal angle lens usually fitted. A true wide-angled lens, too, is not the best all-purpose lens to fit in a camera lacking facilities for the rapid interchange of lenses. Most amateurs are, therefore, forced to tip their cameras upwards in order to photograph tall buildings. The result, depicted in Fig. 6, is that verticals of the original subjects are represented on the negative with greater or lesser convergence towards the "top" of the image, which is, of course, the bottom of the negative when in the camera.

Fig. 2 (Left).—As severe a case of vertical convergence as the author could produce with his normal-lens camera, without eliminating the ground completely.

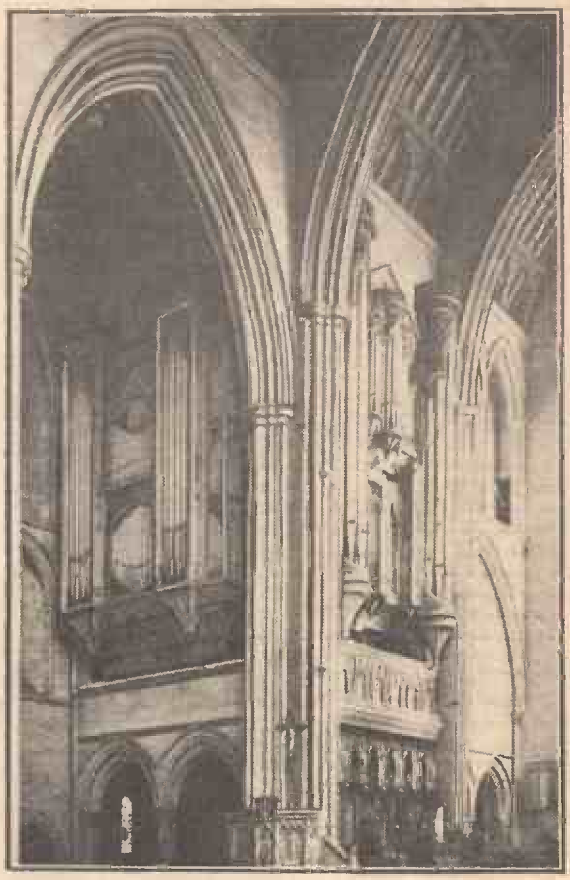


Fig. 3 (Right).—A print made with the verticals corrected. This was made with an easel swing of about 45°, full aperture (f4.5) being used. The definition is equal to that of Fig. 2.

Some time ago I had to use my Rolleiflex tilted upwards at an extreme angle to take photographs of a church organ; there was no space in which to secure the desired photographs otherwise. The consequent convergence of the verticals on the negative was quite intolerable so I set about correcting this in making the enlargements.

The first step in correcting this convergence of verticals on the print is to swing or tilt the enlarger easel or masking board so that it is no longer at right angles to the optical axis of the enlarger lantern, and to such an extent that the movement of the top of the image away from

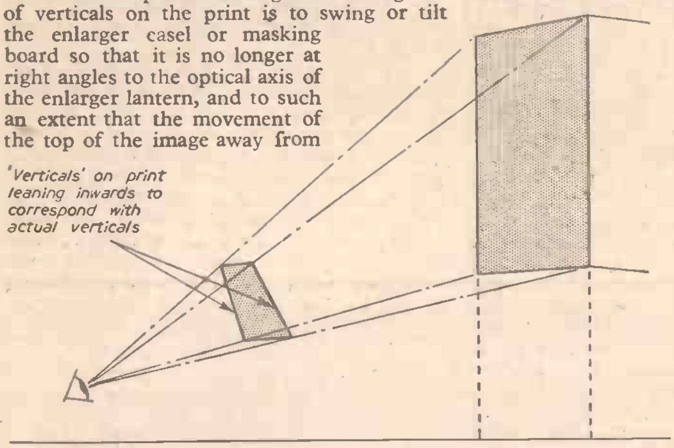
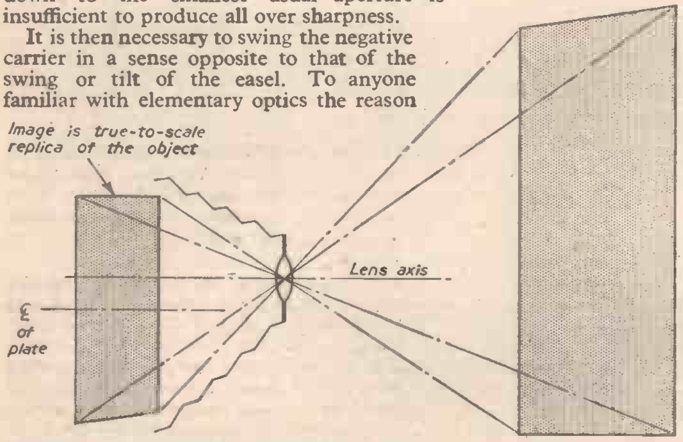


Fig. 4.—The print held at right angles to the line of sight. The verticals are inclined inwards towards the top of the print to convey the same impression as looking at the original building.

the lens and the corresponding movement towards it of the bottom of the image results in the verticals becoming parallel on the paper. It will now be found that, with any reasonable lens aperture, the image is hopelessly out of focus at both top and bottom, and stopping down to the smallest usual aperture is insufficient to produce all over sharpness.

It is then necessary to swing the negative carrier in a sense opposite to that of the swing or tilt of the easel. To anyone familiar with elementary optics the reason



for this will, of course, be obvious, but for the benefit of those less used to these matters Fig. 7 shows the final result (in the case of a vertical-sided building) where the top, AB, and bottom, CD, of the projected image have been corrected to be equal in width, from a negative in which the "top," ab, is narrower than the bottom, cd.

From simple geometry it is evident that the necessary condition is arrived at when

$$ab \times \frac{OH}{OG} = cd \times \frac{OF}{OE}.$$

Many commercially built enlargers will not permit much, if any, tilting of the normal negative carriers, but even a small amount will be found to be helpful, particularly when high degrees of enlargement are being used.

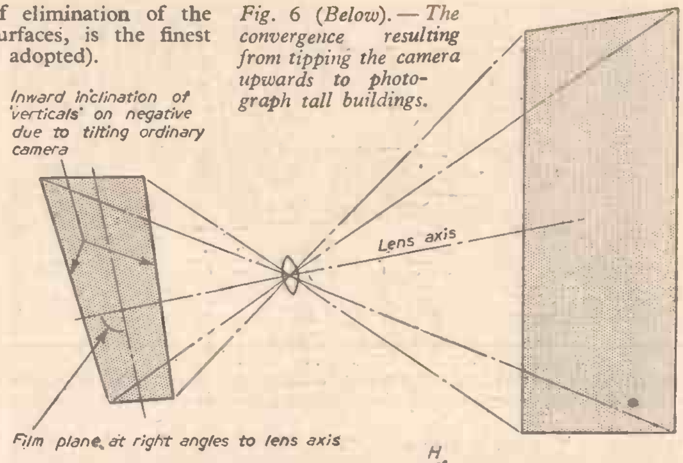
The main disadvantage of working at the very small apertures which are needed if full correction by negative swing is not possible is the very long printing exposure then required. This is tedious and unsatisfactory from several points of view:

(i) Greater risk of vibration of the enlarger by domestic movements outside the dark room.

(ii) Proportionately increased risk of fogging of the paper by any stray light from the enlarger lamphouse, etc.

(iii) Similarly increased risk of heat buckling of the negative held in a glassless carrier (which, on account of elimination of the dust-collecting glass surfaces, is the finest time-saver I have ever adopted).

Fig. 6 (Below).—The convergence resulting from tipping the camera upwards to photograph tall buildings.



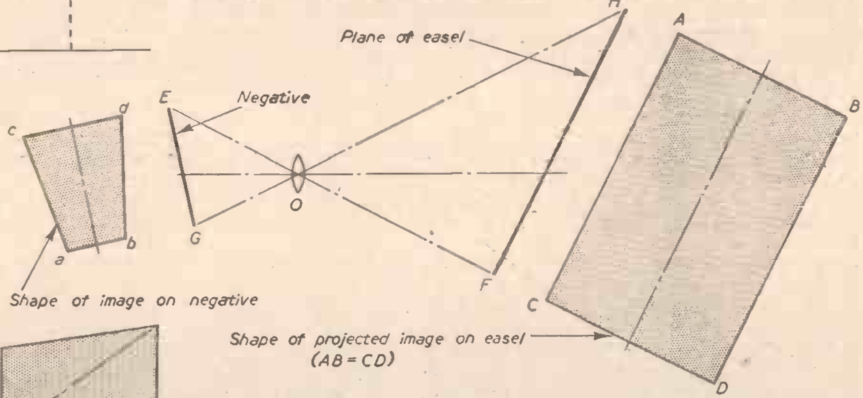


Fig. 7 (Above).—Correcting a distorted negative by swinging the negative carrier opposite to the swing of the easel.

Fig. 8 (Below).—The author's enlarging equipment.

Fig. 5 (Left).—The effect of using a rising front camera.

My home-built enlarger, shown in Fig. 8, is based on a pair of 5½in. condensers which almost cover quarter plate negative size, and as I have standardised on 3¼in. × 2¼in. plates and 3¼in. × 2¼in. film (or subdivisions thereof) I was able to make a negative carrier pivoted inside a surrounding frame which slips into the normal carrier guide slot. This device is illustrated in Fig. 9. When it is in position I can then swing the pivoted negative carrier proper to any desired angle by means of the brass wire handle which is an extension of the pivot. This handle projects outside the enlarger guides.

I have indicated a few details of the enlarger as a matter of interest. It possesses adjustments which many commercially made

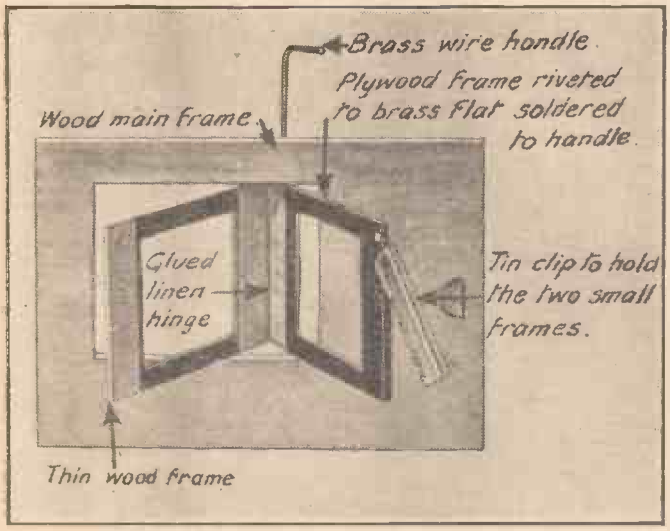


Fig. 9.—Details of the swinging negative carrier.

and yet the full lens aperture of $f4.5$ was used. The definition is substantially equal to that of the uncorrected (normal) print Fig. 2.

So far I have omitted detailed reference to the matter of vertical distortion which is usually introduced by the process of swinging the enlarger easel and negative carrier. It will be found that if, as is customary, a lens is used in the enlarger of a working focal length somewhat greater than that used in making the negative there is a certain unavoidable vertical elongation of the image on the print so made.

negative plane is considered as remaining at right-angles to the optical axis in both cases. It is evident from the geometry of the figure that the proportions A_1, B_1, C_1 on the print will be the same as those of the original A, B, C.

If a lens is used in the enlarger of longer focal length than that used in the camera when making the negative it will be found that, to correct the converging verticals, it is necessary to swing the enlarger easel through a greater angle than the amount of tilt given to the camera when taking the picture. This will result in vertical elongation of the image on the print. It does not, however, appear to be very serious, as will be seen by comparison of Fig. 2 and Fig. 3 taken with the 8 cm. lens in the Rolleiflex and enlarged

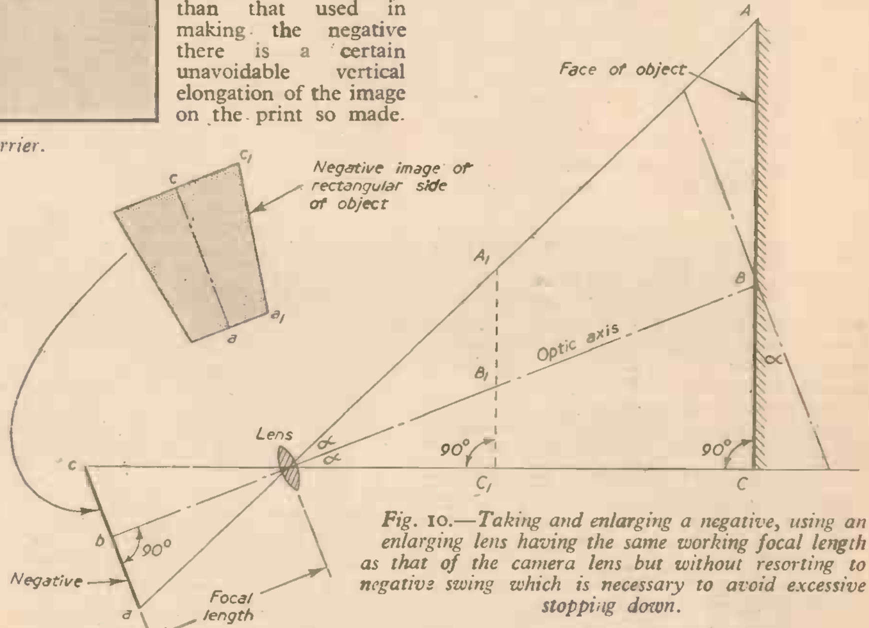


Fig. 10.—Taking and enlarging a negative, using an enlarging lens having the same working focal length as that of the camera lens but without resorting to negative swing which is necessary to avoid excessive stopping down.

amateur instruments do not. As the front half I use a Zeiss Ideal camera having an $f4.5$ Tessar lens, and I find the shutter and the cross and rising front movements extremely useful for exposing and adjusting the image on the easel. The condensers are so large that a small amount of off-centring does not upset uniformity of lighting.

The only disadvantage of my horizontal set-up which I use is that, since the easel is not capable of movements at right angles to the optical axis, but only rotation about its vertical axis, I have to have four adjustable masking bands instead of two, with special springs soldered to two of them to ensure correct margins on left and bottom of the prints. The details of this easel and its masking frame are shown in Fig. 8. It was simple to make and is perfectly effective and rapid in use.

A typical example of the correction of verticals with this equipment is shown in Figs. 2 and 3. This is as severe a case as I can produce with my normal-lens cameras without eliminating the ground from the picture entirely, i.e., the angle of elevation of the camera while taking the picture was roughly half the angle of acceptance of the lens. The significance of Fig. 3 is that it was made with an easel swing of about 45 deg.

In the diagram Fig. 10 are shown the conditions of both taking and enlarging a negative when using a lens in the enlarger having the same working focal length (at the degree of enlargement being used) as that of the camera lens.

For the purpose of this discussion the

with the 12 cm. lens of the Zeiss Ideal camera working at about 16 or 17 cm. actual focus.

In conclusion I should draw attention to the fact that when the enlarger easel is swung round to be oblique to the optical axis, then the parts of the print farthest from the lens will need longer exposure than those closer to it. This is done by progressive shading.

New Protective Clothing

AT an exhibition staged by the Ministry of Supply recently was shown a protective suit, consisting of an inner suit of strong net and an outer one of white fabric of great strength. The suit is completed by helmet mask with a large transparent visor. Built-in air lines supply fresh air from outside the contaminated area. The suit is intended for people working amid highly toxic chemicals and fumes.

"Memomotion"

A NEW type of cinematography, called "Memomotion," has been developed recently for the analysis of processes and techniques in business and industry. This new application of time-lapse photography automatically records and condenses hours of office or plant procedure into a matter of minutes.

Improvement in service to customers in retail establishments, elimination of inefficient handling of materials in factories, and re-routing of traffic inside and outside plants are examples of areas particularly suited to the new photographic technique.

In contrast with "time-and-motion" studies which involve continuous cinematography, with many exposures per second that produce the effect of slowing down the operation to be studied, "Memomotion" uses intermittent exposures to condense the action, and allow projection of the film either at normal speed, or frame by frame. A condensed photographic memorandum is obtained by placing a motion picture camera at a key point and exposing the film at intervals ranging from one frame every 20 min. to one per sec., depending on the procedure to be studied.

Atomic Power Station for Northern Ireland

THE establishment of a power station in Northern Ireland is under consideration. In a recent statement Lord Chandos, chairman of the Northern Ireland Development Council, mentioned the economical advantages over the conventional coal-fired station and the saving which would be made in coal and freight, and urged that definite arrangements should be made immediately.

Titanium Pigment

THE titanium element was first discovered 150 years ago, but for 100 years remained little more than a scientific curiosity. It was not until after World War 1 that a commercial method of extracting white titanium oxide was evolved.

To-day, titanium finds its chief use in the paint industry, but is employed also in the manufacture of paper, rubber, plastics, linoleum, vitreous enamel, etc., and improves the appearance of many other products. The largest producer of titanium in this country is British Titan Products Co., Ltd.

Success of U.S.S. "Nautilus"

RECENTLY, the U.S. atomic submarine completed a cruise in which she steamed 39,658 miles without refuelling, 23,303 of which were under water. Depths greater than 350ft. can be reached and she can steam round the world at more than 20 knots. It is not known how long the uranium pile can operate without refuelling.

AN AUTOMATI

NOW that the colder weather is with us, this bedside accessory will be appreciated more than ever by all who dislike getting up before that morning cup of tea. Construction is straightforward and the completed unit is neat and very simple in operation—only one switch has to be touched by hand! The kettle is filled and placed in position, together with the teapot (plus tea) before going to sleep and the machine is switched on. In the morning, at the required time, the tea is made and the bedside lamp is lit to announce that it is ready. The unit is switched off, and all is ready for pouring out.

Principle of Operation

This depends principally upon a simple see-saw action. The weight of the filled kettle depresses the kettle switch (see Fig. 1) completing the mains circuit to the heating element and thus allowing the kettle to boil. As boiling water siphons over into the teapot, the see-saw balance is altered and the teapot descends, presses down the "teapot switch" and lights the lamp. It could, of course, be used to switch on a radio, ring an alarm buzzer or complete any other circuit.

The whole sequence is set off by the alarm clock, which is adapted to complete an electric circuit instead of ringing the alarm. When the alarm "goes off" it completes the kettle circuit (see the wiring diagram, Fig. 2).

Components Required

An electric alarm clock (I used a Smiths "Callboy") and an electric kettle with 750-watt heater and curved pipe (as shown in the photographs, Figs. 4 and 5) made by Pifco. No doubt other types would suit or the arrangement could be modified to include an alternative type. The kettle can be made if the individual skill is sufficient. One on/off switch and two press switches, a small 15-watt bulb and batten type holder complete the list.

The Clock

This must be adapted to complete an electrical circuit instead of ringing the alarm and is the only "tricky" job in the whole construction.

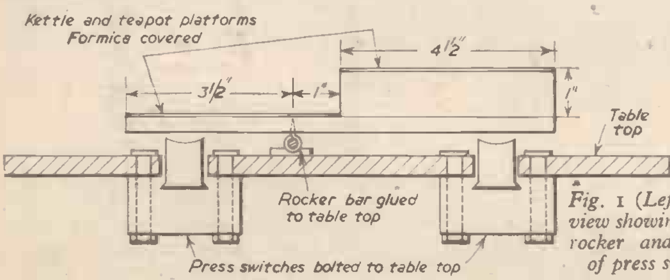


Fig. 1 (Left).—Side view showing see-saw rocker and position of press switches.

A pair of contacts must be fitted inside and a glance at Fig. 3 will show that one contact is fixed to the frame of the clock while the other moves with the alarm mechanism.

The alarm in these clocks (Smiths Callboy and similar types) is merely a spring strip of steel which vibrates in the A.C. field of the coil which drives the clock. This strip is normally held away from the magnetic iron field. The clock resets itself during the day so that no interference with it is needed once the contacts are in position.

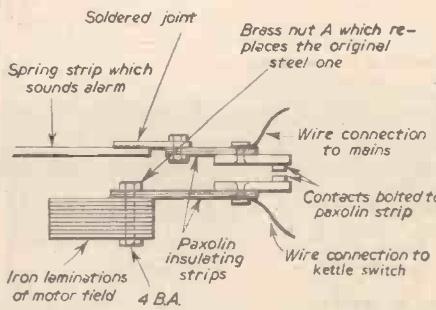
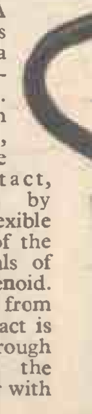


Fig. 3 (Right).—Details of contacts fitted inside electric alarm clock.

If contacts are fixed as shown the movement of the spring strip is used to make and break the circuit instead of vibrating to act as an alarm.

To stop the vibration, the travel of the spring towards the magnet is stopped by the fixed contact (in the off position the gap is only 1/16in.). In addition the steel nut towards which the spring moves (A in sketch) is replaced by a brass one (non-magnetic). The contact on the spring, which is the moving contact, is connected by insulated flexible wire to one of the mains terminals of the clock solenoid.

The wire from the fixed contact is brought out through the base of the clock, together with



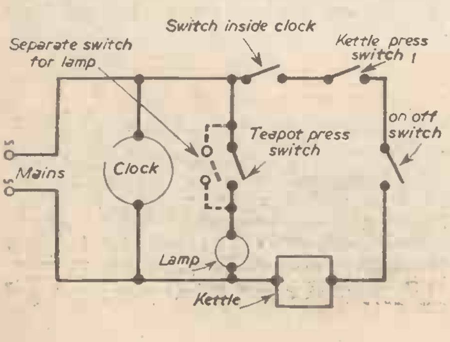


Fig. 2 (Left).—The wiring diagram.

Fig. 4 (Right).—The completed tea maker mounted on a small table.

C TEA MAKER

Your Morning Tea in Bed Immediately the Alarm Sounds!

By A. S. NEALE

Fig. 5.—View with teapot removed showing teapot platform raised.

a wire from the other mains terminal. Thus, when the alarm mechanism closes these contacts, the kettle element circuit is completed and the kettle boils.

Before proceeding further, test this switch mechanism by connecting up a lamp to the two wires.

Note that the kettle current will be around 3 amps. (750-watt heater) so the contacts must be heavy-duty types and have their contacting surfaces flat and parallel.

The See-saw Rocker Mechanism

This is straightforward and the measurements given in Fig. 6 can be varied to suit individual requirements. Teapots, for instance, will vary in size and weight and allowances will have to be made for this. The writer's apparatus was built directly on to a small bedside table top so that no special base or box had to be constructed to hide the wiring. This part of the work, however, must be left to the individual requirements of the constructor.

The hinge or pivot on which the see-saw rocks consists of a length of ¼in. dowel rod glued to a small plywood base which itself is glued to the table top. The dowel rod moves inside two brass screw-eyes, which are fixed underneath the sea-saw platform. Details of this arrangement can be seen in the photograph, Fig. 7. This makes a firm but very free-moving rocker and if the kettle and teapot are placed on their platforms, tests can be made to find exactly where their final positions will be. This is best done by keeping them close together and moving both to and fro until the rock-over occurs when the kettle is about half empty. The block on which the teapot rests must be included in these experiments because of its weight. Besides raising the teapot, it also acts as a "stop" against which the kettle will be placed each time so as to fix its position. Do not glue this block to the platform or the dowel rod rocker to the table top until trials have proved successful and all switches and wiring are complete.

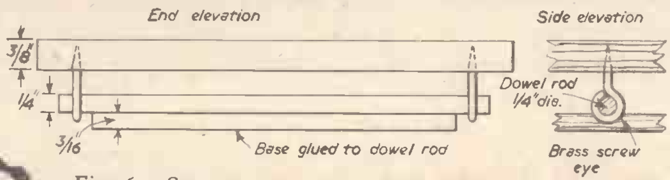


Fig. 6.—See-saw and rocker mechanism.

If the see-saw platform is to be covered with Formica, this must also be done before final assembly.

Kettle and Light Switches

These two switches are ordinary mains 5-amp. press switches bought locally for 2s. 2d.

Unfortunately, the coil springs inside these switches are too strong to be pushed down by the weight of the see-saw, and must be changed. They are easily replaced as the top of the switch unscrews and a spiral of approximately 28 s.w.g. steel wire can be substituted (the author used an old guitar string). One of the switches is shown in section in Fig. 8.

These adapted switches are mounted below the table top and holes drilled for the pressure tops to protrude through (see photograph, Fig. 7). Layout of tea maker is shown in Fig. 9.

The wiring is simple. The circuit diagram shows how the on/off switch is wired in series with the clock contacts and the kettle press switch; make sure that standard 5-amp. mains type flex is used.

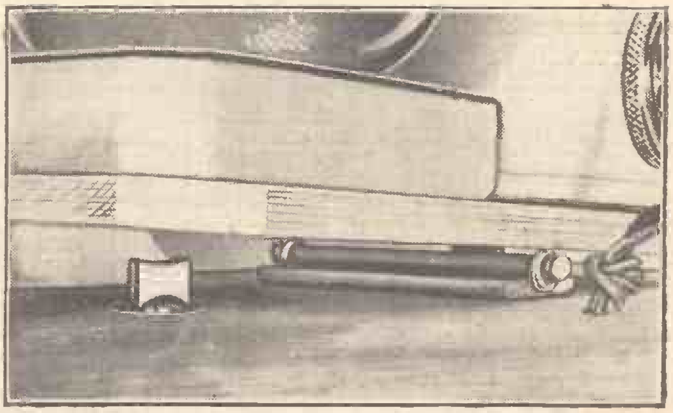


Fig. 7.—Close-up of rocker and switch under teapot.

The clock switch completes this circuit, the see-saw tilting switches off and the user, on waking, can switch off with his on/off switch to prevent accidents when the teapot weight is removed. The on/off switch must be able to carry at least 3 amps.

A separate switch for this lamp (shown dotted in circuit diagram) could be fitted to make it independent of the teapot switch and act as an ordinary bedside lamp.

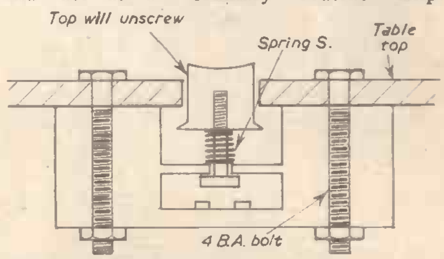


Fig. 8.—Section through pressure switch Approx. ½ lb. will depress switch.

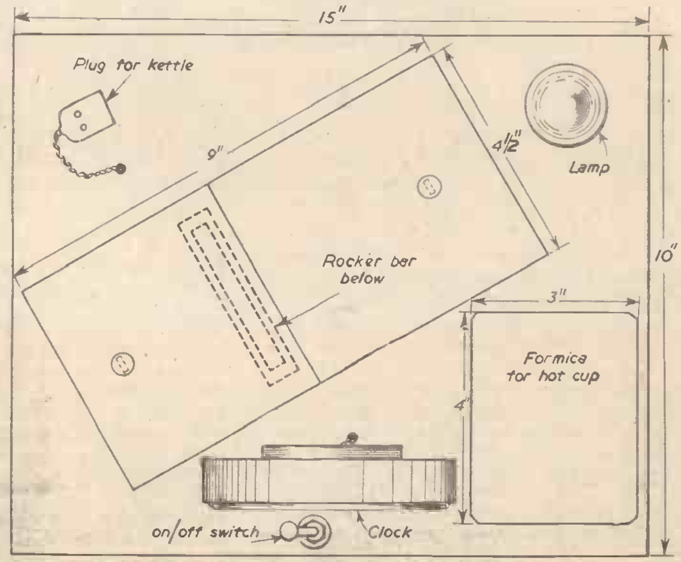


Fig. 9.—Plan of automatic tea maker.

Brazing and Sifbronzing

The Technique Explained for the Newcomer to Model Engineering. The Self-explanatory Sketches Show the Method Used for Various Joints

By K. VERDEN

THE terms brazing and Sifbronzing are often confusing to the newcomer to model engineering, and there are many occasions when he refers to one process when in point of fact the opposite is required. This article aims at revealing the rather wide difference in the two methods.

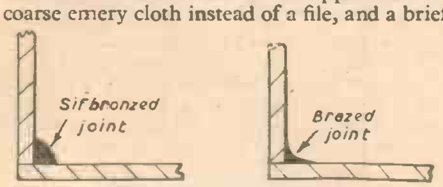
Brazing

This type of join is made with the aid of a paraffin blowlamp or an air/gas blowpipe, and for joining non-ferrous metals together (copper and the kindred alloys being typical examples) a material is used which runs easily at a medium temperature.

This alloy usually contains a high proportion of zinc, and at a certain heat it will " sweat " through closely fitting parts—a feature which makes a more tenacious joint. Perhaps the crux of this work is the amount of heat applied to the pieces that require joining together, and in addition to the actual vicinity where the joint occurs a fairly wide adjacent area also needs heating to the same temperature.

For such an operation a large diffused flame is necessary—hence the reason for the paraffin blowlamp or the air/gas blowpipe such as The Flammaster. Next, the parts are held in close contact with each other, and in the case of sheet metal work a few judiciously spaced rivets are an asset, but if halfway through an operation the flame suddenly dies away the delay which refilling creates can cause the joint to crack. The reader should make sure all the materials also are ready to hand to enable him to complete the work in one continuous heat.

Clean faces are essential, and the time spent on removing grease and oxide that has formed on the surfaces is well worth while; but one should not aim for a perfectly smooth finish—a rough, filed face provides a key for the molten alloy and a superior article results. Tubes are best treated to an application of coarse emery cloth instead of a file, and a brief twist while they are held in the hand is sufficient to provide a rough surface.



Joining angular pieces.

Equipment Required

For comparatively small parts which the average model maker is likely to encounter a brazing pan about 20in. by 10in. is ideal, especially if the depth is about 2in. Failing this an old teatray will prove suitable—the actual shape does not matter. To the back of this is attached a vertical piece about 9in. deep, bent round semicircular. Four or five rivets will hold this in place, or it can be brazed to the tray.

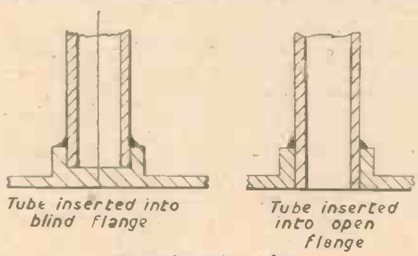
Whether you consider a metal stand essential or worth while is for you to decide, but unless you undertake a fair amount of this work, then the tray is just as conveniently used. A sheet of asbestos is first placed on the wood bench and the process performed there.

In this tray is put some coke or blacksmith's breeze to a depth of 2in.; pieces about the size of a shilling packed down reasonably solid make a firm bed for the articles being joined together.

Most amateurs start off with a 2½ pint blowlamp, and this, besides being easy to handle, also gives sufficient heat for all but the massive jobs. If funds are available it is suggested that two of these are obtained, one being held in the hand, while the other is placed on the bench and directed at some particular spot on the assembly.

Materials and Tools

A supply of easy running brazing strip, some fine and coarse grade silver solder, borax powder or Boron compo to use as a flux, some tongs to hold the parts and to turn them over as the operation progresses and a piece of ¼in. diameter rod filed to a sharp point to use as a scratching wire are all the materials and tools needed for the work. The tongs can be made up as the occasion arises, large versions for the big jobs and diminutive pairs for those parts the size of the proverbial sixpence. A small pair of tongs is required, anyway, to hold the brazing strip as it becomes used up, and these are easily made from odd lengths of mild steel.



Procedure for tubes.

After the work is completed the entire assembly is lowered gently into a pickle bath in order to clean it, and if an earthenware vessel is not obtainable, then a wood box lined with sheet lead is necessary. Into this is poured a mixture of sulphuric acid and water—one proportion of acid to 20 of water—but if the reader is friendly with a garage proprietor, then he may obtain some old accumulator acid, which, if diluted with about four parts of water to one of acid, will serve just as well.

The Brazing Operation

When satisfied that all the tools and materials are to hand and the joining surfaces have been rough filed according to previous instructions commence as follows:

First, ascertain that the pieces fit properly and that there are no wide-open joints, because obviously the material will just run through gaps ⅛in. wide. Next, smear all the parts with the flux where the joint is to occur, stand the assembly in the pan and pack coke or breeze round it.

Light the blowlamp and see that the flame is fairly large and going well. Play it on the part and on the coke surrounding it, and in a few minutes the complete assembly will have reached a red colour. Apply a length of brazing strip at one end of the joint, and if the heat is sufficient it will commence to melt and run into the joint in much the same manner as ordinary soft solder enters a crack, though, of course, the heat in this case is not so great.

Only a few articles are completed without moving the flame along the surface, and for long joints the work is performed rather slowly as the brazing material disappears into the crack. Make certain that the strip on melting does run correctly, and watch carefully for the appearance of bubbles; a gentle application of the scratch wire is necessary to ensure that bubbles do not remain after the flame has passed. When the joint is finished it will appear as a series of ripples, each overlapping the other for the complete length.

What May be Wrong

Sometimes the brazing material melts and remains in the shape of balls without attempting to run into the joint, and this is a sure sign that the parts are oxidised through insufficient flux being applied or the faces are dirty and require cleaning in the way described above. The wire is a useful tool for applying more flux, and after a minute or so in the flame dip it in the tin of flux until some adheres to the point. Scratch the balls of brazing alloy with the wire while the flame is concentrated on them, and in a few moments they will commence to run evenly into the joint.

Occasionally insufficient heat is the cause of bad joints, but if the parts glow red for a fair distance round the spot where the strip is held, and the flame is allowed to travel along slowly to enable it to heat the metal properly, then little difficulty is experienced in this respect.

Some older sheet metal workers prefer granulated material, and if this is used one should mix some dry flux with it. An old spoon is useful for applying it to the region of the join, but keep it for this particular operation. The same pointed wire is necessary to break up any borax blisters that may form, and every suspicious-looking spot along the joint should receive this treatment; a brief scratch only is needed. Incidentally, a little silver solder as a " starter " melts very quickly, and the reader will find the brazing strip commences to run more readily if this idea is first followed.

Another item well known to experienced workers is the reaction of a flux when the flame is played on it. It will first bubble as the heat dissipates the water content—then it settles down and becomes a clear liquid. At this stage the brazing alloy is applied and it should readily enter the joint—thus a careful noting of the flux reveals whether the proper temperature has been attained. Slightly overfill the joints, as a shrinkage takes place, and without the presence of extra material the joint has the appearance of being unfinished.

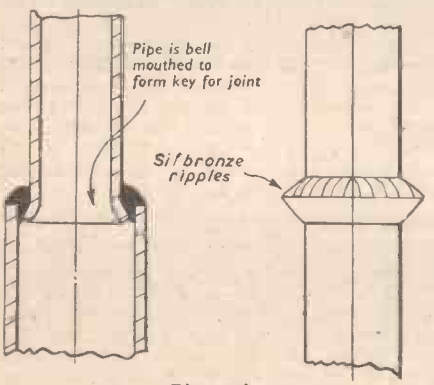
When you are satisfied the complete joint has been covered and the tell-tale ripples well and truly overlap one another, put the assembly in the pickle bath. This operation is simple enough, but care should be exercised, otherwise the splashes of acid on the clothes will obviously eat them away. An old overall or a good, thick apron is the best wearing apparel for this work, and then the splashes can do no harm, but, of course, great care should be taken to shield the eyes.

Lower the parts with the aid of a pair of tongs, a pair of bent strips or a piece of thick wire and leave it for about 20 minutes. Lift it out, let most of the acid drain off and then give it a thorough wash in running water. Never stint this later work as failure to remove all traces of acid only means that corrosion will begin immediately the assembly is put aside.

Sifbronze

Sifbronze is the trade name for a material marketed by the Suffolk Iron Foundry, Ltd., of Stowmarket, and though some readers may think this process is similar to brazing there is, however, a distinct difference.

Perhaps the first noticeable feature is the flame used for this work, and a much smaller but powerful one is essential. This makes the brazing alloy used with the paraffin blowlamp unsuitable because the heat would "burn



Pipework.

out" the zinc content and render it useless for joining two parts together.

The special rod called Sifbronze is composed of 60/40 copper zinc alloy with a specified silicon addition, and this metal has a melting point of 800 deg. C. to 850 deg. C.

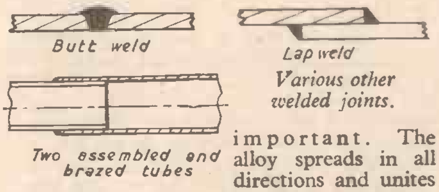
The question of the fit of each joint is another item of importance because in brazing the fluidity of that particular material enables it to penetrate and fill every crack, Sifbronze on the other hand does not possess quite such easy flowing qualities, consequently the fit between the parts is greater to allow it to enter easily. Incidentally, this penetration is assisted if both items are bevelled to provide a larger clearance at the top of a joint, and some attention to this seemingly trivial operation amply repays the user by the ease with which the material flows and so secures an efficient uniting of the pieces.

The Sifbronze Process

There are several of these Sifbronze alloys, but the one model engineers will undoubtedly use is Sifbronze No. 1—the standard all-purpose bronze rod for cast-iron, copper and malleable iron. As the makers state, it will join practically all metals with the exception of aluminium.

A special flux is supplied, and this is mixed with water into a paste and placed all over the area needing treatment. If the articles for uniting are large, this means a considerable amount of oxy-acetylene gas is necessary before the parts are heated sufficiently, and in order to conserve supplies a preheat with a blowlamp is advisable. This naturally removes all moisture from the paste, and before the work has a chance to cool the torch is set going with a slightly oxidising flame by adjusting the controls to make the inner cone shorter than when set for the natural flame. Dip the rod in the flux and apply the torch until a drop falls off the Sifbronze rod into the vee.

If the temperature is correct, i.e., 700-800 deg. C., this drop spreads out and "tins" the parent metal. This tinning process is very



Various other welded joints.

important. The alloy spreads in all directions and unites as a thin film over the metal. If the first drops stay as globules similar to water on a greasy surface or drops of mercury when the latter is allowed to fall on a plate, this is a sign the parts are either dirty, too hot or too cold and the remedy in such a case is obvious.

When this drop of Sifbronze has spread to your satisfaction add more material and allow it to fall into the vee or cavity until it is completely filled. The work moves rapidly to the left as the opening fills—always, of course, preceded by the "tinning" effect achieved by the first drop of alloy falling and covering the surface.

In the case of a wide groove the flame is moved from side to side to ensure each surface is properly heated, otherwise the lower part of a vee will reach the welding heat while the surfaces near the top faces are comparatively cool and will not permit the Sifbronze to adhere properly. These deep grooves are seldom filled in a single run, and may need two, three or even four applications before a joint is secured. This practice of filling them stage by stage with Sifbronze is quite in order, though it is doubtful whether the model maker will have occasion to use such tactics.

However, he should remember that the first drop will fall in the crack and some runs down into it. The second may fill the groove and if this is so, then the flame is moved along to the next spot and the same method carried out until the complete groove is completed. Working with the torch in the right hand and the rod in the left the flame gradually moves in the latter direction, and with the average parts which are required in the amateur's shop one pass is usually enough.

Oxy-Coal-Gas

Not all our readers are fortunate enough to own oxy-acetylene equipment, and they rely on the oxy-coal-gas outfit for their needs. Cost is the primary factor in deciding to use this form of heating as only one regulator is needed and one gas cylinder. The process requires more oxygen and coal gas, but as the flame is large and diffused it will quickly preheat the boiler, making that work with a blowlamp unnecessary.

You can Sifbronze the parts with this type of flame without much difficulty, but a somewhat different working method is essential, because, due to the size of flame, you cannot concentrate it on the small drops which the items require.

Prepare the details in the same way as for oxy-acetylene welding and brush the paste on all the joint surfaces. The joint is heated to a bright red and the rod after being dipped in the flux is applied to the metal. Provided the joint is heated sufficiently, the Sifbronze will run easily and will set just as quickly. When it runs along a joint, feed in more alloy, following it with the flame tip, as this is the hottest part of a flame, and the Sifbronze will thus melt rapidly.

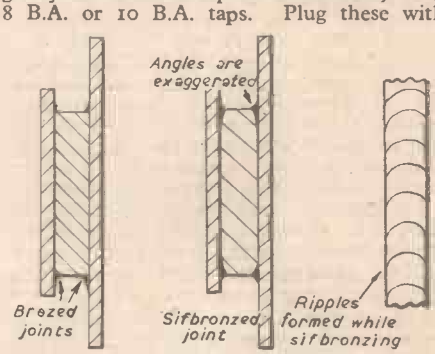
Flux

There is no point in using a flux different from that specified by the makers as there is then a definite risk the joint will fail. The recommended flux cleans the surface of a metal part of oxide and it also slags the top of a molten weld pool to prevent further oxidation during the welding process. It may be applied by dipping the heated end of a Sifbronze rod as already described or by brushing it along a groove—the latter idea is useful when the actual joint is not easily accessible.

General Notes

The beginner may find that in the case of model boilers a test will reveal perhaps two or three tiny leaks where he has failed to concentrate the alloy. He may attempt to "go back" and correct this by again applying the flame to the offending area, only to find that local expansion is set up and the joint breaks.

The easiest way to overcome these leaks and to preserve the joint is not again to use Sifbronze, but to centre-punch the spot gently and drill and tap the boiler shell, using 8 B.A. or 10 B.A. taps. Plug these with



Other Sifbronze applications.

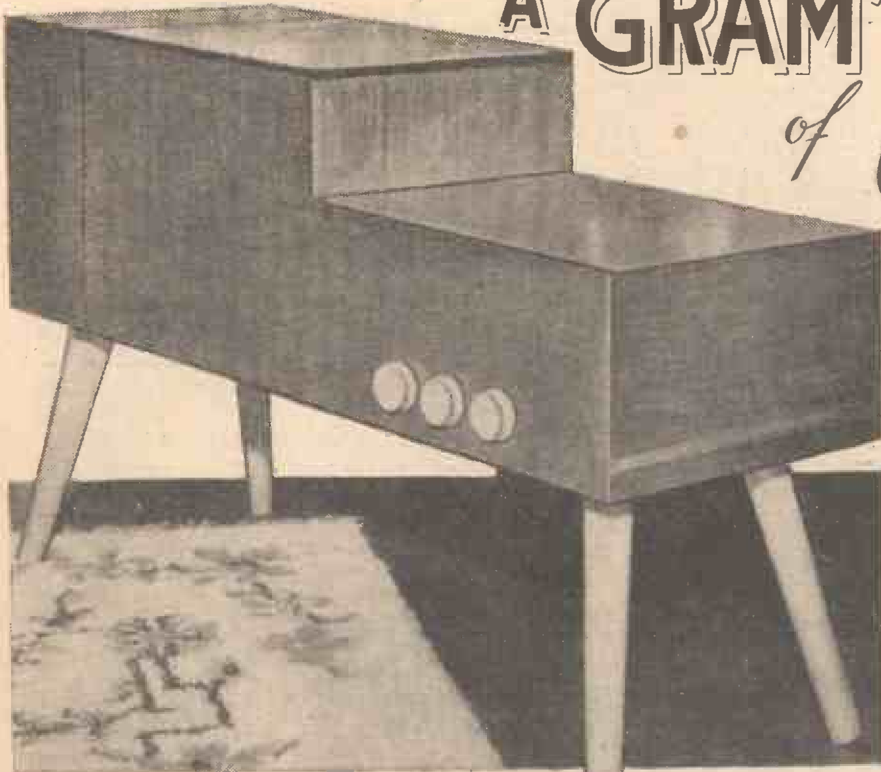
pieces of copper rod screwed tightly into the holes and file them off flush with the joint.

You can silver solder over the place. The boiler is first well preheated with the aid of a blowlamp, and then carefully using the oxy-acetylene flame on the particular spot requiring treatment drop a spot of silver solder on to the leak. Then concentrate the flame on the exact area, but take care not to let it remain too long, otherwise the joint will start cracking. I prefer the screwed rod method, because the latter risk is eliminated.

Cleanliness is another factor which constantly arises in this type of work, and you cannot expect to secure two parts together if they are smothered in grease. First-class welds require a good base, and you should thus roughen the surfaces until the metal appears bright and clean. Old, coarse files are useful for this process, and the rough emery also if held round the ends of tubes soon causes them to shine bright, but I would not advocate grinding as this tends to close the pores of the metal and makes it more difficult for the welding alloy to secure a tenacious grip.

Do not stint the welding alloy, but make the corners with an ample fillet as this not only looks well, but it also adds to the strength of an assembly. Finally, a few brief sketches are included showing the technique employed in brazing and Sifbronzing.

All readers should know that neither of these processes is suitable for uniting the aluminium alloys, zinc, lead, zinc base alloys; tin or electron are other metals with similarly low melting points.



A 'GRAM' CABINET of Original Design

To Harmonise with Furniture of Contemporary Style

By HENRY G. RUSSELL

THE cabinet to be described was designed to harmonise with furniture of contemporary style, to accommodate one of the popular high-fidelity amplifiers and gramophone equipment.

The loudspeaker was a separate unit, but if desired this can be easily incorporated without alterations, and will be dealt with later.

Because of inadequate woodworking facilities, the design was kept as simple as possible so as to permit construction on the kitchen table and with a minimum of tools.

The wood chosen was ⅜in. mahogany-faced plywood for the main housing and birch plywood for the bottom and back.

Constructional Details

To eliminate complicated constructional explanations, the parts have been keyed so that by reference to the exploded view, Fig. 1, and the skeleton drawing, Fig. 2, the method of assembly is made clear.

To simplify handling under domestic conditions, the wood should be bought in two pieces: (1) 31in. x 39in. x ⅜in.; (2) 42in. x 30in. Piece No. 1 will supply parts F, G, J, K and L, and piece No. 2 parts A, B, C, D and E, which can be marked out as shown in Fig. 3.

Working in this manner minimises the cutting operations and reduces waste to a minimum.

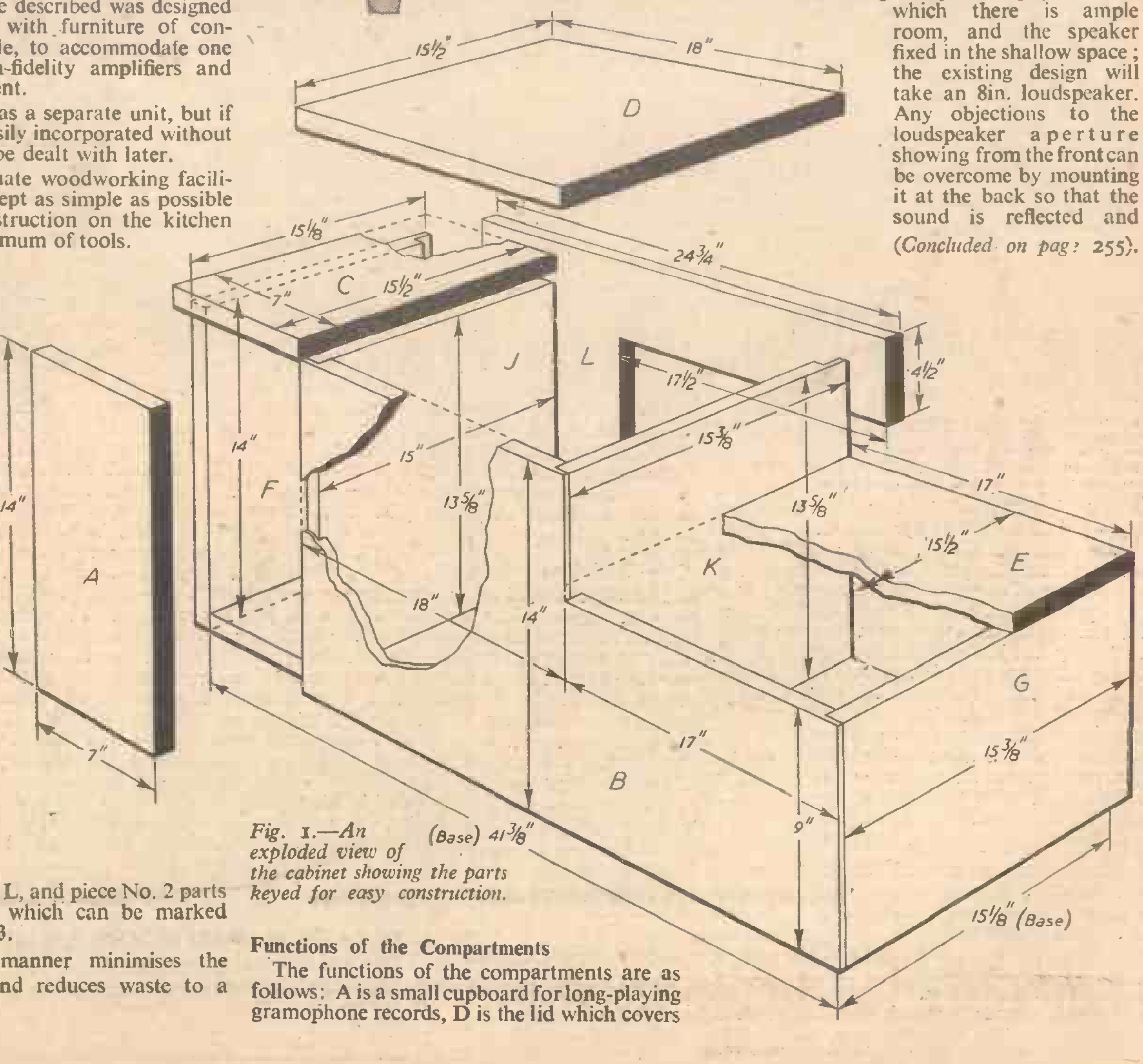


Fig. 1.—An exploded view of the cabinet showing the parts keyed for easy construction.

Functions of the Compartments

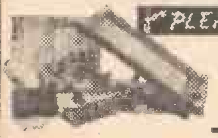
The functions of the compartments are as follows: A is a small cupboard for long-playing gramophone records, D is the lid which covers the gramophone equipment, and the compartment enclosed by B, E, G and K houses the amplifier. The three knobs controlling the amplifier come out on the front of the shallow end of B.

In the original cabinet, these three knobs were the only external fittings and the door A is easily opened by pulling at the bottom.

The question of external decoration is one you must decide for yourself, but if you desire a cabinet which is functional and yet looks like a piece or ordinary furniture, the less mechanical fittings there are the better.

Where it is necessary to house the loudspeaker in the cabinet, the amplifier can be housed below the gramophone equipment, for which there is ample room, and the speaker fixed in the shallow space; the existing design will take an 8in. loudspeaker. Any objections to the loudspeaker aperture showing from the front can be overcome by mounting it at the back so that the sound is reflected and

(*Concluded on page 255*).



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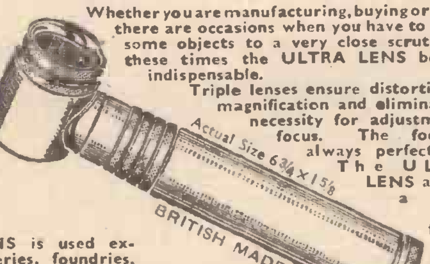

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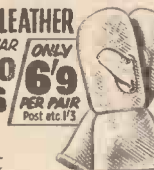

What does SKI indicate? Frozen icy terrain, wind howling around corners. These Ski-mitts are constructed to keep fingers and hands warm as toast and to give them free movement. The cuffs are especially woven with elasticated adjusters, adjustable to prevent escape of heat. Unused, real genuine supple waterproof hide leather SKI-MITTS, when you buy a pair you get a real friend. Ideal Motorists, Cyclists, etc., 6/9 only, post 1/3. A new Ex-Ministry bargain that makes us think how much the War really cost. Brand New Real Fur Canadian Trappers Hat, 12/6, post 2/6.

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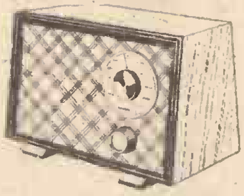

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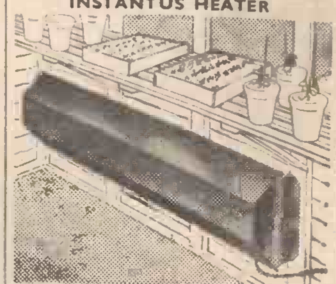

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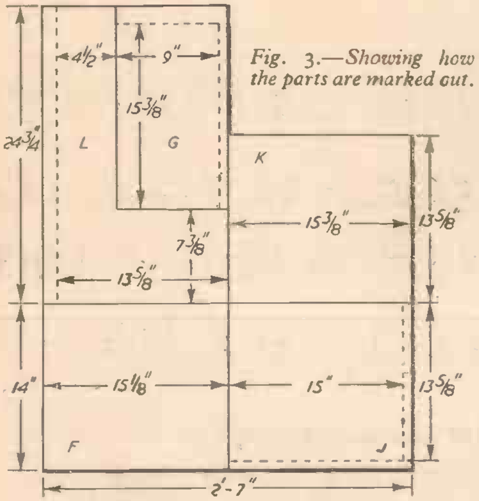
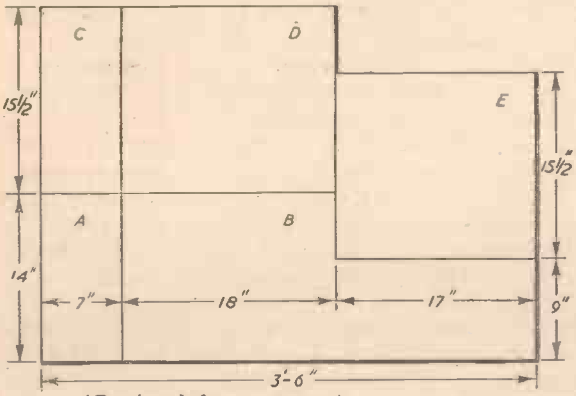


Fig. 3.—Showing how the parts are marked out.



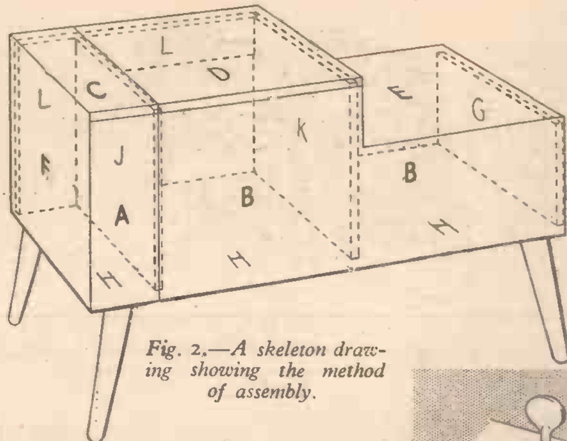


Fig. 2.—A skeleton drawing showing the method of assembly.

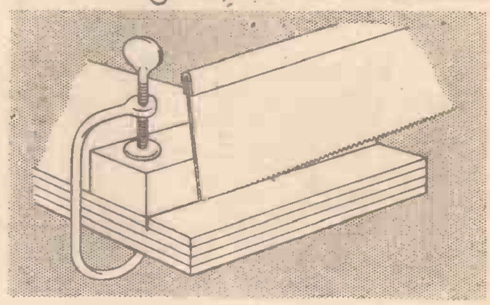


Fig. 4.—Cutting the joints by clamping a block of wood along the cutting line.

(*Continued from page 252*)

diffused by the wall against which the cabinet is placed.

Cutting the Joints

The cutting of the joints is quite simple and consists of sawing and cutting away the laminations; by clamping a block of wood along the cutting line, Fig. 4, a long cut can be made cleanly and surely.

In the back view, Fig. 6, are shown the right-angle blocks which are glued in for strength, and it will be noticed that these do not extend to the full depth of the inside. They should be equal to the height of the two ¾in.-square blocks marked "a" so that the tops of the right-angle posts and the square blocks form the support for the gramophone turntable.

To avoid defacing the surface of the wood, especially that seen from the front, the only screws used, apart from those for the lid and record-cupboard hinges, were for fixing the bottom of the cabinet H. After giving the corner joints a coat of glue, drive in panel pins and punch below the surface. The tiny hole made can be filled in afterwards with plastic wood or fine sawdust mixed with glue. The general assembly is reasonably simple, but the legs need a little more consideration. Should you possess a "Wolf" or "Black and Decker" outfit with the lathe attachment, the turning of the legs should present no difficulty. Alternatively, they can be shaped with a spokeshave and smoothed with a scraper and sandpaper, which was the method used for my cabinet.

Fixing the Legs to the Cabinet

After several experiments the fixing of the legs to the cabinet was successfully done as shown in Fig. 5, using blocks of wood 4in. x 3in. fixed with four screws to the baseboard. The addition of "silver domes" to the feet enables the cabinet to be moved smoothly without damage to the floor and compensates for any slight inaccuracy in cutting parallel to the floor.

The finish of the cabinet is governed by the colour of the wood used in the existing furniture, but it is important to get a really smooth surface before attempting to stain or polish.

First go over with a medium sandpaper, and then apply a filler consisting of a mixture of "Alabastine." When this is perfectly dry, rub down again with a No. 0 sandpaper; next apply a water stain and allow to dry, after which rub down again and finish with garnet paper.

I need hardly add that the stain used should be for the wood and colour of the furniture you are matching, but if it is your intention to french polish the cabinet do not use a varnish stain.

Although the joints for this cabinet have been cut to cover rough plywood edges, it will be found that the front of piece C, the edges of the record-compartment door and lid D do show, but strips of veneer ⅜in. wide will give a smooth finish and due to their narrow width are easy to glue on.

Lid Lined with Felt

To give a dignified and professional appearance to the completed cabinet, the lid D should be lined inside with felt, also the sides around the gramophone turntable. The inside of the record cupboard door should be treated likewise. An excellent colour scheme is maroon for the lid and cupboard door and grey for the sides.

With slight modification the basic design of this cabinet could be used to house a radiogram and loudspeaker. One practical way of doing this is to use the compartment under C to take the radio chassis mounted vertically with the controls being just below the top of the cabinet; if the width of this space is insufficient the space under E should be shortened to 12 in. instead of 17in., adding the 5in. taken away to the width of the space for the radio.

If this modification is made, the lid D would have to be large enough to cover the front at present occupied by C and D and the front of the cabinet would be one piece instead of two.

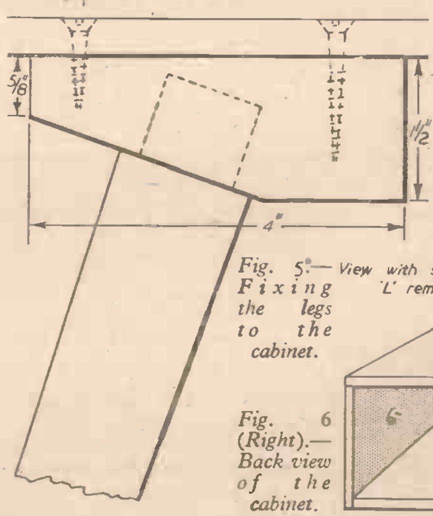


Fig. 5.—Fixing the legs to the cabinet.

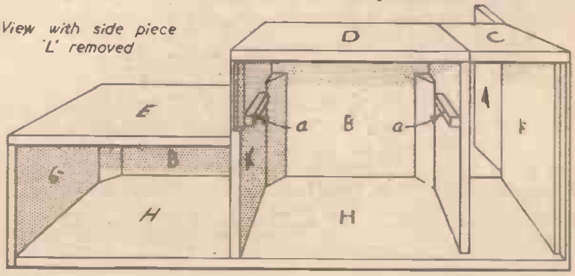


Fig. 6 (Right).—Back view of the cabinet.

AIDS IN THE STUDY OF GEOLOGY

(*Concluded from page 244*).

shake or stir the fluid before applying it or unwanted bubbles will be introduced into it) and place in position a clean cover glass. Apply gentle pressure in order to squeeze out excess balsam and then leave, preferably in a warmish room and away from dust for a week or two to give the solvent ample time to evaporate. A small weight placed over the cover glass helps to keep it in position until the mounting medium has set.

In the grinding process the ends of the slip will most likely have suffered from the action of the carborundum powder and have a frosted appearance. Some experts can transfer the extremely delicate rock slice to a new slip before covering, but this is a tricky and most risky business. The author sees nothing in the ground ends of the glass of which one needs be ashamed.

Interested readers will have realised that the grinding of a smooth face on a piece of rock can just as well be applied to larger hand specimens as to chippings for microscopic study. Apart from the desirability for this when the structural detail of a fossil needs to be studied under a hand lens, some rocks can display great beauty when so treated.

After finishing on the fine plate an artificial "polish" can be very simply given to the specimen by coating the surface with Durafix or Le Pages transparent cement. This should be quickly spread over the surface and then left in a dust-free place to dry.

Fossils can often be etched so as to stand out in slight relief by flooding the ground surface with dilute hydrochloric acid. After a thorough wash the cellulose treatment should be given when dry. The shiny surface resulting shows the structure of the fossil more clearly.

The Patent Office, Chancery Lane.

A NEW SERIES

Applications for FOREIGN PATENTS

By "ATTORNEY"

> Valuable Advice to the Inventor on Patent Procedure Abroad. This Month — Czechoslovakia, Denmark, Eire, Finland and France are Dealt With

Czechoslovakia

PATENTS are granted for a term of 15 years from the application date and priority may be claimed, under an International Convention, if the application is filed not more than 12 months from the date of a corresponding United Kingdom Application.

The application may only be made by the inventor or inventors, or heirs, and cannot be filed in the name of an assignee. When granted, however, the patent can be assigned, but it is necessary to record the assignment in the Patent Office together with other documents, including a translation of the assignment into the Czech language. The applicant, if a foreigner, must be represented by an officially authorised representative in Czechoslovakia.

A patent will not be granted if the invention, before the application or priority date, has been disclosed in a printed publication, irrespective of its country of origin. The Czechoslovak Office of Inventions also conducts a search to ascertain whether the invention has been disclosed in a previously filed Czechoslovak application. Previous use of an invention in such a manner as to come to the notice of the Czechoslovak Office of Inventions will also be a bar to the grant of a patent. The official examination not only extends to these matters, but also to the question of whether the alleged invention is patentable on other grounds.

If official objections are raised, the applicant is entitled to make requisite amendments to his specification and to respond to the objections. The ultimate decision of the Office of Inventions is, however, final. The application and specification are not published before grant of the patent and opposition procedure is not provided for. The specification is published in printed form after the grant of a patent.

The documents for an application for patent must include a declaration that the applicant is the author of the invention and is not under obligation to offer the invention to the Czechoslovak State. This latter requirement exists as employees of State-established or supported organisations are bound to offer their inventions to the State and to receive compensation if the offer is accepted.

If the application claims priority on the basis of a United Kingdom application, an officially certified copy of the basic application must be filed in the Office of Inventions within three months from the Czechoslovak application date and be accompanied by a legalised translation into the Czech language.

Annual renewal fees are payable, the first being required at the time of filing the Czechoslovak application.

Application fees are from £59 10s. and renewal fees rise from £9 5s. at the second year to £112 5s. for the last year of the patent term.

Denmark

Denmark is a party to an International Convention which enables an applicant for a United Kingdom application to file a corresponding application in Denmark within one year of the basic application and to claim priority in respect thereof. The term of a Danish patent is 17 years from the date of application, but patents of addition only remain in force for the unexpired term of the main or parent patent.

The applicant may be the actual inventor, a firm or a company or may be the assignee of the inventor. If the applicant is an assignee, it is necessary to file in the Danish Patent Office an assignment from the inventor of the right to apply for a patent. The assignment must be legalized by the Danish Consul and must bear a date prior to the date of application in Denmark. A patent application may, however, be assigned while it is still pending in the Danish Patent Office. A Danish patent may also be assigned after grant, but it is necessary to record the assignment in the Patent Office. If the assignment is in the English language it is not necessray to file an attested translation thereof in the Patent Office.

A patent application is submitted to official examination to see that it satisfies a number of requirements and that the invention is novel and patentable. The examiner is entitled to object to an application if, as a result of his examination, he discovers that the invention has been described in any printed document, irrespective of its country of origin. A patent application or patent is vulnerable if the invention was publicly used in Denmark before the application date or priority date. Unless an invention is of substantial importance as compared with what was previously known or used, the grant of a patent may be refused. If an application is rejected, a request may be made within two months of the rejection decision for re-examination by the Patent Office, but good supporting grounds have to be given. In the event of a final rejection, the application can only be proceeded with by appeal to a special Commission.

On acceptance of an application, it is published in the Official Danish Gazette and laid open to public inspection for eight weeks in order to give any interested party an opportunity of opposing the grant of a patent.

Where an application is filed under convention claiming priority of a United Kingdom application, an officially certified copy of the basic application must be filed before acceptance of the Danish application. Within three weeks from the date of the official notice granting a patent, it is necessary to pay an issue fee. It is also necessary to pay printing costs if the specification exceeds three sheets of description and claims or drawings. Within two months from the date of grant accumulated renewal fees must be paid.

Application fees are from £45 10s. and renewal fees rise from £5 15s. at the second year to £25 10s. for the last year of the patent term.

Eire (Irish Republic)

Patents are granted in Ireland for a period of 16 years from the application date or from the priority date, i.e., the date of a corresponding United Kingdom application made in respect of the invention not more than one year before the date of filing the Irish application. Patents of addition are granted for the unexpired terms of the parent patents.

An application may be filed in the name of the true and first inventor, either alone or jointly with another person or persons or with a company. If the application is made under the International Convention, the application may initially be made in the name of an assignee who may be an individual, firm or company.

If a patent application in the Irish Republic is based on a corresponding United Kingdom application, it is necessary to give particulars thereof to the Irish Patent Office. Upon acceptance of the British application, an officially certified copy of the accepted British specification has to be supplied to the Irish Patent Office and the corresponding Irish application has to be brought into agreement therewith. If the Irish application is not based on a United Kingdom application under Convention, it is necessary for a Statutory Declaration to be made by a Registered Patent Agent to the effect that he has made a search through the records of the British Patent Office and that the invention, the subject of the Irish application, has not been wholly or partly claimed or described in any specification published within 50 years previous to the date of the Irish application.

An Irish application or patent is vulnerable if the invention thereof has been publicly used within the Republic of Ireland before the Irish application date or the Convention date. It is also vulnerable if it has been previously disclosed within the 50 years period in a British patent specification or if

(*Continued on page 259*)

it has been disclosed in any other document published in the Republic of Ireland.

If an ordinary application is filed, i.e., not under the International Convention, it may be accompanied in the first instance by a provisional specification and must be followed within nine months by a complete specification, if the applicant desires to continue the application with a view to obtaining a patent. An extension of time of one month for lodging the complete specification is obtainable.

Acceptance of the Irish application by the Patent Office and an abridgment of the specification are published in an official journal and opposition may be lodged against the application within two months of the date of publication of acceptance of the complete specification. An Irish application must normally be accepted within 15 months from the date of application, and a sealing fee for securing a patent must be paid within 18 months from the date of application. Extensions of time are, however, obtainable on payment of prescribed fees.

A patent may be assigned after grant; registration of the Assignment in the Irish Patent Office is not obligatory. It is advisable, however, to register the Assignment to enable the new proprietor to be recognised in a Court of Law in connection with the patent.

Annual renewal fees are payable as from the fifth year of the patent with respect to the date of the Irish application or the date of the basic application in Convention cases.

There are provisions to enable anyone to apply for a licence under the patent if it can be proved that there has been abuse of the monopoly rights. A request for such a licence would not be entertained until after three years from the date of application of the patent.

Although not obligatory it is advisable, in order to succeed in a claim for damages for infringement of an Irish patent, to mark the patented article with the word "Patent" together with the year and number.

In order to reduce renewal fees by one-half, a patentee may apply to have his patent endorsed "Licences of Right" which enables anyone to apply for a licence under the patent.

Application fees are from £36 15s. and renewal fees rise from £9 10s. at the fifth year to £21 10s. for the last year of the patent term.

Finland

Patents are granted in Finland for a period of 17 years from the date of the Finnish application. Improvements of an invention in a main patent may be protected by a patent of addition which remains in force for the unexpired term of the main patent.

A Finnish application may be made in the name of the actual inventor or inventors or the assignees thereof, whether individuals, firms or companies. If an application is made in the name of an assignee, an Assignment executed by the inventor and legalised by the Finnish Consul must be filed in the Patent Office. If, however, the inventor is an employee of the applicant, a corresponding statement to that effect may be accepted by the Finnish Patent Office in lieu of an assignment.

Finland is a party to an International Convention which enables a Finnish application to be granted priority rights, based on a corresponding United Kingdom application, providing the latter was not filed more than one year before the Finnish application date.

An application for patent undergoes official examination as to form, novelty and other requirements. An invention is not regarded as novel if before the application date or Convention date it has been made available to the public in any printed document or otherwise, irrespective of the country of origin. Novelty is also destroyed if the invention has been publicly used or disclosed in Finland before the relevant date. If an objection is raised by the examiner on the ground of lack of novelty, the application may be amended to restrict the invention to novel features over the prior art, but such features must be shown to possess inventive merit or technical ingenuity. Two stages of appeal are provided if an application is rejected by the examiner.

Upon acceptance of a Finnish application, it is laid open to public inspection for a period of 60 days to enable anyone to lodge opposition to the grant of a patent.

A claim to priority based on a United Kingdom application may be made at any time before acceptance of the Finnish application. A certified copy of the basic application need not be filed unless required by the examiner, as may happen if the application conflicts with another Finnish application.

Before the grant of a patent, the applicant has to pay a sealing fee and also a printing fee if the specification exceeds a prescribed number of pages and sheets of drawings. After grant, a Finnish patent may be assigned and the Assignment, after being legalised by the Finnish Consul, must be filed in the Patent Office. If, after three years from the date of grant of a patent, the invention is not being adequately worked in the public interest a compulsory licence may be applied for and may be granted to anyone capable of putting the invention into effect. It is not obligatory for patented articles to bear the Finnish patent number.

Annual renewal fees are payable, the first of which is due when the application is filed.

Application fees are from £60 10s. and renewal fees rise from £4 15s. at the commencement to £50 10s. for the last year of the patent term.

France

A French patent not only extends to the Republic of France but also to a number of French overseas territories. French patents are granted for a period of 20 years from the date of application. Patents of addition are obtainable and remain in force for the unexpired terms of the main patents to which they relate.

As France is a party to an International Convention it is possible to claim Convention priority on the basis of a corresponding application filed in the United Kingdom within one year from the date of the French application. If the French applicant is an assignee of the applicant in the United Kingdom, an assignment declaration signed by the United Kingdom applicant must be executed and give authority for the filing of the French application and the claim to Convention priority. This assignment must be lodged in the Patent Office within three months from the date of filing the French application.

The official examination of an application is limited to formal requirements. It does not involve a search to ascertain whether the invention is novel in the sense of whether it has been published prior to the application date or Convention date in any publication, irrespective of country of origin. A French patent is granted, however, without any guarantee of validity and is vulnerable if the invention lacks novelty owing to prior publication. A radical change in the French Patent Law is likely to be made and will provide that a French patent must be examined as to novelty by the International Patent Institute of The Hague after a period of five years from the date of filing the French application, providing that the annual renewal fees in respect of the first six years of the patent term have been paid. The patentee will be supplied with a report on the state of the art as revealed by the examination and the patentee will have an opportunity of submitting comments on the report within a period of three months. A final report will be drawn up and published and copies will be obtainable. The changes also contemplate an application being made by the applicant or patentee or by any other party for a novelty report before the expiration of the five years period. In such a case the applicant for the report will have to bear the costs.

French patent specifications are published in printed form and finish with a "Résumé" setting out the novel features of the invention. A French patent, however, may give protection for an invention in respect of features which are not referred to in the "Résumé," but are described elsewhere in the specification. A publication fee must be paid at the time of filing the French application, which matures into a patent without requiring the payment of any final or sealing fee.

Assignments and licences concerning French patents will not be effective against third parties unless recorded in the Patent Office. Although marking of patented articles with the French patent number is not obligatory, it is necessary, if such marking is voluntarily made, to accompany it with the additional marking "Breveté S.G.D.G.," which means that the patent is without government guarantee as to validity.

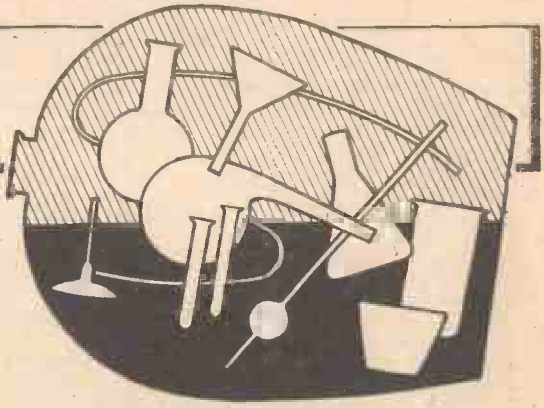
If a patented invention is not worked without good cause within three years from the date of grant of the French patent, anyone may apply to the Courts for a compulsory licence, but must prove that he has applied, without success, for a licence from the patentee.

Annual renewal fees are payable as from the anniversary of the filing date of the French application and must be paid even if the patent has not yet been granted.

Application fees are from £45 and renewal fees rise from £6 5s. at the second year to £14 15s. for the last year of the patent term.

(To be continued)

THE JUNIOR CHEMIST



No. 3.—Further Interesting Experiments the Amateur Can Perform

NUMEROUS occasions arise when the home experimenter wishes to perform a few experiments in his laboratory and has insufficient time to devote to the fitting up of apparatus or lengthy preparations. Or, on the other hand, he may wish to show his friends a few short, interesting experiments when they call to inspect his "lab."

The Magic Jars

It is the activity of potassium permanganate in contact with glycerine which enables us to perform this experiment.

Three glass jam jars are all the apparatus necessary. The chemicals required are about an ounce of potassium permanganate, strong solution of oxalic acid, hydrogen peroxide solution, dilute sulphuric acid, and strong hydrochloric acid.

Arrange the three jars in line, and in each place sufficient permanganate to generously cover the bottom. To the second jar add sufficient dilute sulphuric acid to cover the potash salt, and treat the third jar similarly. Now, to the first jar add about an ounce of strong hydrochloric acid, to the second two ounces of peroxide solution, and to the third a good helping of oxalic acid solution. A vigorous reaction will be seen taking place in each. Allow this reaction to proceed for a minute or two, then take a splinter of wood, dip it in turpentine, and plunge it into the first jar. Immediately it bursts into flame. While still burning, transfer the splinter to the second jar; notice how brilliantly it now burns. Complete the changes by placing it in the third jar when it is extinguished (see Fig. 1). This is a most interesting experiment and well worth performing.

The Explanation

Chlorine gas is liberated by the reaction in the first jar, turpentine is spontaneously inflammable in an atmosphere of chlorine, and hence the turps-soaked splinter catches fire. Interaction between peroxide and permanganate produces oxygen gas. In this the wood burns very brightly. The third jar contains carbon dioxide, liberated by the decomposition of the oxalic acid, and thus the flame is extinguished.

Caution.—Perform the experiment near an open window—chlorine is poison gas.

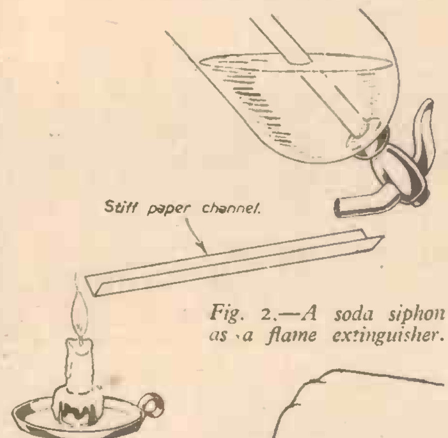


Fig. 2.—A soda siphon as a flame extinguisher.

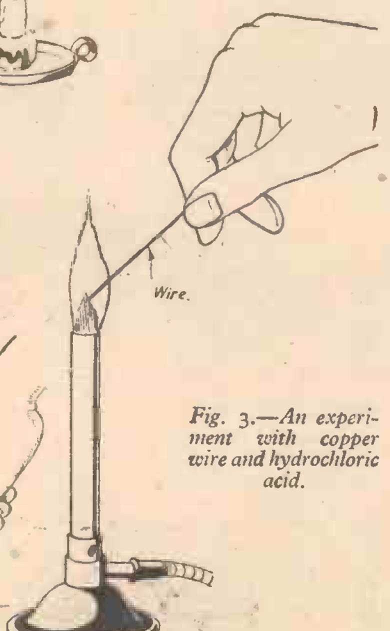


Fig. 3.—An experiment with copper wire and hydrochloric acid.

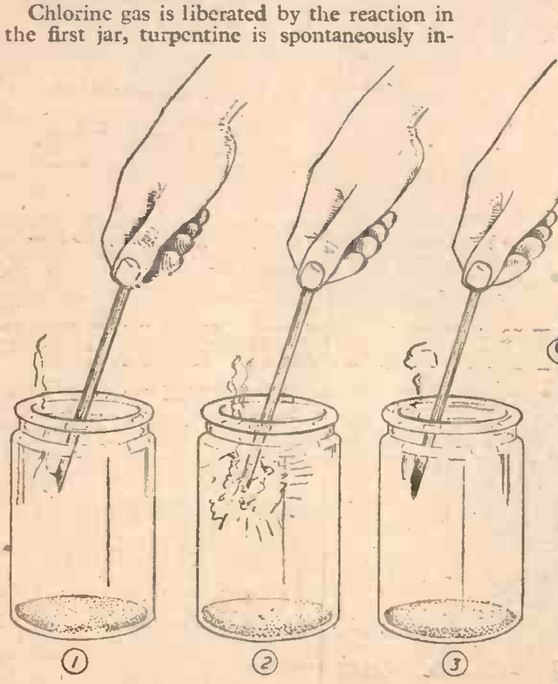


Fig. 1.—The "magic" jars.

Purple Changed to Green

Permanganate again proves useful in this experiment. Dissolve one or two crystals in a glass jar of water. A fine purple solution results. To this add a little solution of caustic soda. The purple immediately changes to green.

Soda Siphon as a Flame Extinguisher

Construct a channel or gutter out of stiff paper as indicated in Fig. 2 and support it at a slight angle. About a foot immediately below the lower end of this inclined channel, place a lighted candle (see Fig. 2). Obtain a siphon of soda water, invert it, shake, and press the tap. A little soda water is blown out, followed by carbonic acid gas. Direct the jet of gas on to the upper end of the gutter and watch the candle. The flame is extinguished as though by some invisible hand. This is mystifying to the uninitiated, but is easily explained. Carbon dioxide is heavier than air and will not support combustion. The gas from the siphon therefore rolls down the gutter and drops on to the candle flame, thereby extinguishing it.

A Ghastly Effect with Common Salt

It is advisable that the nervous-minded be turned out of the "lab." while this experiment is in progress. The materials required are few—a saucer, a little methylated spirit, and a handful of common salt. Place the salt in a saucer and soak it well with the spirit. Ignite the mass and turn out the lights in the room. Now look at the countenances of your friends illuminated by the yellow light from the saucer. The ghastly corpse-like appearance is very startling. Perform the same experiment, substituting boracic (boric) acid for the salt. The light this time is an eerie green.

Coloured Lights With a Bunsen Burner

These experiments are to advantage performed in a darkened room.

To obtain green light, dip a length of copper wire in hydrochloric acid and hold it in the Bunsen flame (see Fig. 3), and the flame will become green.

To make red light, wet a piece of iron wire and dip one end in a little strontium nitrate

(Continued on page 264)

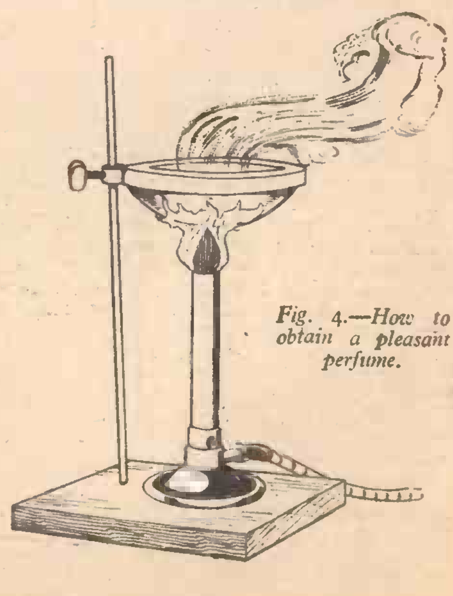


Fig. 4.—How to obtain a pleasant perfume.

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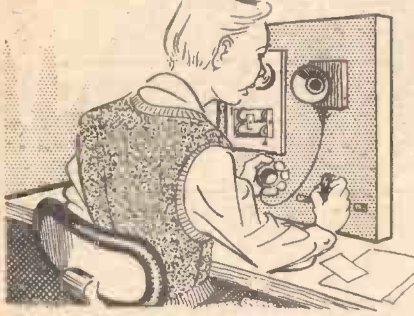
JUNIOR SECTION

Making a Simple Telephone



An Easily-made and Efficient Telephone That Can be Constructed From Odds and Ends

THIS telephone was designed so that it might be constructed almost entirely from odds and ends. The only things which are not made are the receivers, which are taken from an old pair of headphones. The original telephone worked extremely well and was used to establish communication between two rooms in the same building. The apparatus may be divided into three parts, the microphone, the bell and the receiver.

Start the construction of the set by making

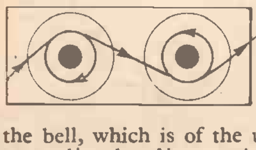


Fig. 1.—The coils are wound in opposite directions.

the bell, which is of the usual type. Obtain two 1¼in. by ¼in. carriage bolts, and file their heads flat. Cut a piece of soft sheet iron, 2¼in. by ¾in. by ⅛in., and drill two holes in it to take the bolts. Cut four fibre washers to fit tightly on to the bolts and slip two on each bolt. Push the bolts through the holes in the iron yoke and screw the nuts on for ¼ in. Arrange the washers as shown, and wind the bolts to their fullest capacity with No. 24 d.c.c. wire. The coils are wound in opposite directions (see Fig. 1).

The Base for the Bell

Cut a base for the bell 3½in. by 6in. from ½in. wood. Chamfer the edges and stain a dark brown. Mount the magnets as illustrated in Fig. 2, by means of a strip of wood and a round-headed screw. The gong is taken from an old alarm clock and is mounted by means of a metal sleeve and screw (Fig. 3).

The armature is a strip of soft iron ⅛in. by ⅝in. by 2½in. To one end, a length of ½in. clock spring is soldered. The spring is heated until it is red hot and then allowed to cool slowly. Drill the end with an ⅛in. hole, cut the spring so that it is 1¾in. long and solder it on to the armature. The contact on the armature is a small piece of tin plate soldered on as shown in Fig. 4. The hammer may be taken from an old alarm clock or may be made. Take a length of iron rod ½in. in diameter, and as close to one end as possible drill a small hole 1/10in. in diameter through the rod (Fig. 3). Cut the end off the rod so that the piece will be ⅛in. thick. Into the hole push a 2in. length of 1/16in. steel wire, and secure it by hammering the iron. Solder the wire on to the armature and fix it on to a wooden block, shaped as in Fig. 4. Connect one end of the magnet coils to the armature and the other to a terminal on the base.

Cut a strip from 1/16in. brass ⅜in. by 1½in. and bend it to form a bracket. Drill a hole in the end and solder a nut over it so that a bolt will screw through. A suitable size of bolt is ¾in. by ⅛in. File the end of the bolt to a point and screw it through the bracket. Drill the other end of the bracket to take a ½in. wood screw and fix it to the base so that the bolt will touch the contact of the armature (Fig. 5). Connect the contact screw to another terminal on the base and join the bell in series with a two-volt cell and adjust the contact screw until the best result is obtained.

Fig. 5 (Left).—The contact screw.

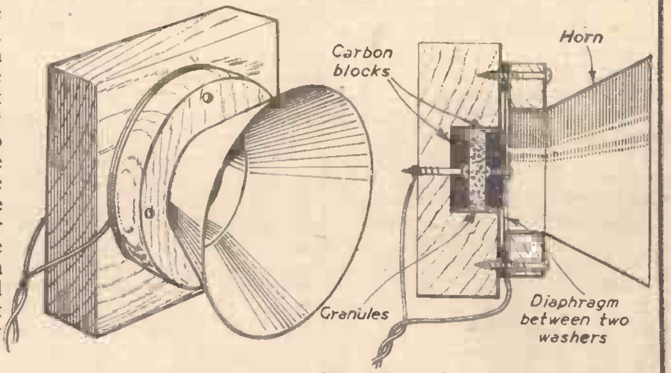


Fig. 6.—Perspective and side views of the microphone.

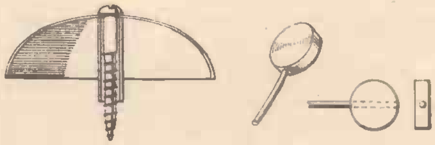


Fig. 3.—Method of securing the bell and details of the hammer.

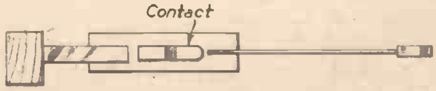


Fig. 4.—The completed armature.

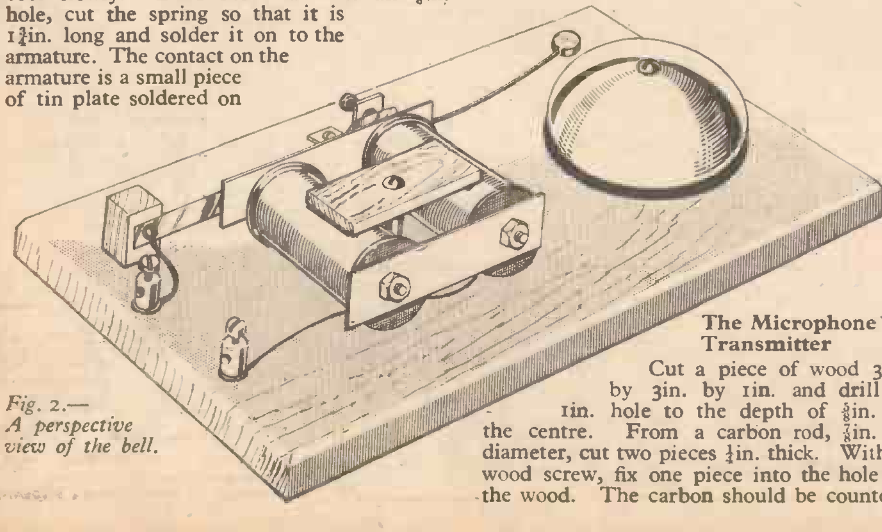


Fig. 2.—A perspective view of the bell.

The Microphone or Transmitter

Cut a piece of wood 3in. by 3in. by 1in. and drill a 1in. hole to the depth of ⅝in. in the centre. From a carbon rod, ⅞in. in diameter, cut two pieces ¼in. thick. With a wood screw, fix one piece into the hole in the wood. The carbon should be countersunk to take the head of the screw. The end of the screw projects through the case at the back and forms one terminal of the microphone. Cut two washers from thick cardboard 2½in. in outside diameter and 2in. inside diameter, and also cut from ½in. wood a circle of 2½in. diameter with a 1½in. hole in the centre. The diaphragm of the instrument is a piece of thin sheet metal 2½in. in diameter. A suitable piece of metal may be obtained from the lid of an air-tight tobacco tin. The tin is supplied with a loose lid and underneath it there is a thin metal seal which can be used for the diaphragm. Drill the remaining carbon block to take a countersunk machine bolt and fix the carbon in the centre of the diaphragm. Shellac the inside of the hole in the block of wood, using a small brush and taking care to keep the varnish off the carbon at the back. When dry, fill the hole in the wood to a depth of ⅛in. with carbon granules and place the cardboard washer and the diaphragm in position. A mouthpiece is made for the transmitter by rolling a sheet of thin metal, about 8in. by 4in., into the shape of a cone and soldering the edges. Cut the cone so that it is 2in. deep and 1½in. in diameter at the smaller end, leaving two lugs to attach it to the microphone case. It is attached to the piece of wood by pushing it through the hole, bending the lugs over and securing them with ¼in. wood screws or small nails. File the heads of these screws down so that they will not touch the diaphragm.

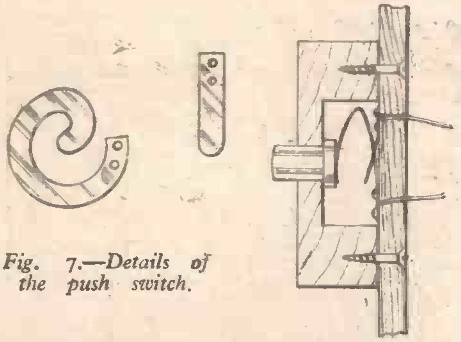


Fig. 7.—Details of the push switch.

Fix the front piece of wood in place by means of four 1in. round-headed wood screws spaced evenly round its circumference: this is best done by clamping the part in place with a fretwork cramp and drilling through the wood, washers, and diaphragm with a small metal drill. A length of wire should be placed under the diaphragm and bent round one of the screws before it is finally screwed up (Fig. 6). Test the microphone by connecting it in series with a battery and a pair of headphones, speak into it, and the voice should be heard through the 'phones.

The Push Button Switch

Take a piece of wood 2in. by 2in. by $\frac{3}{4}$in. and drill a 1in. hole to a depth of $\frac{1}{2}$in. in its centre. In the centre of this hole drill a smaller $\frac{3}{8}$in. diameter hole through the remaining $\frac{1}{4}$in. of wood. Cut a plunger from a length of dowelling rod, leaving a flange at one end so that the plunger is exposed about $\frac{1}{4}$in. Two contacts are cut as shown in Fig. 7. One from springy brass and the other from 1/16in. brass. The contacts are mounted on the base of the instrument, and the front of the push is secured by means of two wood screws driven through the panels from the back. The wires should be passed through holes in the panel and connected up before the push is finished.

The action of the receiver may be made automatic, but as this is not very efficient a two-way switch is used instead. The contacts and arm are cut from 1/16in. brass and need only be of simple design.

A single receiver is used and is taken from a pair of wireless headphones. Connect to it a yard of flex and also fix a small hook so that it may be hung on the panel.

The Panel

This may be of any convenient size and wood, and should be well finished. The components are mounted as in Fig. 8. No terminals are essential if the apparatus is to be permanently mounted, but it is an advantage to have two to which the batteries may be connected. They should be made by slipping two washers over a screw-eye and fixing it in the base.

Two such instruments as this are necessary to form a complete telephone installation, and

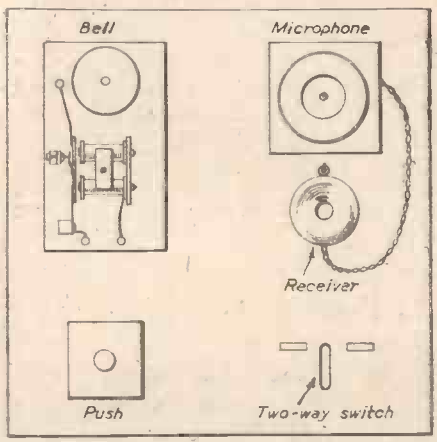


Fig. 8.—The panel with the components mounted.

each station is wired as in Fig. 9. Double bell wire of No. 22 gauge should be used for the lines. Connect the line terminal on one panel to that on the other, and similarly with the earth.

To call up a station, push the switch from contact 1 to contact 2, and press the push, which rings the bell at the distant station and attracts the attention of the operator, who also pushes the arm of the two-way switch from contact 1 to contact 2. Both sets of instruments are in circuit and the two people may converse at will. On leaving the instruments the arms are put on contacts 1 again so that the bells may be rung from either end.

Various automatic switches have been designed, but in home-made instruments these are not so efficient as the two-way switch. After a great deal of experimenting the following switch was decided on as being the most

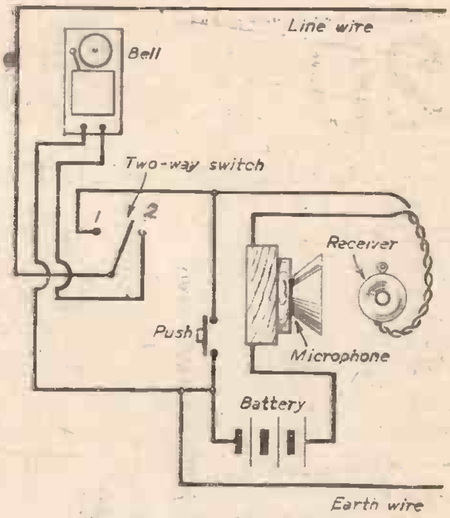


Fig. 9.—The wiring diagram.

efficient for the amateur to construct. Cut a hole in the centre of the panel $\frac{1}{2}$in. square and cut a strip of springy brass $\frac{3}{8}$in. wide and $4\frac{1}{2}$in. long, and bend and mount it as in Fig. 10, using a $\frac{1}{2}$in. wood-screw. Cut two blocks of wood about $\frac{1}{2}$in. by $\frac{1}{2}$in. by $\frac{3}{8}$in. and drive $\frac{3}{8}$in. screws through them. Glue the blocks above and below the spring to the end of which a small hook is soldered. Hang the receiver on the hook and adjust the bottom screw until it touches the spring, remove the receiver, the spring goes up, and now adjust the top screw until it touches the spring. Solder wires to the screws and spring, and connect them as for the two-way switch. With this switch the board must be mounted on blocks of wood so that there is a space between it and the wall.

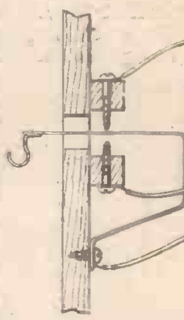


Fig. 10.—The automatic switch.

The telephone will work from two dry cells but for best results use three dry cells or a four-volt accumulator.

THE JUNIOR CHEMIST

(*Continued from page 260*)

powder. A few tiny crystals will adhere to the wet wire. Hold these in the flame and a beautiful crimson light is produced.

By performing the foregoing experiment, using saltpetre instead of strontium nitrate, a brilliant lilac flame is formed.

A Display of Shooting Stars

Iron filings are required to produce this effect. Gently dust them into the flame and watch the showers of white sparks thrown out.

An Orchard Smell

One usually associates chemistry with the reverse of pleasant odours, but here is an experiment to prove that chemistry is libelled when schoolboys call it "stinks."

Vinegar, methylated spirit, concentrated sulphuric acid, and a porcelain evaporating basin are required. Place about half an ounce of vinegar in the basin, cautiously add a little acid (about quarter of an ounce should be sufficient), and then add to this mixture about a quarter of an ounce of spirit. Light the Bunsen and, supporting the basin on the tripod and gauze, gently heat it (see Fig. 4). After a few minutes notice the rich fruity smell which pervades the room. This pleasant odour is due mainly to a substance called ethyl acetate.

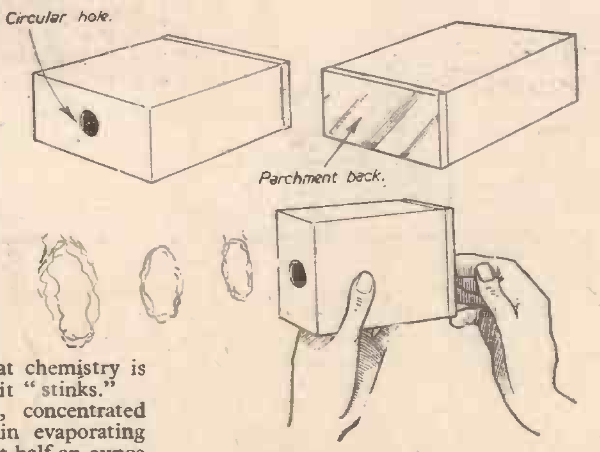


Fig. 5.—How to make smoke rings.

How to Make Smoke Rings

This is a very instructive experiment and the apparatus requires little making. Procure a cardboard box rather longer than it is wide. Cut a circular hole about 2in. in diameter in one end and remove the opposite end (see Fig. 5). Soak a piece of tough parchment paper in water, and then, by means of seccotine, fasten it over the open end of the box. When dry the parchment should be tight like a drum skin. Soak a wad of cotton wool in strong hydrochloric acid and similarly treat another with ammonia. Introduce both wads into the box through the circular hole and notice the dense white fumes of ammonium chloride (sal-ammoniac) which fill the interior. Now smartly flip the parchment and watch the smoke ring driven through the hole and across the room. The fumes merely make the vortex rings, as they are called, visible. They are produced each time the parchment is tapped by the sudden rush of air through the hole. Thus candles may be extinguished mysteriously by the experimenter when no rings are visible; that is, when the wads have been removed from the "magic box."

Letters to the Editor

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

Truing a Lathe Chuck

SIR,—On reading your reply to the query from Mr. J. Grey, December, 1956, PRACTICAL MECHANICS, on truing a lathe chuck, may I venture to suggest the following method which will give a reasonably good result? Of course, the checks as you describe should be carried out first.

A small self-centring chuck is used mostly on work from ½in. to 1½in. diameter as it is with this range we mostly concern ourselves. Take a piece of 1in. diameter steel bar of about 5in. length and either hold it in the four-jaw chuck and skim up the projecting piece dead true or centre both ends and skim it up between centres.

Remove the backplate of the three-jaw self-centring chuck to be trued and grip it firmly on this bar with its back to the tool rest. Lightly skim the backplate register and backface until they are quite true. Next take the backplate and fit it carefully to the lathe spindle nose, turn off the old spigot and re-turn a new one to fit the enlarged register of the chuck. Make sure there is sufficient clearance in the backplate securing holes and then re-bolt the chuck to the backplate.

The body of the chuck will now be found to wobble, a light skim over the entire chuck will correct this and will leave the front face true.

The chuck will now operate reasonably accurately over its most useful range.

Regrinding of chuck jaws does not always have the required result.

This is because it is necessary to grip the jaws back against an outside ring to hold them firm.

Thus the jaws are held against the inner surface of the scroll thread and this is the surface *not* used for the majority of work and is never worn to the same extent as the scroll thread outer surface, therefore the jaws are not in the best position for the regrinding. —P. G. EDEN (Devizes).

Preventing Smell from a Paraffin Stove

SIR,—*Re* query and your reply in the November, 1956, PRACTICAL MECHANICS about preventing smell from paraffin stove, I would add that not only dirty burners, etc., but paraffin being spilt and not properly wiped away will cause the smell.—J. PAYNE (Dublin).

The Steam Car

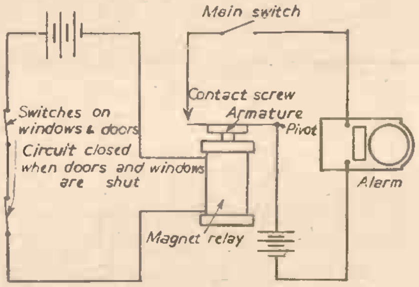
SIR,—Now that Britain and other countries are faced with a long oil crisis, engineers are presented with a great opportunity to help Britain save pounds and dollars by reintroducing and developing the steam-driven car.

Most cars could have a small steam plant installed in place of a petrol engine which would be reliable, silent, safe and economic for comparatively short journeys of, say, 100 miles or so.

It would surely give pleasure and perhaps profit to some of our enterprising steam engineers to plan a little steam engine that will keep the car on the road and help the motorist to "pour water on the troubled oils"!—E. Cox (Somerset).

Electric Alarm

SIR,—Re "Information Sought," December, 1956 issue, being a budgerigar fancier myself I sympathise with Mr. Major-Dunkley's problem. His 500-volt transformer would be most effective in discouraging would-be intruders but it would be equally dangerous.



Mr. A. Strang's electric alarm circuit.

I suggest he uses the simple alarm circuit (shown in the sketch). It can be run either off dry cells or the household supply. It has the advantage that even if the intruder cuts the wires the alarm will ring.

Switches are fitted to the doors and/or windows in series and included in the circuit is a battery and a relay. When all doors and/or windows are closed a current flows continually in this circuit; the magnet of the relay is, therefore, energised and holds the armature away from the contact screw. If the circuit is broken in any way (i.e. if a door or window is opened or if wire is cut), the magnetic field in the relay collapses and the armature springs back and touches the contact screw. The second circuit is then complete and the bell rings.—A. STRANG (Ayrshire).

Space Visitors

SIR,—If the phenomena described by "Theorist" in the December, 1956, issue of PRACTICAL MECHANICS are typical of those claimed to prove the existence of intelligent extra-terrestrial visitors, then the claim for the reality of these visitors is very shaky indeed. Every single one of the incidents described is capable of a natural explanation, all but one being meteors or "foo balls."

To take the meteor phenomena first, the death of Captain Mantell was, no doubt, caused by the extremely long and narrow Mach cone trailed by a fast and low-flying meteorite. The shock-wave caused by the passage of such an extra-terrestrial visitor would be quite capable of destroying so comparatively flimsy an object as a fighter aircraft, and if the meteorite itself was travelling (as many do) at several times the speed of sound, then its shock at the sort of altitudes attainable by aircraft could be many miles behind it. Remember, also, that the distance of large meteors is always under-estimated, it being on record that one pilot dipped his wing to "avoid" one that was about 100 miles away!

Also the apparent acceleration, in the sky, of a visible light, does not preclude the latter's being a meteor. In Chapter VII of his book, "The Elements Rage," which, incidentally, forms excellent reading for those wishing to take the matter further, Frank W. Laine quotes a Mr. Irish as having said, in describing a meteor which was seen over Homestead, Iowa, on February 12th, 1875,

"To these observers, all of whom stood near the meteor's line of flight, its size seemed gradually to increase, also its motion, until it reached a point almost overhead, or in a direction to the east or west of the zenith, when it seemed to start suddenly and dart away on its course with a lightning-like rapidity."

In other words, the visible acceleration was simply an effect of perspective, foreshortening a part of the meteor's path. To forestall those who might see in this incident an early saucer sighting, I should add that the meteorites which caused the phenomenon were later picked up, and found to have a total weight of 500 lb.

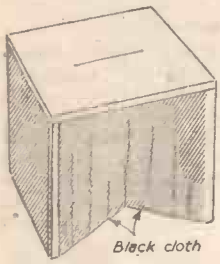
The description of an U.F.O. as emitting flames is almost sufficient in itself to identify that object as a meteor, since if we are to believe in visitors from space, we must also believe that a technology which has developed an inertialess drive—for that is what is implied in the immense accelerations described—and spanned the stars is still primitive enough to have to use chemical rockets for propulsion. Atomic rockets, of course, will not produce exhaust flames.

"Foo balls" are widely known to combat pilots. They appear as small balls of light which keep formation with the aircraft, but yet take evasive action when approached. They are caused by irregularities in the surface of the aircraft, or the latter's exhaust heat, setting up density gradients in the air through which refraction takes place to form what is, in effect, a small mirage of the brightest local source of light. Their apparent position relative to the aircraft is, of course, fixed by the aircraft's position relative to the source of light. Thus, when the aircraft turns to pursue them, the foo balls also alter their apparent position, and seem to take evasive action. Into this class all lights which keep formation with aircraft can probably be put, mentioning in passing that the small lights seen by Captain Howard accompanying his airliner were probably his own lighted cabin windows!

The object sighted by F./O. Bullivant is more interesting, in that it lends itself to more exact analysis. The description of it as "conveying the impression of strong light reflecting on a chromium or silver-plated body" strongly suggests that it was a "sun-pillar" or similar halo phenomenon. That this is an accurate description of the apparent texture of such an appearance I can confirm from personal experience. It is stated to have been observed at 18.15 hours on an August day. This is presumably 18.15 hours B.S.T., i.e., 17.15 hours G.M.T. The Sun bears 270 deg. at 18.00 hours. G.M.T., and moves roughly 15 deg. per hour. Thus, at the time in question, the Sun would be bearing roughly 255 deg. So a small portion of a halo of 46 deg., or a "mock-sun" formed on this halo, presented by an isolated patch of ice-crystal cloud, would bear about 209 deg. The precise heading of the glider is not stated, it being only claimed to be "southerly." Also the bearing of the object from the glider may not have been precisely dead ahead. I believe that the difference of 29 deg. between the 180 deg., representing due South and the 209 deg. calculated above is not sufficient to preclude this explanation. To paraphrase a famous remark reputed to have been made by Thomas Jefferson, "I could sooner believe that an R.A.F. officer made a mistake in a rough bearing than that ships come from heaven."—BRIAN L. KERSHAW (Leeds, 16).

The Speaking Head

SIR,—*Re* your article "The Speaking Head" in the December issue of PRACTICAL MECHANICS. This is a clever illusion and can be very baffling, but I think that the preparation of the table could be improved by making it "hollow" in front (see sketch).



Mr. T. H. E. Marsh's suggested modification.

The "head" would then sit with his knees apart, one in each corner. The magician can show that the table is hollow underneath by thrusting his wand under the table and striking the legs.

Again if the head box has a small weight fixed inside at the front, the box will automatically fall a little to the front when it is lifted by the handle, which should be placed centrally on the top.—T. H. E. MARSH (Glasgow).

Deck Rails for Ship Model

SIR,—Your correspondent Mr. B. Hill, of Reading, in December's issue asks for information *re* deck rails for ship model. The following description and sketches might help him to overcome his difficulty.

A in Fig. 1 shows an ordinary thin split pin about 1½in. in length. Next obtain the pair of metal jaws shown in fine dots at B, Fig. 1. These are tightly clamped together with the pin sandwiched between, to a depth, determined by individual requirements, from the underside of eye in the pin.

The free ends of the pin are now opened

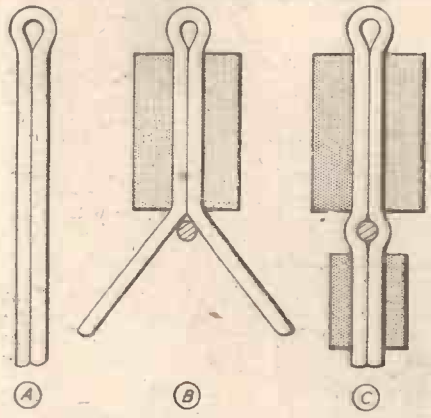


Fig. 1.—Stages in construction of deck rail.

out as shown in B, Fig. 1. Obtain a piece of stout wire the diameter of which will pass through the eye without shake, this wire is used to make a second eye in the pin by holding it between the open ends of the pin and as close to the metal jaws as possible (refer again to B, Fig. 1). The ends of the pin are now closed with the aid of a pair of pliers, shown by dots at C, Fig. 1. The two halves must touch well up under the wire. The result is a split pin (stanchion) with two eyes.

All that remains to be done now is to select a brass, copper or even a piano wire to act as a rail that will pass through the eyes without shake.

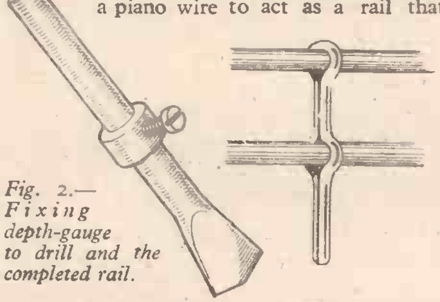


Fig. 2.—Fixing depth-gauge to drill and the completed rail.

Now a final word on fixing the pins to the deck of the ship.

I suggest drilling holes in the deck a shade smaller in diameter than the pins, so that the latter will be a tight fit. To bore the holes so that each one will be exactly same depth, I suggest clamping a small collar in the drill bit (see Fig. 2). This sketch also shows a perspective view of rails in position.

These drawings are not to scale.—A. WARNE (Newcastle-upon-Tyne, 5).

Perpetual Motion

SIR,—I was very interested in the article by Mr. Bramley Moore on "Energy from Permanent Magnets," as I have made many drawings of machines to achieve perpetual motion, mainly of the "over balanced wheel" type.

I did not make a model of any of these, but if I had ever drawn one with promise, I would have done so.

This year I became interested in magnets, drew a rotor which I thought should work, and made my first model. It was mainly of wood, using parts of old clock balance wheels, with the little bar magnets fastened on with cement.

This first model had eight magnets round the rim of the rotor, and eight outside this on frame, with all the magnets NSNSNS in line round the rim. It did not work!

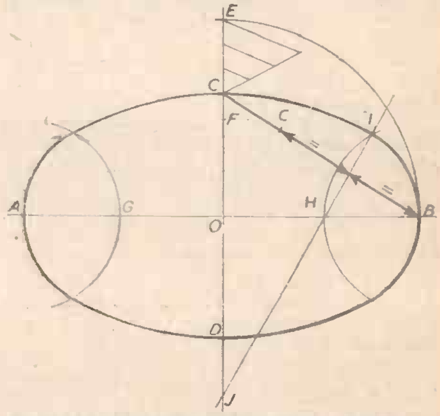
I next tried the magnets in line with the centre, putting differing numbers of magnets on rotor and stator, putting a second stator inside the rotor and making this movable, changing the rotor magnet round to bring N to N and S to S.

My last attempt has 13 magnets on the outside stator (frame), 12 on the rotor, and 11 on the inside adjustable stator, but it does not work yet.

Someday, perhaps, one will work!—W. R. BROOKS (Scarborough).

Constructing an Ellipse

SIR,—Regarding the query and your reply published in the November, 1956, issue of P.M., may I suggest a quicker construction for an ellipse which gives the



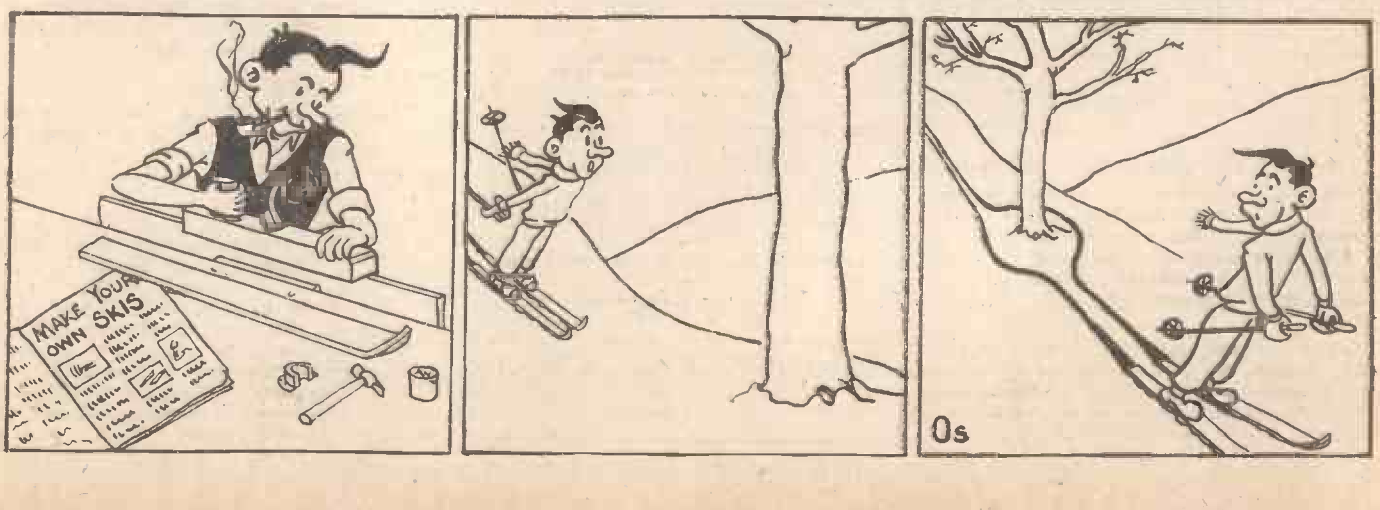
Mr. E. Easter's alternative ellipse construction.

same result? Referring to the sketch above and original in Nov. issue: Join CB.

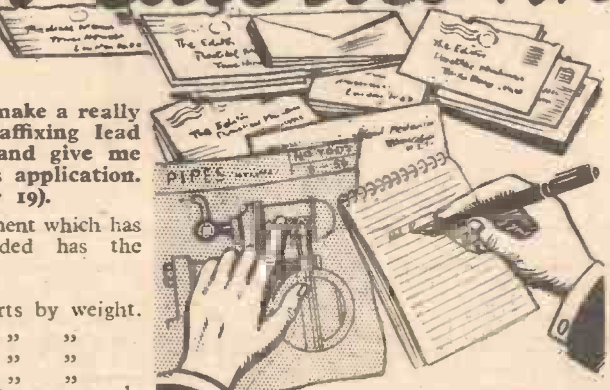
Make CC, equal to ½ major axis—½ minor axis (i.e. AO—CO)

Bisect C, B, which gives the line I J and thus the two centres required H. and J.—ERIC C. EASTER (Middx).

ANDY MANN .... THE PRACTICAL MECHANIC



Your Queries Answered



Metal-to-Glass Adhesive

PLEASE tell me how to make a really effective cement for affixing lead strip to outside windows and give me some information as to its application.—P. J. Hardy (Manchester 19).

A METAL-TO-GLASS cement which has been much recommended has the following composition :—

Medium-soft pitch (or bitumen)	3 parts by weight.
Resin	10 „ „
Beeswax	5 „ „
Brickdust	3 „ „

The first three ingredients are gently melted down together and the brickdust is then stirred in. We are of the opinion, however, that the more modern clear adhesives based on plastic resins will be more suitable for your purpose. You could, however, make a good waterproof cement by dissolving scrap Perspex in trichlorethylene to give a transparent, rubbery solution. Another cement of this type is made by dissolving polyvinyl chloride in any high boiling point organic ester. Incidentally, you can obtain this type of cement ready-made from Portland Plastics Ltd., Wear Bay Road, Folkestone, Kent, under the name of "Portex" Universal Cement. One of the silicone adhesives (DC.40.C) is a viscous solution which would suit your purpose. This is fast-setting and waterproof. If too thick it can be thinned down by acetone. It can be obtained from Messrs. Albright & Wilson Ltd., 49, Park Lane, London, W.1.

In applying any of these adhesives, coat *both* the glass and the lead strip thinly with the adhesive. Then bring the lead strip into contact with the glass and press it down firmly.

Fire-proofing Cardboard

PLEASE can you tell me of a method of treating cardboard which will make it resistant to fire ?—F. W. Bright (London, N.4).

CARDBOARD can be made fire-resistant by brushing over it a hot, strong solution of common alum or, alternatively, by brushing over it a saturated solution of sodium tungstate.

If waterglass is diluted with four times its volume of water, the solution can also be brushed on to cardboard in order to give the latter fire-resisting properties.

Probably the best way of effecting this end is to brush alternately such a waterglass solution and a solution of common alum on to the cardboard. The objection to this treatment, however, is that a whitish film of aluminium silicate is likely to be formed on the surface of the cardboard, and this will not be readily removable by water. The film, however, if it is not objected to, is highly fire-resistant.

Preventing Warping in Picture Mounts

I HAVE a number of coloured scenes for my model theatre, 15in. x 22in., mounted on 1/16in. cardboard.

Can you suggest something to cure warping. The weight should not be seriously increased.—B. C. Barton (Witney).

BY the "warping" of your cardboard mounts, we presume that you refer to the inwards-curving of them, due to the pull of the mounted picture on the thin cardboard. The best way to overcome this difficulty, and to prevent it when further prints are mounted similarly, is to paste on the back of the cardboard plain paper of a thickness and texture approximately equal to that on which the print or view is made. The pull on both sides of the cardboard will then be approximately equal and the cardboard will remain flat.

Castor Oil Solvent

PLEASE suggest some solvents for cleansing internally and externally an internal combustion engine lubricated with a castor based oil.

Would any of these be detrimental to aluminium or similar metals ?—J. A. Newport (Eltham, S.E.9).

CASTOR oil is only very slightly soluble in petrol and in paraffin liquids. It is, however, soluble in alcohol, ether and benzene. We suggest, therefore that for cleaning out an internal combustion engine which has been lubricated with castor oil you use warm methylated spirit, which is about as cheap a solvent as you will be able to get for the purpose. Alternatively, you could use benzene (benzole).

These solvents can be used externally, of course, and they would not have the slightest effect on aluminium or on any other metals or alloys.

Cheap Gilt and Silver Finish

HOW can I obtain the "gilt" finish such as is used on cheap "costume" jewellery, and can I apply it to small white metal castings or stampings ?

Is there some method whereby I can obtain a bright "silver" finish on these white metal objects as an alternative to "gilt" ?—J. C. E. Hutchinson (London, N.9).

THE simplest way of obtaining a gilt finish on white metal castings or stampings, would be to go to your nearest paint stores and obtain therefrom a small tin of clear cellulose lacquer. Place a little of this lacquer in a shallow dish and mix with it about one-third of its bulk of a good gilt powder, stirring the mixture well. Then, with a soft brush, brush the gold "paint" so made, over the white metal surface. This will immediately produce quite an effective "gold" metal surface of fair durability. By giving two or three coats the gilt appearance can be increased in depth and in body.

Very fine "gold" powders can be obtained from Messrs. Johnson & Bloy Ltd., Metana House, Hind Court, Fleet Street, London, E.C.4.

From the same address, an imitation silver (not aluminium) powder can be obtained which can be worked up in the same way to produce readily the silver finish which you require on white metal objects.

These gold and silver finishes will, when complete, be slightly grainy in nature, but for most purposes they will be quite satisfactory. If not, your only alternatives are the much more difficult processes of brass-plating and silver, tin or nickel-plating.

Glass Cleaning Liquid

COULD you tell me how to make liquid cleaners for glass please ?—R. B. Ripin (Worcs.).

WE give below two typical glass cleaner formulae.

(A) Strong ammonia, two tablespoonfuls ; Whiting, four tablespoonfuls ; Methylated spirit, two tablespoonfuls ; Water to one pint.

Apply thinly to the glass. Allow to dry and wipe off with a soft paper or cloth.

(B) Soap shreds, two parts ; water, five parts ; chalk, seven parts ; Tripoli powder (or whiting), two parts ; petrol, five parts.

Dissolve the soap in the water, then add the resulting solution slowly to the petrol.

QUERY SERVICE
RULES

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

Finally, stir in the chalk and the Tripoli powder.

This may be applied as in formula (A). It may also be used by pouring into a wet rag, which is then applied to the glass for the quick removal of the dirt.

Aquarium Novelties Suspended in Water

I WISH to make some aquarium novelties in plastic, which are to be suspended in water, i.e., neither sinking to the bottom nor floating on the surface.—C. G. Leaker (Walsall).

YOUR problem is mainly concerned with the obtaining of the correct degree of buoyancy necessary to make the plastic articles neither sink nor float when immersed in water. The best way to do this is to drill small holes in and under an inconspicuous part of the article and then to fill each hole up partially with fine lead-shot, subsequently filling up the hole entirely with warm pitch or sealing-wax. By this means, you will be able so to regulate the buoyancy of the article that it will sink or swim in the liquid exactly as you require. In place of lead-shot you could use anything else which is not soluble in water, such as sand, grit, small stone particles, but lead-shot is the most convenient for the purpose. Remember, of course, that the holes which you thus provide must be equally distributed on the under-surface of the article, otherwise the latter will not float on an even keel. The employment of pitch or sealing-wax is merely to prevent the drilled hole from filling up with water. Any other non-aqueous material can be used instead, such as candle-wax, or even dried plastic cement as obtained from tubes sold in the usual chain-stores.

Chewing Gum Solvents

DO you know of a liquid that will dissolve chewing gum please? I wish to remove some from a tweed jacket.—W. M. Shaw (New Brighton).

CHEWING GUMS differ considerably in composition, and one which is soluble in one liquid will not necessarily be soluble in another liquid. Hence, unless we know the type of chewing gum which you have been using, we cannot give you the name of a liquid in which it is likely to be completely soluble.

Carbon tetrachloride and benzine are likely to prove good solvents for the gum, particularly if they are used warm or even hot; carbon tetrachloride can be heated without danger, since it is quite non-inflammable. Other possible solvents of the gum which may be tried are: Methylated spirit to which a few drops of ammonia have been added sufficient to make the spirit smell faintly of the ammonia, toluene, white spirit, petrol, ether, trichlorethylene. All these liquids would act more potently as solvents if they were warmed before application. Remember, however, that ether is an *extremely inflammable* liquid, and, therefore, that some danger attaches to the warming of any substantial quantity of it. The affected area of the jacket should be soaked in the solvent contained in a small dish or saucer. This method will permit of its easy removal with a minimum of subsequent scraping.

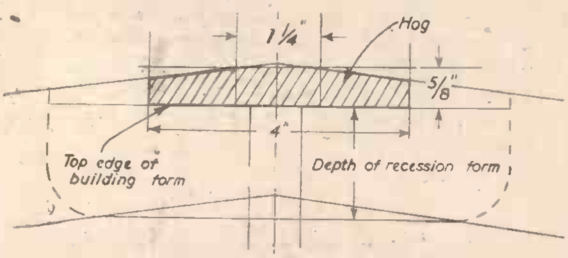
The 8ft. Sailing Dinghy Construction

I AM making the above dinghy, described in the August, September, October and November issues, but am having difficulty with a small point. Please elucidate the following: Referring to Figs. 6 and 7, the dimensions to sheer and keel lines in Fig. 6 are the same as for the frames in Fig. 7, so that apparently the keel line coincides with apex of the frames. Figs. 8 and 9, however, call for the hog to be laid along the building form, i.e., along the keel line and the frame apex recessed to house the hog. Ought the building form to be cut, not along the keel line, but along a line parallel to it, allowing for the distance from apex of frame to underside of hog, i.e., ⅝in. + ?—G. W. Rideout (Surrey).

MAKE the three frames. Mark out the recesses on each (according to the dimensions on sketch below) to take the hog.

Cut the form sufficiently deep so that the top edge of form is level with edges of the recesses on the side nearest to frame 2 in the case of frames Nos. 1 and 3.

The recesses in frames 1 and 3 must be paired off now towards bow and stern respectively so that fore and aft edges run in with the line of the building form.



The 8ft. sailing dinghy construction

Tyre Paint

I REQUIRE a formula for making rubber tyre paint (black). Can you help?—R. Wall (Liverpool, 17).

DISSOLVE about 20 parts of polyvinyl-acetate in 80 parts of warm methylated spirits. To the viscous liquid remaining, work in a quantity of artists' water colour paint of the colour required until you get a paint mixture of the required qualities. The resulting paint will adhere well to rubber and it will be waterproof. It can be wiped off by means of a cloth charged with methylated spirit. Polyvinyl-acetate can be obtained under the name of Gelva Resin No. 7 from Shawnigan Ltd., Marlow House, Lloyd's Avenue, London, E.C.3. If you are unable to obtain this resin a suitable paint medium can be made by dissolving scrap celluloid in a mixture of approximately equal volumes of acetone and amyl-acetate. To this mixture a few drops of castor oil should be added to render the paint more flexible.

Lens Focus Calculations

IF the focal length of a lens is 2in. and the centre of the lens is placed 2in. from the film, would it be focused at infinity?

Is there a basic formula to work out the spacing for, say, 3ft. to 12ft. focus?—A. V. Corne (London, S.E.18).

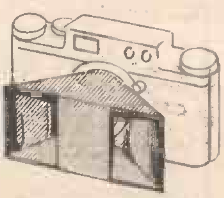
ALTHOUGH, strictly speaking, a fixed focus is a theoretical impossibility, your assumption about the infinity position of your lens is correct for practical purposes. Remember that the smaller the lens aperture the more accurate the focusing and the less the aberrational errors. The distances between the centre of the lens and the object and the centre of the lens and the film are called conjugate foci of the lens. The nearer the object to the lens centre the greater the distance between lens-centre and film.

The rule for finding the distance between the lens-centre and film in order to focus any object at any given distance may be stated in practical words as follows: Take the distance of the object from the lens-centre. Subtract from this the focal-length of the lens and divide the result also by the focal-length of the lens. Divide the latter result into the focal-length of the lens and the final result will be the distance that the ground glass of the camera will have to be shifted from its normal or infinity position. This distance *added* to the focal-length of the lens will give what is known as the "back conjugate focus" of the lens.

Information Sought

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

Stereo Attachment



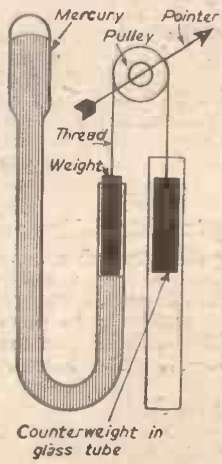
I WISH to construct a stereo attachment for my single lens camera similar in principle to that shown in the sketch. My camera is a Voigtländer Bessa 66, taking 120 film, but I wish to take pictures of a size suitable for a Viewmaster viewer which I already possess. Can you give me the necessary information?—R. J. SHAILER (Essex).

Electrifying Organ Bellows

I HAVE a small "Hillier" organ in which the sound is produced by metal reeds, activated by suction from two foot-operated bellows in the lower part of the instrument. These connect with a large single bellows which is spring-loaded and maintains the suction when the foot-bellows are at rest at the ends of their strokes. A mechanically-operated safety-valve is provided in the large bellows in the form of a long screw which pushes open a spring-held flap, thus admitting air and reducing the vacuum when the bellows has been drawn in to a certain point.

All three bellows are in very poor and leaky condition and I wish to replace them with an electric fan.

The foot bellows each measure 16in. by 20in. and open a distance of 4½in. at the top when extended. Allowing for a moderate pedalling speed of thirty movements of each bellows per minute I calculate that something like 23 to 25 cu. ft. of air will be drawn through the instrument per minute, but cannot estimate what degree of suction is required to activate the reeds. Please advise me of the type of fan and its wattage or h.p. most suitable.—A. DAVIES (Shrops.).



Barometer Adjustment

I HAVE just been given a mercury barometer, but have been told that it has to be adjusted to correspond with height above sea level (600ft.). The glass was set at Plymouth (almost at sea level). How is this done?—F. FISHER (Devon).

Making Bellows

I WISH to make a set of bellows about 8in. long. They are to be of the tapered type similar to camera bellows and are intended for use on an enlarger. Can you help me?—J. PAYNE (Dublin).

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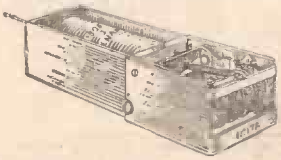

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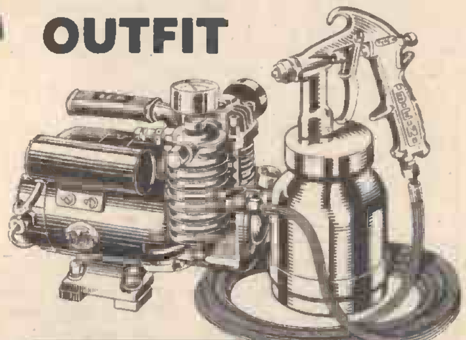

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THE Cyclist
Editor : F. J. CAMM
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All letters should be addressed to the Editor, "THE CYCLIST," George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2

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WHAT I THINK By F. J. C.

Changes in the Traffic Laws

THIS year, lighting-up time will mean the time between half an hour after sunset and half an hour before sunrise, during the period of summertime, as well as during the remainder of the year. Previously, lighting-up time in the summer has been from one hour after sunset to one hour before sunrise. Most road users, however, switch their lights on as soon as it becomes unsafe to drive without them, irrespective of the legal lighting-up time. Lighting conditions almost equalling night-time can suddenly arise long before the official lighting-up time, but the law takes no cognisance of such conditions, and a roadfarer could not be summoned for riding without lights in such conditions.

A minor change, but one which cyclists will welcome, is that local authorities will have the power in future, by Order, to designate roads on which dogs will not be allowed unless on a lead. Such an Order must, of course, be confirmed by the Minister, and the maximum penalty is a fine of £5. The Order will not apply to dogs kept for tending sheep or cattle in the course of a trade or business or under proper control for sporting purposes.

A Head-down Fatality

A 20-YEAR member of the Harworth and District C.C. lost his life after colliding with the back of a motor lorry whilst riding as a competitor in the Rotherham Wheelers Open 50 last July. During the inquest, the Coroner inquired whether the cyclist's life would have been saved had he been wearing a crash helmet.

The doctor said that the cyclist died as a result of a fractured skull and that it is possible that the wearing of a crash helmet would have saved his life. A representative of the Rotherham Wheelers pointed out that it was not the practice of cyclists riding in road events to wear crash helmets, although it was compulsory for track racing. The lorry concerned was correctly parked in front of a garage and had been there some minutes when the cyclist collided with it. The Coroner thought that the accident occurred as a result of the cyclist riding head-down. There have been several such accidents in the past quarter of a century and the R.T.T.C. may now think fit to introduce a new rule that crash helmets must be worn in time trials. Indeed, I wonder that this has not been done before.

They have a rule regarding riding head down, but it is practically impossible to enforce it. Perhaps the R.T.T.C. could spare a little time to discuss this matter, even at the expense of neglecting the subject of who is to control road sport !

White Line Experiment

THE M.O.T. has decided to experiment with a new pattern of road markings for the guidance of drivers. The continuous single white line now used at bends, humps and dips in the road will be replaced experimentally on two trunk roads by a system of double or paired white lines, including lengths of broken line. Markings of this kind are already widely used on the Continent and in America, and the Minister wishes to test their suitability for this country.

The experiment will be made on the London-Folkestone-Dover Road (A20 and A259) and the London-Portsmouth Road (A3).

Dunlop's Daughter Dies

WITH the death of Mrs. Jean McClintock passes the last link with those responsible for the first air tyres. Sir Arthur du Cros, who was the sole surviving member of the famous family which launched the pneumatic tyre, died some months previously. I met Mrs. McClintock, the wife of a doctor, many times ; she had no other topic but the pneumatic tyre and the part her father played in its invention. She had the *idée fixe* that her father, J. B. Dunlop, had not received the recognition which he deserved and that he had been badly treated by the original Pneumatic Tyre Company. This, however, could not be substantiated. His name has been associated with the tyre ever since and, in my view, he was well treated by the company of which he was a director. It is equally my view that in producing the pneumatic tyre for the convenience of his son Johnny, who had spinal trouble, and found the riding of his bicycle over the stone setts of Dublin aggravated the ailment, he had not the slightest idea that he had made an invention of world wide import, and had not du Cros seen the commercial possibilities it is possible that many years would have elapsed before the pneumatic tyre was developed, for it had been produced many years before by Thomson, and not only produced but marketed for horse drawn carriages. It was the discovery of this fact which invalidated Dunlop's patent, and which drew attention to a flaw in our Patent Laws under which it was possible for two or more inventors to obtain a patent for the same idea. It is also worth while recording that Dunlop, when he resided in Scotland, lived only a short distance from Thomson, and as carriages fitted with Thomson's tyres were undoubtedly in use on the local roads, it is difficult to see how Dunlop could maintain, what he undoubtedly did maintain, throughout his life, that he had no knowledge of it. It is my firm conviction that he must have done, although he has been given the benefit of the doubt. Sir Arthur du Cros, with whom I often discussed this matter, was only half convinced, I think, that Dunlop's invention was a case of two minds thinking alike. His book is rather vague on this point.

It matters not, however, who invented air tyres. They are here and a part of civilisation, and it seems somewhat remarkable that Dunlop's name did not appear in the honours list when we remember that those who have done far less are regularly honoured.

Piddinghoe
A corner of the little Sussex village lying behind Newhaven.

N.C.U. Offer

A CIRCULAR distributed by the N.C.U. to the press and headed "A Crisis Beating Offer" draws attention to the increase in petrol prices and the rising cost of road transport, and believing that large numbers of people will now turn to cycling, offers a new class of membership. Any person who has to travel to and from work by cycle owing to the present petrol shortage can join the N.C.U. for only four shillings and receive free legal aid and advice, third party insurance cover up to £500 and personal accident cover up to £250. Unfortunately, their notice arrived too late for inclusion in last month's issue and the list for this new class of membership closed on January 14th.

Legacy for the Roadfarers' Club

THE late Sir Arthur du Cros, who was a vice-president of the Roadfarers' Club, left a legacy to the Roadfarers' Club. Sir Arthur took a keen interest in the Club, for many of the members were well known to him over a long period of years.

This is the second legacy left to the Club, for the late Dudley Daymond in his will bequeathed a sum of money to the Club, having originally intended to leave a legacy to the Bath Road Club, from which he resigned some years before his death.

The Next Two Years

IT will be nearly two years before another Cycle Show is held—if, indeed, it is held. This will give the trade ample breathing space to produce some really new designs and to test them. The lapse of two years is just long enough to ensure that attendances will be large. But the public would not expect to see the same old designs in different colours. The cycle trade, it is well known, is not having a particularly rosy time at present. It has a golden opportunity now to get out of the rut into which the industry has drifted since the war.

The HEAD BEARING

Dismantling : Repair : Adjustment

THERE are two main types of head bearing, the expander bolt type and the headclip type, these terms applying to the method of securing the handlebar extension. The most common type of head set is that shown in Fig. 1 and, as can be seen, the fork column (B) passes through the head tube and turns inside it by means of ball races fitted at top and bottom. The handlebar stem (E) is held rigidly by the expander bolt system. When the hexagonal head of the expander bolt (F) is tightened, the expander cone (D) is drawn up into the bottom of the stem which is slotted vertically, thus allowing it to expand against the sides of the fork column.

The headclip fitting is shown in Fig. 2. This is very similar to that already described except that the handlebar stem is of a type without expander bolt and is held in place by the headclip, the top half of which is slotted vertically as at (A) in Fig. 2 and part way round horizontally as at (B). Tightening the bolt (C) contracts the clip on to the top of the extended fork column, which is also slotted and, in turn, contracts on to the handlebar stem.

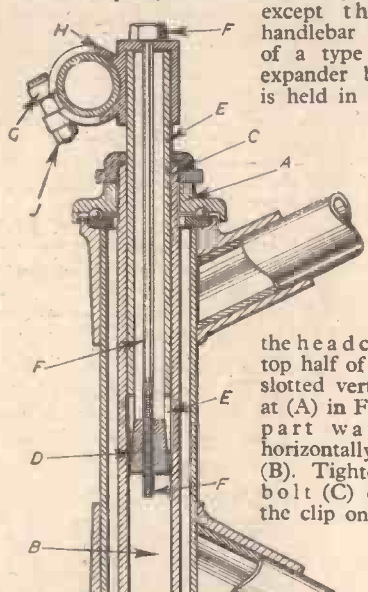


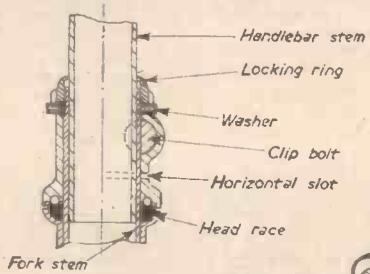
Fig. 1.—A sectional view of the usual type of head set. The letters G, H and J refer to handlebar rake adjustment.

Another common variation is one where the head lugs do not have the bell-shaped seating shown in Figs. 1 and 2 for the races. Instead the lugs are designed to receive a special type of race having a flange which is a drive fit. This is shown diagrammatically in Fig. 3.

Fitting a new head set of the type shown in Fig. 1 is not a difficult operation once the head assembly has been dismantled.

Dismantling

The first step is to remove the handlebar extension. Undo the nut on top, F in Fig. 1, a couple of turns and tap it sharply with a hammer to release the expander cone (D). The extension can then be pulled out by levering with the handlebars. If the brake cables are not long enough to allow the end of the extension to clear the top of the head, the brake levers must be removed or the cables dismantled: if the machine is fitted with rod and lever brakes, these must be unscrewed at appropriate points.



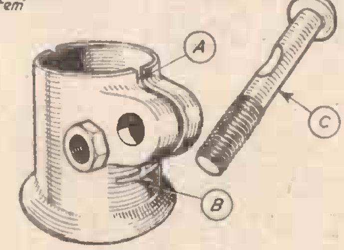


Fig. 2.—The headclip.

Next undo the locking nut (C), using an adjustable wrench if of the hexagonal type; a hammer and punch if provided with appropriate holes or notches. Unscrew the top half of the upper race (A in Fig. 1), first laying the machine on its side on a sheet of newspaper to collect the balls as they fall out. The forks and their column may now be removed, catching the balls from the lower race as they drop.

The two halves of the races which fit into the bell-shaped ends of the head lugs at the top and bottom of the head, can usually be removed without difficulty, but if they are wedged, they can be tapped out by means of a long punch passed through the inside of the head and a hammer. The half of the race which is a drive fit on the shoulder at the base of the fork column will also probably have to be driven off.

Replacement

When buying replacement races it is wise to take the old head set to the shop so that a perfectly matching replacement may be obtained, although there are not many different types available. The lower half of the bottom race is driven into position at the base of the head column by means of a mallet and using a piece of wood as a punch. The ball track is then greased and the appropriate number of $\frac{5}{32}$in. balls inserted. The top half of the race is placed gently into position and the fork column inserted into the head tube until the race fits snugly into its seating in the bottom of the head tube.

Now the lower half of the top race is dropped into position in its seating in the top head lug and filled as before with new balls. The top half of the race is screwed into position and the washer and lock ring screwed down hand tight.

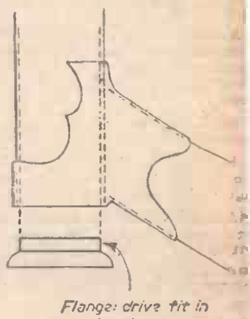


Fig. 3.—The drive-fit race.

Adjustment

The top half of the race should be screwed down until side and end play are eliminated and yet the forks can still be turned smoothly and without any tight spots. When this point of adjustment is found the locking ring may be tightened with a wrench and then another test made to see that the adjustment has not altered.

To replace the handlebar extension, pull up the top nut (F in Fig. 1) until the expander cone wedges in the bottom of the handlebar stem, push the stem back into the head tube and tighten the expander bolt head.

Other Types of Race

There are some small differences when dealing with the headclip type of fitting. When dismantling, slacken the clip bolt first, when it will be found that the handlebar stem can be withdrawn, then undo the locking ring. Subsequent procedure is the same as has already been detailed. Assembly, too, follows the procedure previously described, but as will be seen from Fig. 2 the clip bolt takes the place of the top half of the upper race. Some sort of provision is usually made so that the clip bolt can only be fitted at the back of the fork column—either the fork column is cut to allow passage of the bolt or the bolt has a flat on it. The clip is tightened just enough to grip on the fork column and then the locking ring and washer tightened down. The clip bolt and locking ring are then tightened alternately until the assembly is correctly adjusted.

The type of race shown in Fig. 3 is treated exactly the same as that shown in Fig. 1, except that two races which fit into the head lugs must be driven into position. This should be done with either a hammer or mallet using a piece of waste wood as a buffer between race and hammer.

There are some other variations on the types of race described, but all conform to the basic details already given.

The head bearings should be kept well oiled and properly adjusted. A loose head set, besides giving faulty steering causes "shuddering" when the front brake is applied, further damaging the races and in extreme cases breaking the front forks. When the head set is dismantled it is not always necessary to renew all the parts of the race, but pitted races or worn balls should always be replaced.

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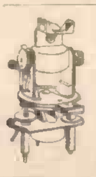

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