Special Christmas Features

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PRACTICAL MECHANICS

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EDITOR : F. J. CAMM

DECEMBER 1953

Staging a Play at Home

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PRACTICAL MECHANICS

EDITOR
F. J. CAMM

The "Cyclist," "Practical Motorist," and "Home Movies" are temporarily incorporated.

FAIR COMMENT — By The Editor

More About Flying Saucers

SINCE last month, when I commented upon the recently published book "Flying Saucers Have Landed," which asserts that space ships had landed, that one of the occupants had been interviewed, and that several people were witnesses of the particular incident which is the subject of the book, one of the joint authors, Mr. Desmond Leslie, appeared in one of the television programmes and amplified the matter. The B.B.C. has been inundated with telephone calls and letters, and it is not surprising that world-wide interest has been evoked in what has become the greatest scientific mystery of the present century.

The book to which I referred includes photographs of the ship used by the Venusian and also contains affidavits, sworn before notaries public, by those who were present at the time. Whether one views the book with the eye of a sceptic or accepts it as fact, there can be no doubt that mysterious objects have been seen in the sky by accredited scientific people over a long period of years. It is just possible that the so-called flying saucers are experimental craft on the secrets list, in spite of the denials issued by the American Government. The most authentic stories relating to flying saucers have come from America.

The matter has been taken sufficiently seriously in this country, especially after Mr. Leslie's broadcast, for questions to be asked in Parliament, but it seems unlikely that the Government knows any more than has appeared in the Press and in books. The matter cannot be dismissed lightly for if, as is asserted, people from other planets have landed on this earth it is a matter of importance not only to the Government but to scientists. Many interesting questions arise, not the least of which is whether such planetary visitors would be regarded as invaders, arrested, and their craft confiscated for examination ?

Flying Saucers Through the Centuries

THE stories concerning flying saucers are too numerous and persistent for the subject to be dismissed as a hoax and, indeed, through the centuries there have been reports of similar visitations. As long ago as 1619 a long, fiery object was seen flying in Switzerland; a similar object was seen over Worcester in 1661, and there have been similar reports in 1704 (England), 1731 (Italy), 1750 (Edinburgh), 1752 (Norway), 1755 (Portugal), 1761 (Switzerland), 1777 (France), 1802 (Germany), 1808 (Piedmont), 1813 (Tottenham), 1816 (Portugal), 1817 (Italy), 1818 (Ipswich), 1820 (France), 1821 (English Channel), 1826 (France), and so on, up to the present time. Practically every year from the middle of the 17th century have come reports of strange objects seen in the sky which have never been accounted for. It is inconceivable that all of these observers, large numbers of them skilled astronomers and scientists, were suffering from hallucinations. We must, therefore, acknowledge the existence of some mysterious craft which has only one of two explanations. Flying saucers are either secret weapons, or they are spaceships from other planets.

Are Other Planets Inhabited ?

THEORETICALLY, there is no reason to suppose that other planets are uninhabited, nor that the inhabitants are less scientific than we are. There is no scientific reason why the inquisitive scientific mind of those on other planets should not seek to explore the earth even as we seek to travel some day to the Moon, to Venus, and to Mars. It seems reasonably certain that experimental flights to the Moon will be attempted before this century has closed.

For this reason I propose next month to review the book in greater detail and to include some of the photographs which the authors have used to support their report.

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The Late W. J. Bassett-Lowke

IT is with deep regret that I report the passing in the latter part of October of Mr. W. J. Bassett-Lowke, a frequent contributor to these pages over a long period of years, and the founder of the model firm which bears his name. It would be true to say that he founded the model industry in this country, and was the first to draw attention to the educational value of realistic scale models. When he founded his firm over 50 years ago there was no cinema, radio or television. Youth depended to a great extent upon practical crafts to occupy their leisure time. Great interest in those years was evinced in model railways although to-day interest in that particular hobby is much less marked owing to the competition of radio and television, model aircraft and model boats. Notwithstanding this competition, Lowke refused to enter the model aircraft field and remained faithful to model railways and model boats. His business expanded from Northampton to London and Manchester, and the windows of many shipping companies display the realism which was built into his models.

In spite of his love for mechanical models, it is strange to report that he was not an engineer, nor was he useful with his hands. Up to the age of 72 he was unusually agile, but seemed to grow old almost overnight. He was an individualist, a keen lover of travel, especially by boat. He never drove or owned a motor car and, as far as I can trace, never rode a bicycle.

Our Query Service

A REMINDER to readers that a 6d. postal order, *crossed* and made payable to George Newnes Ltd., should be enclosed together with the query coupon from the current issue and the stamped, addressed envelope with every query submitted, for reasons which were given last month.

All enquiries regarding back issues should be addressed to the *Publishing Department*, and orders for books should be sent to the *Book Department* and not to the Editorial offices.—F. J. C.

Staging a Play at Home

Practical Information on the Erection and Lighting Effects of a Stage for Home Productions

WHEN arranging the Christmas party a great amount of time and trouble is usually spent in compiling a list of games and stunts to amuse the guests, but it is really surprising how seldom the presentation of a play is included in the programme. It is all the more surprising in view of the fact that a great amount of fun is derived from the actual preparation of the play, if carried out properly.

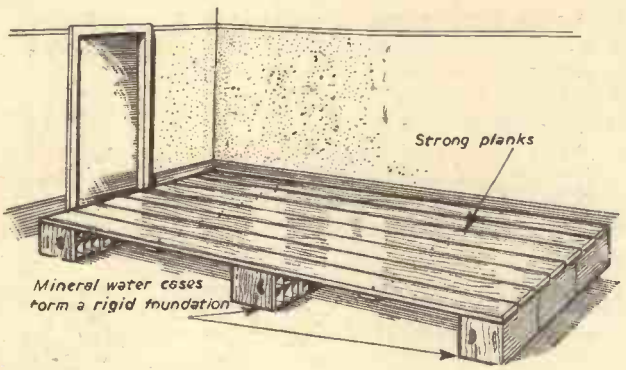


Fig. 1 (Left).—A simply-constructed stage made with planks nailed to wooden boxes.

Erecting the Stage

It is possible, of course, to act the play on the ordinary floor of the room, but we will assume that we are really ambitious and are going to present quite a "professional" effort—and, therefore, the first thing is a stage. An excellent dais, which will be found suitable for a not too ambitious production may be erected, as shown in Fig. 1, from boxes and planks. Mineral water cases will be found to make an excellent foundation, and builders' planks laid on top and named to the cases will hold the whole structure together. It should be remembered, however, to have plenty of "foundation" to prevent the planks from sagging, for there is nothing more disconcerting for an actor in the middle of a dramatic speech than to find the ground swaying under his feet. The whole stage should, on completion, be covered with carpet and the front boxed in.

An Ambitious Structure

Should a more ambitious structure be required a stage built up in the manner shown in Fig. 2 will be found quite useful. This, of course, entails a certain amount of carpentry work, but this is of such a simple character that it is a job which may be tackled even by an amateur. An advantage of this type of stage is that it is collapsible and may be easily stored away for use with future productions. The portion illustrated represents one section, and the number of these which are to be employed is governed by the space available.

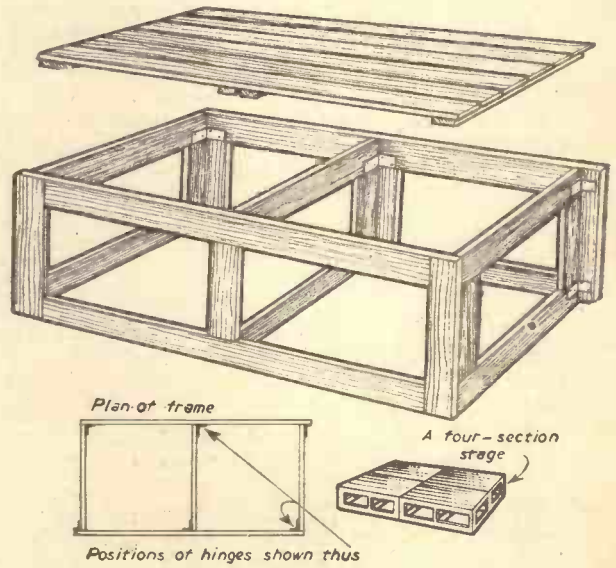
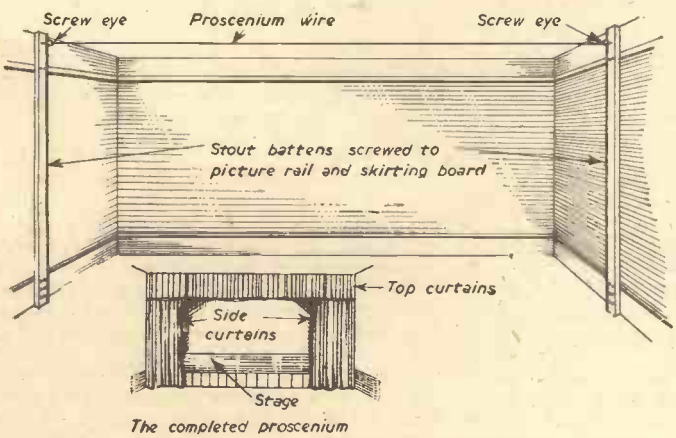


Fig. 2 (Right).—This type of stage, built up of collapsible sections, is easily stowed away when not in use.



The completed proscenium

Fig. 3 (Left).—This sketch shows how the proscenium is erected, and indicates the positions of the side battens and proscenium wire.

The Proscenium

An excellent site for the stage is at an opening between two communicating rooms, for here the proscenium is ready made and as these openings are often covered with curtains, the problem of the curtain is automatically solved. We will assume, however, that we are not placed in so fortunate a position and that we are staging the play in the room in which the audience is to be seated. As we have gone to the trouble of erecting the stage we should do the job properly and cover in the front of our stage and erect a proscenium. A very simple and effective method of doing this is shown in Fig. 3. Here, as will be seen, two stout battens are fixed, one to each of the side walls, by screws into the picture rail and the skirting board. House-proud people may be afraid of the damage done by the screws, but these holes are easily filled with plastic wood and a touch of stain will complete the repair. Into the top of the battens screw eyes are fixed and a wire is tightly stretched between them. Light but opaque material is hung in a strip at each side, and a narrow strip suspended right across the room. Thus we have our proscenium completed, and our "theatre" is now definitely taking shape.

About the Curtain

Our next job is the curtain, and a very convenient method of arranging this is shown in Fig. 4. This again is supported upon another wire which is stretched in the same way between the two battens. The distance between the curtain wire and the proscenium wire should be about 6in. less than the depth of the top strip of the proscenium. An alternative method of raising the curtain is shown in Fig. 5, but unless the room is very lofty this type of curtain should not be used,

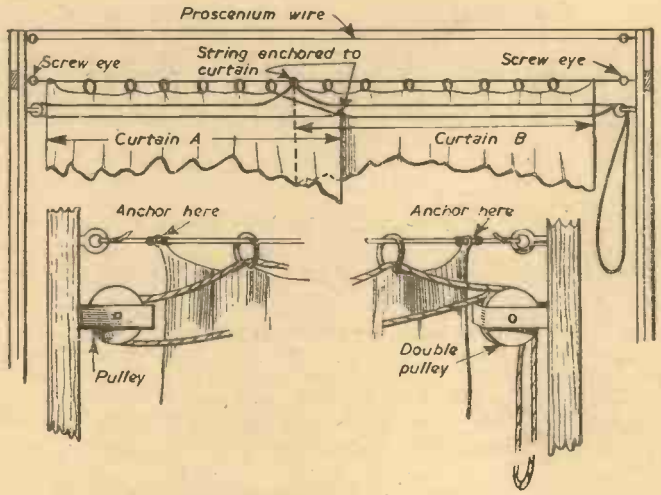


Fig. 4.—Details of the draw-type of curtain which is a very convenient arrangement for screening the stage.

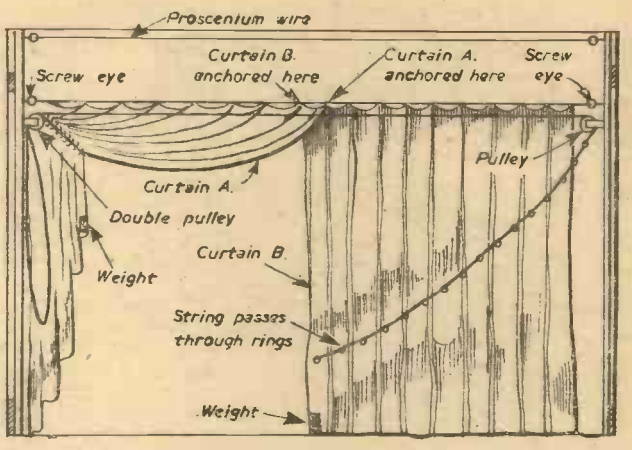


Fig. 5.—An alternative method of raising the curtain, known as the tableau curtain. (Note the rings through which the hoisting string passes.)

as it will tend to cut down the height of the opening.

The Scenery

Curtains draped on the back wall form the simplest way of overcoming the scenic problems, and are very effective for certain plays.

Strips of curtain for side-wings complete the dressings for this type of setting, but folding screens will do the job excellently.

For those who are prepared to go to a little trouble very realistic scenery may be built up and a glance at Fig. 6 will show the construction of a typical screen. The number of these which will be required will again depend on the type of set desired and the size of the stage. The best covering for the screen is canvas, but stout paper will be found very suitable if a temporary set is needed. It is interesting to note that suitable covering paper for this job is obtainable already printed. It is possible for instance, to obtain panelled oak windows, fireplaces, drawing-room decorations or out-door scenes, all of which may be mounted and used in the manner explained above. This paper is also supplied mounted on calico and this, of course, will stand much more handling.

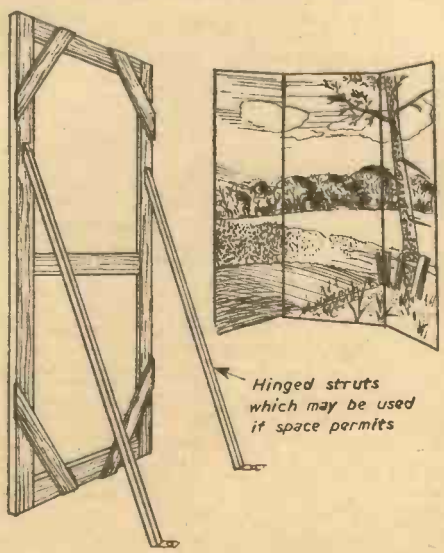


Fig. 6.—A useful scenery frame. The number of these required will depend on the type of set used, and the size of the stage.

Lighting the Stage

A word or two about lighting may prove useful, for it should be remembered that this may either make or ruin the play. One point to make sure of is not to have too much top lighting, as this will tend to throw the face into shadow. It is possible, of course, to write a book about stage lighting, but for our purpose the system shown in Fig. 7 will be found quite satisfactory. As will be seen, the footlights are mounted on a piece of wood and cardboard boxes act as reflectors and shields. It is as well to have all the stage lighting connected to a separate switchboard, which should be situated behind the stage and in the charge of the "stage electrician." One point arises here and that concerns fuses! It is wise to have spare fuse wire and an electric torch handy just in case one blows in the middle of the show.

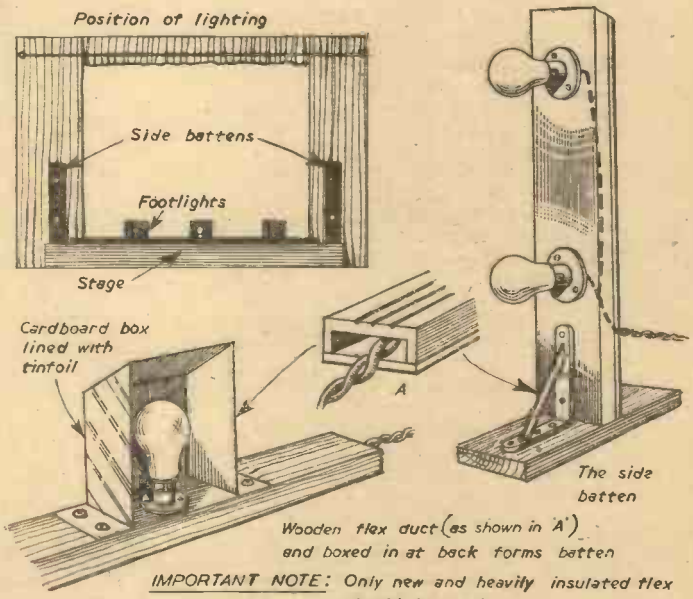


Fig. 7.—An ideal lighting arrangement. It should be remembered that inadequate lighting may ruin the play. Avoid having too much top lighting as this will tend to throw the faces of the actors into the shade.

A Word on Production

Although advice on production does not strictly come within the scope of this article, perhaps a few pointers in this direction are justified in view of the considerable amount of trouble taken to build the theatre.

If you have never tried a play before, the best type to start with is a short one-act affair. Whether it is comedy, drama, or mystery of course depends on your individual taste and the acting ability of your cast. If the play is dramatic don't choose one with too many characters, as an over-crowded stage will tend to destroy the effect and hamper the actors. Keep the furniture arrangement as simple as possible, and rehearse the play beforehand in the space which you know will be at your disposal. Although it is just for fun, it is well worth spending a little extra time in order to put over a really good show.

Several publishers issue books of short plays suitable for production by amateurs at home, and such are usually of the one- and two-act type. The short "curtain raiser" is best for home production.

Moulding Leather Dust

A SIMPLE moulding process developed by the Plastics Research Co., Alhambra, California, transforms leather dust normally disposed of as scrap into usable products possessing many physical properties of tanned leathers. Based on the dispersion of adhesive powders with the leather dust, the process involves the use of a centrifugal mixer, and a compression press. It results in moulded leather-like sheets or parts.

The bonding ingredient consists of resins in available powder form, such as thermoplastic polymers, and B-stage thermosetting resins. Properties of the resulting product resemble those of the adhesive only with respect to flexibility. The resinous components may be pigmented prior to mixing, to obtain homogeneous colour effects.

Making Rubber Stamps

A Practical Method of Making Facsimile and Ordinary Rubber Stamps

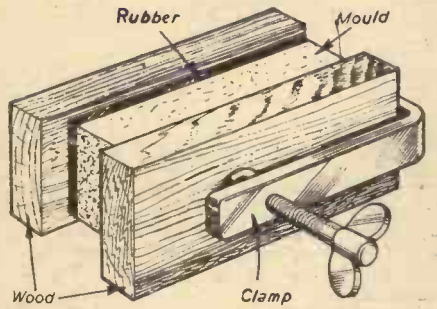


Fig. 2.—How the stamp rubber is prepared.

THE making of rubber stamps is an interesting and profitable hobby; this article shows how to do the work with the simplest of tools and materials. Stamp-making may be roughly classed into three divisions, i.e. (1) facsimile signature stamps; (2) moulded rubber from printers' type; (3) made-up stamps needing no vulcanisation.

Facsimile Stamp

A small flat piece of metal plate will be needed for these and it should be laid on a table perfectly level. Bend up a strip of cardboard to form a long rectangle, about 3in. by ¾in., lay it on the plate, pressing it down with one finger, and pour in a little beeswax, sufficient to cover the plate about 1/16in. (Fig. 1).

Let the wax just set, then remove the cardboard rim. Before the wax can get hard, with a sharp pointed instrument write the signature, penetrating the wax through to the metal plate. When hard, clean out all tiny chips, then replace the cardboard

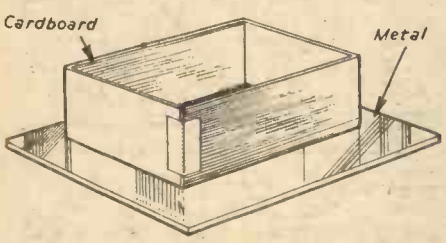


Fig. 1.—How the cardboard is bent and placed over the metal plate.

rim; all is now ready to make the plaster mould. Sift some plaster of paris through fine muslin, then dry the powder in an oven, making it hotter than the hand can bear. Grind it up to remove all lumps, then sift again. Mix the powder with water to the consistency of thin cream, pour upon the wax autograph and pat down lightly with the end of a stick to force the cream into the lines of the autograph.

When the plaster is set quite hard it should be a perfect facsimile of your signature. Coat it with blacklead, taking care not to fill in the eyes of your letters, place the cardboard rim around it and make a plaster mould of it as before. This mould, from which the stamp will be made, should be dried in the oven until all moisture is expelled, otherwise it may crack during the vulcanising process.

For the stamps you will require some unvulcanised rubber sheet about ⅛in. thick; that used to repair motor tyres would do, but it must be unvulcanised, as the ordinary kind for applying with rubber solution is already cured, and is no use for the purpose. Cut a piece as large as the mould, place the mould (blackleaded as before) and rubber face to face, lay a piece of wood on either side and clamp together (see Fig. 2). It must now be heated gradually to 150 deg. C. to vulcanise the rubber. This can be done in a gas oven, but for the sake of economy

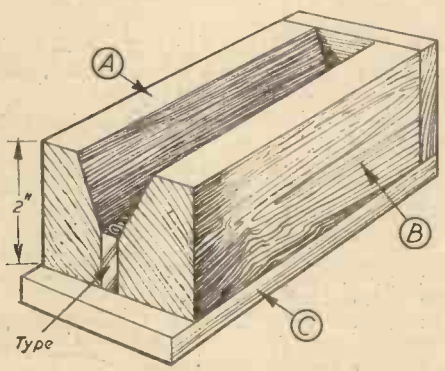


Fig. 3.—The wooden chase.

it is best to make up an improvised oven from an old tin, placed over the gas jet.

During the heating process, give the screw of the clamp an occasional turn or two to force the soft rubber into the mould. About twenty to thirty minutes should finish the

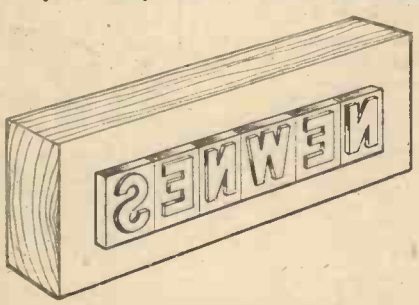


Fig. 4.—The letters should be attached to the rubber by means of rubber solution.

operation, after which the stamp can be removed and trimmed ready for mounting.

Moulded Rubber Stamps

Obtain a fount of printers' type suitable for rubber stamps and make up the wooden chase shown at Fig. 3. The pieces A and B are nailed to the wooden base C, both ends being closed with pieces of wood. The space between A and B should just admit the size of the type chosen, and the inside surfaces should be blackleaded to prevent the plaster sticking.

Set the name in type (reversed of course) and fill up the spaces at each end with the slips of metal provided with the fount of type. See that the letters stand quite up-

Fig. 5.—Larger stamps, as shown, can be cut from sheet rubber and glued to a wooden base.

right, and with a narrow strip of wood hammer them on top so that they lie level. With a small brush apply a little sweet oil to the type faces, then fill up the chase with plaster. This time there is no need to bake it—sifting alone will do. The stamps are moulded in rubber as for facsimile ones.

For small stamps obtain a child's rubber printing outfit; the cheap ones with the type only about ¼in. high are most convenient. Plane up a piece of wood suitable for a foundation, and on the top stick with glue or cement a piece of sheet rubber; any old motor tyre's inner tube would be suitable.

Apply a coating of rubber solution to the sheet rubber and the bottom of the types, then leave until tacky. Next stick the letters on the sheet rubber (Fig. 4).

Larger stamps, as shown in Fig. 5, can be cut from sheet rubber and glued to a wooden base. A good plan is to attach a sheet of paper each side.

Draw the desired figures or letters on a sheet of stiff paper, lay a piece of carbon paper underneath, coated side uppermost, then trace through. The paper can now be turned over and fixed with adhesive.

Details of an inking pad are given in Fig. 7 and, for those who prefer to make their own ink, it is only necessary to dissolve some aniline violet in hot glycerine and strain it while hot.

[*This article is reprinted by request from an issue long since out of print.*]

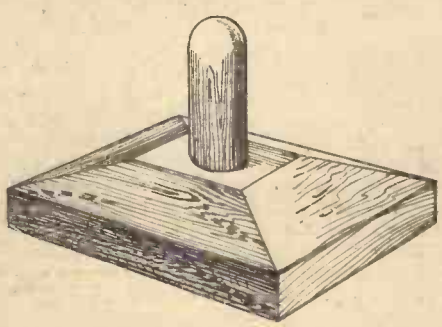


Fig. 6.—The wooden mount for the stamp.

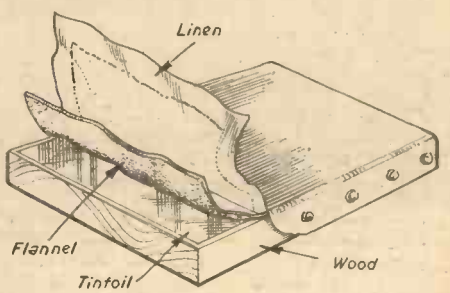


Fig. 7.—Method of constructing the inking pad.

ELECTRICAL Christmas Games

Constructional Details of Simple Devices for Entertaining the Christmas Party

By F. G. RAYER

THE devices to be described can cause quite a large amount of amusement and have the advantage that no difficult constructional work is called for. Most of them can be made with materials which are to hand and none of the dimensions or other details are in any way critical. The work called for is also generally of so simple and straightforward a nature that no one should experience difficulty with it, and the time involved is very small. The games or puzzles are so arranged that an electrical circuit is completed, and this can cause an indicator lamp to light, sound a bell or buzzer, or operate a radio loudspeaker, as will be explained.

Operating current may be drawn from a small dry battery, or a mains transformer can be used (with A.C. mains), if this is preferred. The type of indicator which is used will depend upon personal preference, and what happens to be to hand. In some respects an aural indicator (e.g., buzzer) is most effective, though variety may be obtained by using different forms of indicator.

Loop Threading Puzzle

This is shown in Fig. 1 and depends for its successful accomplishment on a steady hand and careful eye. A vertical piece of wood is secured to a baseboard, and supports a stout wire. This wire is bare, and something such as 16 swg tinned-copper is most satisfactory. Insulation is provided at one end only, as shown, and it is the task of the competitor to pass the screw eye all along the wire without touching it, until the eye and handle can be hung on the insulated sleeve. This puzzle can have almost any degree of difficulty, according to the internal diameter of the screw eye and the shape of the projecting wire. If eye and wire touch at any point, the circuit is completed and the competitor has failed.

The competitor may also be required to withdraw the handle and eye to their original free position, without completing the circuit by allowing contact between eye and wire.

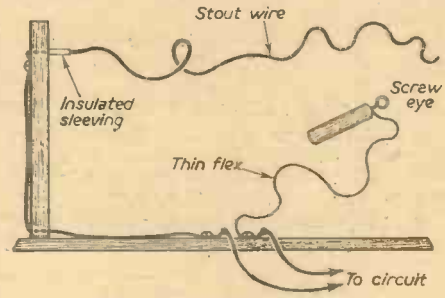


Fig. 1.—Threading the ring.

"Buried Treasure"

For this puzzle, a number of drawing pins are pushed through stout card, and a map glued over to conceal them. The general arrangement will be seen from Fig. 2, and if the map is glued to the top of a shallow cardboard box, this will conceal the location of the pins.

The competitor is required to indicate on the map, by piercing with the needle, the point at which treasure may lie. In the event of the guess being correct, the indicator circuit is completed.

A means of changing from one pin to another is desirable so that the puzzle is not rendered useless when one spot has been found. This can be done by attaching a clip to the internal, projecting points of the drawing pins, or by wiring up the pins to a switch or series of sockets. The location at which treasure is to be found can then be changed at will according to which pin is brought into circuit.

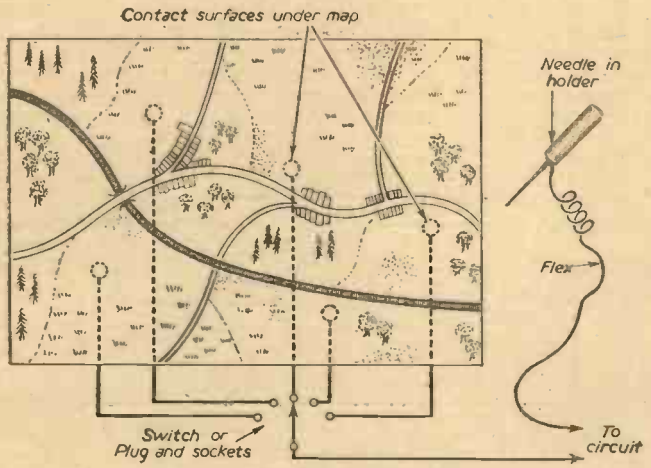


Fig. 2.—Treasure locating circuit.

Coin Board

This arrangement is shown in Fig. 3, and makes use of drawing pins pushed through stout card or thin plywood. This board should be marked out with a checker pattern, and its dimensions are not important provided a coin can bridge the gap between adjacent pins.

A length of thin tinned-copper wire is then taken, and looped round the projecting pin points, about half the pins, selected at random, being connected together in this way. If the wire is drawn tight and given a turn round each pin, no soldering should be required. The free end of the wire forms one connecting lead.

A sheet of stout paper or thin card is then pushed tightly in place so that the pin points project through it, and the remaining pins are connected, as before, to a second lead. No contact between the wires of one circuit and those of the other will be possible, even when crossing, because of the card. The completed board is best mounted in a shallow tray or box so that the leads cannot be seen.

In use, the competitor tosses a coin upon the board from some distance. If the coin bridges pins connected to each circuit, the indicator will operate. If the pin does not complete the circuit, however, it is "lost."

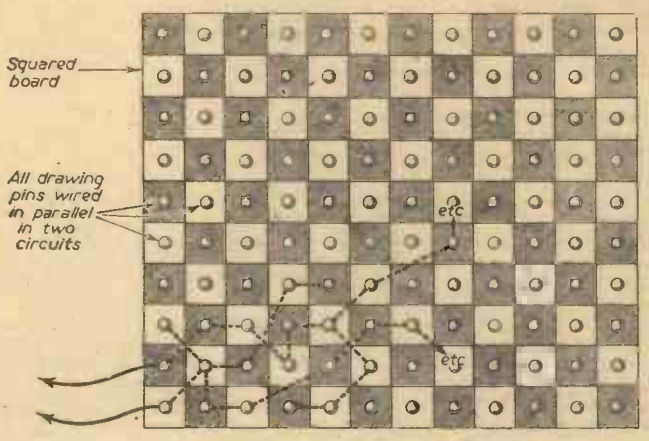


Fig. 3.—Coin-tossing board.

Ring-tossing Board

The ring-tossing board shown in Fig. 4 is a somewhat similar arrangement, curtain or other metal rings completing the circuits

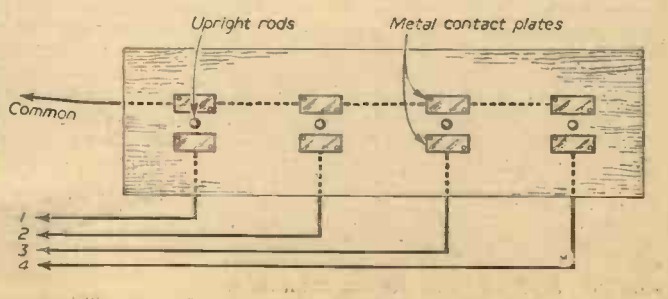


Fig. 4.—Ring-tossing board.

when thrown over the upright pegs. The difficulty of this game will depend upon the size of the rings and the distance from which the competitor is required to throw.

The rods or pegs may be made from short lengths of wooden dowel glued in holes of suitable diameter, and the metal contact plates may be cut from any thin metal, being secured over the ends of leads which pass down through small holes in the baseboard.

In this device, four separate circuits can be completed, and these may go to an indicator board of the type shown in Fig. 5. The operating battery is wired in series with the "Common" lead, and up to four indicator lamps may be made to light if four rings are correctly thrown. The numbers may be painted on thin paper glued over the windows on the inside, and various forms of scoring are possible, with the numbers not visible until the appropriate lamp is lighted.

As with any other lamp indicator, the bulbs may be 2.5 or 3.5 volt torch-bulbs, and screw-in holders are obtainable for these. A variety of methods of employing such bulbs, either plain or coloured, will come to mind and a range of indicating devices can readily be constructed.

Bell Circuits

These are very straightforward, and are shown in Fig. 6. Any small bell or buzzer can be used, and may be mounted, with battery, at some convenient point under the puzzle or game.

If mains operation is desired, then a bell transformer (or similar component with an output of about 4 to 6 volts) can be used, wired as shown in Fig. 6. If a proper earth is

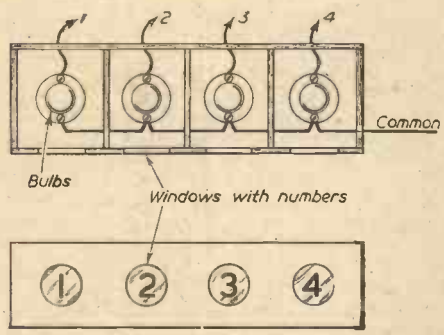


Fig. 5.—A simple indicator board.

available on the mains plug, then the core of the transformer should be wired to this to avoid danger of shocks if a breakdown in insulation should arise. Frequently, one secondary lead is similarly earthed for the same reason. Such transformers cannot be used with D.C. mains. It is not recommended that mains voltages be used in any of the puzzles, since these are far too high and the danger of shocks is very great.

Musical Indicator

This type of indicator may be provided if a radio receiver can be used, matters being so arranged that when the circuit is completed the loudspeaker operates. The receiver should be tuned to a musical programme.

The existing loudspeaker may be used by cutting one lead to the speech-coil and taking wires from these points to the game. The leads to the primary of the speaker transformer should not be cut, as this would interrupt the anode circuit of the output valve. In addition, unpleasantly high voltages will be found at this part of the circuit, particularly with mains receivers.

An external speaker may be connected as shown at "A" in Fig. 7, and this keeps direct-current voltages out of the leads, so that shocks are not likely to be felt. The speaker should have its own matching transformer with this circuit. If necessary, the receiver speaker may be silenced by interrupting or disconnecting one lead to the speech-coil.

Where low-impedance extension sockets

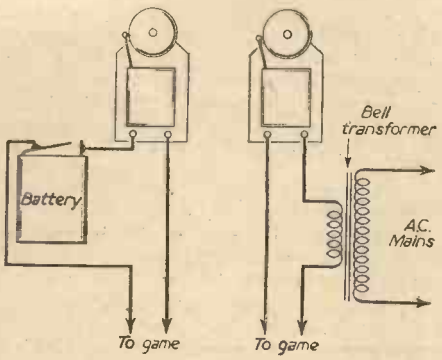


Fig. 6.—Battery and mains bell circuits.

are provided, the circuit at "B" can be used, the speaker then requiring no transformer. A similar circuit can be provided by taking leads from the *secondary* of the output transformer in the receiver.

If the constructor has any doubt about connecting up this type of indicator, it is recommended that a buzzer or bulb be used instead. The loudspeaker type of indicator is best used with a battery-operated receiver when no danger exists. If, however, it is used with a mains-operated receiver, proper care should be taken when wiring up to assure that there is no possibility of mains or high-tension voltages reaching the contact surfaces of the puzzle or game. The required isolation of the indicating speaker may be

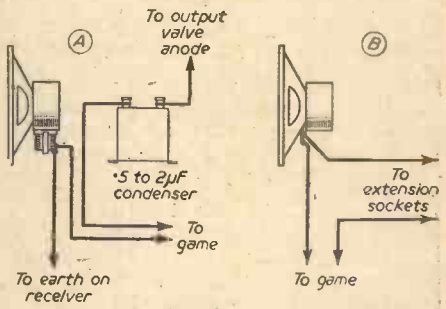


Fig. 7.—Circuits for musical indicator.

obtained by using a transformer, or condenser of reliable type, as explained. Direct wiring to the speaker should in no circumstances be attempted, especially with A.C./D.C. receivers. An unsuitable form of connection may cause shocks or damage to the receiver or speaker.

Flashing Fairy Lights

By E. W. CROWE

THE usual flashing fairy lights leave a "black spot" between going off and coming on again and, if any other source of light is near, it detracts from the sparkle of the fairy lights when they are on.

The answer to this is to have another light which will come on when the fairy lights go off; this can be accomplished very simply and effectively by a method which I have devised.

The type of flasher I used is one from the local chain store, which consists of a small bakelite unit which plugs into a light socket and the fairy lights plugged into the flasher.

This circuit can be modified as shown in the accompanying diagram.

The continuous lines show the orthodox flasher circuit, and it can be seen that by including the wires shown dotted and using a 15 watt, 230 volt lamp that at first the fairy light bulbs light and as the heater causes the contacts to open the fairy lights go out and the 15 watt lamp lights up to almost full brilliance. The result is very effective if the lamp is encased to appear as a star at the top of a Christmas tree, or put inside the coloured skirt of a fairy doll's dress. Naturally the bulb will have to be of the miniature type, similar to the type used in sewing machines.

By turning the lampholder half a turn (by changing connection A and B round) both the fairy lights and the star will flash together, and by turning the bayonet plug round the star will light and the fairy lights flash with longer periods off, since there is a small current flowing through the heater constantly.

I found from trial and error that the 15 watt, 230 volt bulb gave the best result, whereas a lower resistance lamp tends to keep the fairy lights on all the time.

Since all connections are made in the lampholder and bayonet plug there is no danger, as there would be with temporary connections.

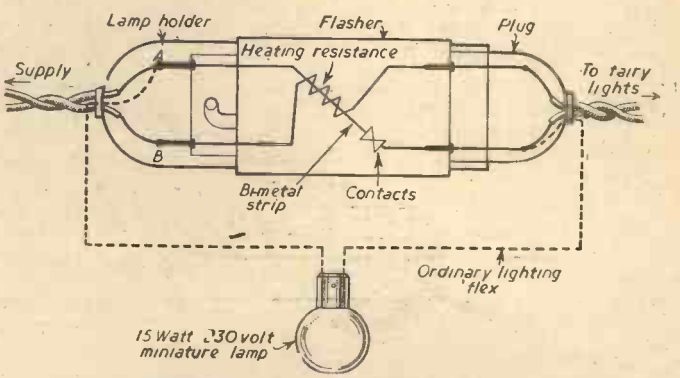


Diagram of the modified flasher circuit.

An Electric Liquid Mixer

Constructional Details of a Useful but Inexpensive Domestic Appliance

By J. D. MacDonald

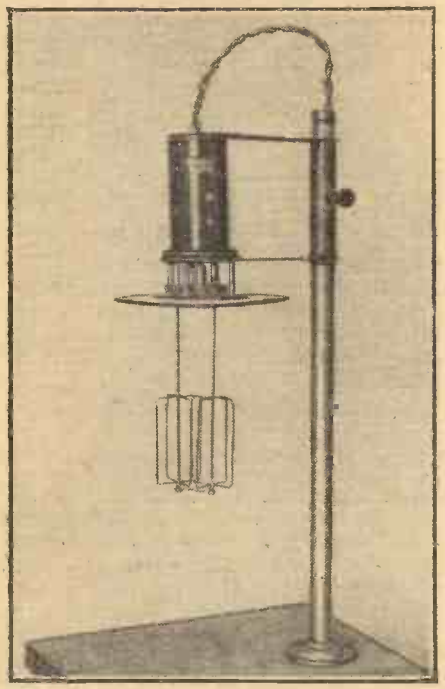


Fig. 4.—The electric liquid mixer mounted on an adjustable stand.

A SMALL electric liquid mixer—not to be confused with its larger brother the batter beater—can easily be made from the instructions given in this article.

Using any low voltage or mains-type motor, a mixer can be constructed which is strong, compact and easy to handle. This can be seen (Fig. 1) by comparing one type of electric mixer with a standard hand driven one.

A mixer consists of four parts, namely:

(1) The electric drive motor,
(2) The control unit,
(3) Beater paddles and gears,
(4) A stand (if required).

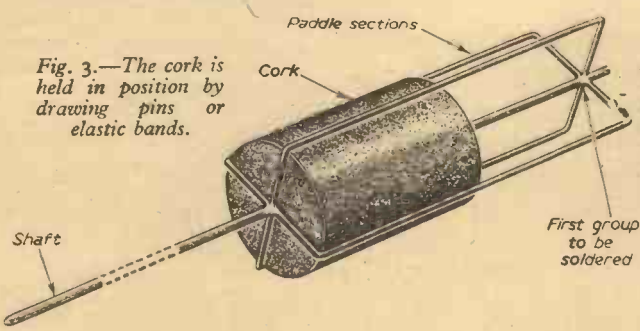


Fig. 3.—The cork is held in position by drawing pins or elastic bands.

The Electric Motor

This motor can be either:

(a) Universal mains;
(b) Low voltage AC or AC/DC;
(c) Low voltage DC.

The various types of motor, like the various types of control unit, have advantages and disadvantages over each other, which might be physical (i.e. size), electrical, mechanical or price. For example, with a universal mains motor its simplest control unit need only be a rheostat, but a low voltage AC motor needs either a tapped transformer or a transformer and rheostat as a control unit. The final cost is about the same, so the deciding factor in this case may be speed control.

The motors in the writer's scheme are in vertical positions. No thrust bearing was incorporated, as in such a small job this is not necessary. However, if one wishes to avoid vertical motor running, then bevel gears can be used with the motor in a horizontal position.

Control Unit

Speed control on 24v. AC motors can be obtained by either of the first two methods and again is a matter of choice:

(1) A multi-tapped transformer;

(2) A rheostat in the secondary of a non-tapped transformer. A rectifier must be incorporated in each of the above cases if the motor is DC.

(3) A variable resistance in the motor field if the motor is DC. This is not always possible as field leads are usually internally connected.

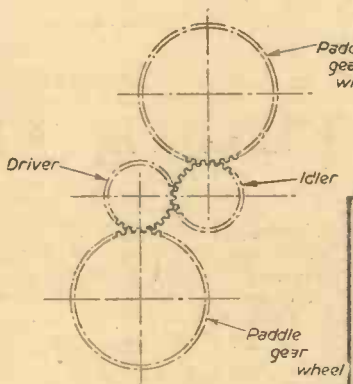


Fig. 2.—The distance between the paddle gear wheel centres can be varied according to the breadth of the beater paddles employed.

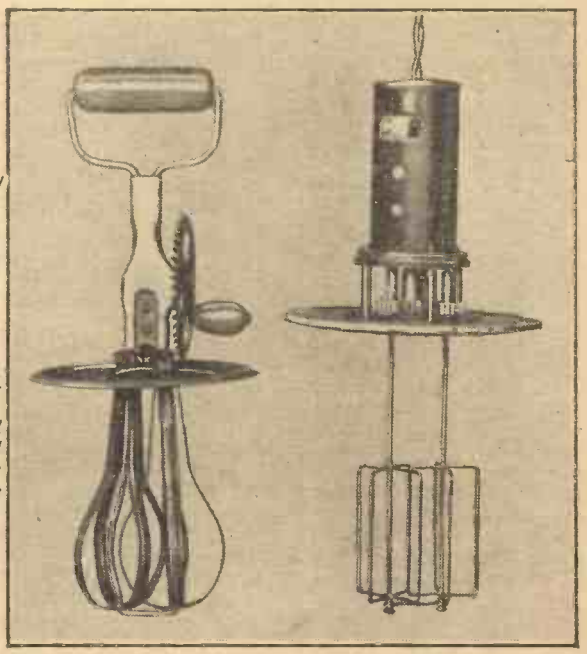


Fig. 1 (Right).—A standard hand-driven mixer, and the completed electric mixer described in the present article.

(4) A mechanical gear box. This is not easy to construct and cuts out simplicity. Electrical control causes less strain on the housewife, as can well be imagined.

Beater Paddles and Gears

The beaters can be either single or double, and can be used with direct drive or reduction gearing. Reduction gearing enables a greater beating power to be obtained. If the motor is vertical, then spur gears are required, but if horizontal, then bevel gears. Gear wheels as used with construction kits are quite suitable. When using gearing bear in mind that gear wheels must be in even numbers, that is 2 or 4, etc., but it is not recommended to have more than four. If an odd number of gears is used, for example, three, then the beater paddles will foul each other. The motor shown in Fig. 1 has a 2 to 1 reduction gearing, the gear wheels being arranged as shown in Fig. 2.

If the idler had been dispensed with then the beater paddles would have fouled each other. This is obvious if the direction of rotation is checked.

The paddles are made of silver steel, the driving shaft being slightly thicker than the paddles and passing through the paddle gears. The paddles are hard soldered to the shaft and are rectangular in shape as they are easier to construct in this form than any other.

It is rather difficult to hard solder four points at right angles to each other, but with a little ingenuity this can be done as follows: obtain a cork of the same diameter as the inside diameter of the beater. Drive a hole down through the centre the thickness of the driving shaft. The hole can be made by heating the shaft and pushing it through the cork. Place the four sections of the beater paddles round the cork at right-angles to each other (Fig. 3), and keep them in place by means of drawing pins or stout elastic bands. When one end is hard soldered push the cork along to that end and solder the other. The cork has then to be cut away.

With double beaters they are apt to separate at speed due to centrifugal force. This can be overcome by soldering to the end of each shaft a bicycle spoke nipple with its square shank removed, and with a hole drilled through it to suit the shaft. The nipples are then linked together with a piece of looped silver steel wire as can be seen in the photographs.

The Stand

A stand is not a necessity; the motor can just have a 6in. dia. Perspex disc fitted

on the paddle side of the gears, as shown in Fig. 1. In this case the mixer is placed on the mixing jar and is then ready for use. Between the gears and the perspex a piece of thin gauge brass sheet should be placed to prevent friction and wear.

A more permanent fixture is shown in Fig 4. The mixer is held by two pieces of shaped brass sheet to a short tube, which moves up and down on a long tube fixed to a base. The mixer can be adjusted for height by means of a fixing screw through the short tube. In Fig. 4 the sliding tube is of copper, and the fixed tube of ¾in. electrical conduit, with an electrical brass bush at one end to act as a stop and a ceiling fixing plate at the other to enable the tube to be fixed to the base. The power supply flex to the motor passes down through the tube and base to the control unit. The base is not fixed as it consists of a hollow box and, therefore, when not in use the mixer can be put away in a cupboard. This makes a neat compact job.

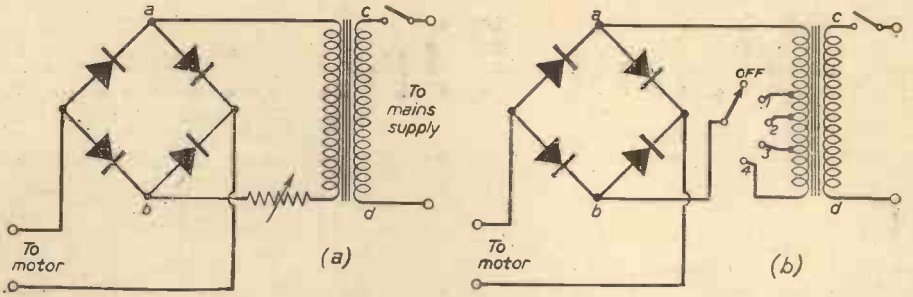


Fig. 5.—These control circuits are suitable for low voltage D.C. For A.C. the rectifier is removed and the motor leads are connected direct to points a and b.

Control Circuits

The control circuits in Fig. 5 give the basic diagrams for low voltage motors. For a mains motor a variable mains dropping resistance is sufficient. Signal lamps, switches and fuses can be placed in any suitable position. For example, in Fig. 5 a pilot lamp could be connected between points c and d.

Making a Perspectograph

A Device for Enabling Artists to Draw Buildings, etc., in Correct Proportion

THIS useful instrument will be found a great aid to the sketch artist. It is intended to be screwed to a tripod stand, and this is the way to use it. Fig. 1 is a view of the instrument minus the stand; you will see it consists of a horizontal bar of wood with a vertical rod at one end and a sliding view-point at the other. On the rod are two crossbars, the top one capable of movement up or down the rod, and itself fitted with two horizontal slides.

Now, suppose you desire to sketch a building of some kind, say, for example, a church. Look through the eyehole, and arrange the height of the tripod until the edge of the lower crossbar coincides with what will be the baseline of your sketch. Slide down the top crossbar until its front edge appears to touch the ground line of the church. The rod is marked in quarter inches, read off the distance between the crossbars, and draw a line on your paper this distance above the baseline already drawn. Raise the crossbar to a level equal to the roof of the church, then read off the distance as before and draw the roof line on the paper.

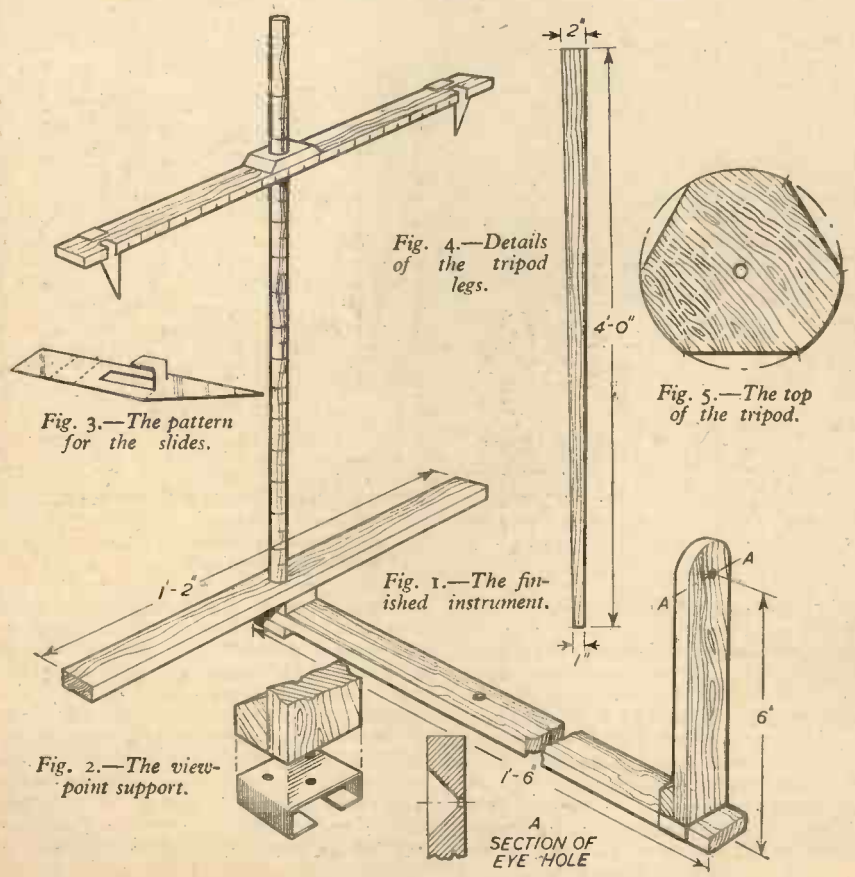


Fig. 1.—The finished instrument.

Fig. 2.—The view-point support.

Fig. 3.—The pattern for the slides.

Fig. 4.—Details of the tripod legs.

Fig. 5.—The top of the tripod.

Moving the Slides

Movement of the horizontal slides will now indicate the width of the church, and the points on the roof where the steeple rises from. The crossbar can now indicate the height of the steeple, and you will have the body of the building drawn in correct proportions. Details are put in the same way, such as windows, etc.

Hardwood is used for the work, 1in. by ¼in. in section, the main dimensions being given in Fig. 1. The rod is a piece of ⅜in. or ½in. dowel rod, glued in a hole bored in the lower crossbar with an inch projecting below; this is tightly fitted in a similar hole bored in the perpendicular bar. To provide a firm seating for this part of the rod, a thickening block, ½in. thick, is glued at the end of the bar.

Marking Out the Rod

The rod is accurately marked into inches by lines scratched half-way round, ½in. lines being a quarter of the way round, and the ¼in. lines being short cuts between.

The top crossbar is similar to the bottom, and should slide easily up and down the rod. This can be effected by lining the hole with a piece of cloth or rubber.

The pattern for the slides at each side is shown at Fig. 3, which should be cut in thin sheet brass and bent to shape. The edge of the crossbar, facing the artist, should be marked in quarter inches, and numbered in inches from the centre outwards.

The View-point Support

This has a small hole bored in, and is screwed to a sheet brass slide, bent to the shape as in Fig. 2.

Bore a hole in the centre of the main bar for a tripod screw, and varnish.

For the tripod stand, cut three legs from wood ½in. thick, to the size in Fig. 4, and at each of the lower ends drive in a wire nail. Cut off the heads of these nails, and file the shanks to a point, thus forming a spike to prevent the legs from slipping. To the tops fix a 2in. brass hinge.

Now mark out and cut the tripod top as shown in Fig. 5, using wood 1in. thick. It should then be varnished. The instrument can be taken to pieces and strapped to the tripod for easy carrying.

Making One-stringed Fiddles

Constructional Details of Two Instruments, Sometimes Known as Japanese Fiddles

THE two simple instruments herein described are easily constructed, and both have a pleasing tone compared with the cheap commercial fiddles of a similar type.

The body of the instrument shown in Fig. 1 is formed of cigar-box wood (approximately ⅛in. thick), but it is not just a cigar-box; it is entirely reconstructed and reduced in length. The sides or "ribs" are carefully glued together with butt joints, strengthened by a triangular block of soft pine about ⅜in. wide, the full height of the ribs glued and rubbed into each angle. A neck- and tail-block, about ¼in. by 1in. in section, with the exposed angles rounded, is glued centrally on the inside of the top and bottom ribs respectively, also extending their full height. Glued to the inside of the belly, so as to lie exactly under one foot of the bridge and running nearly, but not quite, parallel to the long axis of the body, is a bass-bar, as in an orthodox violin; and about its own diameter tailwards of the other foot of the bridge a sound-post (see article Sound-post in Grove's "Dict. of Music") is fitted tightly between the belly and back, and perpendicular to them. The absence or improper fitting of these two members is the cause of much of the poor tone emitted by both commercial and amateur-made one-stringed fiddles, and also of the undeservedly low opinion which many people have of these instruments generally. Both bass-bar and sound-post should be of straight-grained pine. The former should be about 1in. shorter than the belly, and the edge which is glued thereto ¼in. wide; the depth is graduated from ½in. in the centre to about ⅛in. at the ends, and the free edge should be well rounded from side to side as well as curved from end to end. The sound-post is a wooden rod of ¼in. dia.

The Neck

The neck is sawn out of a piece of ¾in. mahogany (a keyhole saw was used for the curved part of the "shoulder" and as much of the straight part as is necessary). The back of the neck is nicely rounded, and the front, which forms the fingerboard, made truly flat—any convexity in the length is particularly to be avoided, as it may cause jarring of the string in certain stoppings. The peg-box is formed like a small violin peg-box (see dotted line on side elevation of head, Fig. 1), being cut out with a chisel; the cheeks are left ⅜in. wide at the front and rather thicker towards the back. The widened part of the head is formed by glueing on two shaped slips of the same wood as the neck and finishing them off flush at the front, back and top. The peg-hole may be bored before the peg-box is cut, at first no larger than the smaller end of the peg. The hole can be tapered with a large rat-tail file, carefully revolved counter-clockwise in the hole; but proper violin peg-borers can be obtained. A home-made peg of rosewood or ebony, something like that shown in the drawing, will look much more in harmony with the rest of the instrument than an ordinary violin peg. If you have a lathe, the forming of the shaft is, of course, a simple matter, but where only one peg is concerned it will not be a very laborious process to shape it with a file from square to octagonal and from octagonal to 16-sided, and then to blend the facets and finish off by turning the peg in a tube of glasspaper formed round it. It is, of course, important to regulate the taper of the peg, and the hole, so that a good bearing is obtained on both sides of the peg-box. The "nut" which raises the string 1/16in. off the fingerboard at the head end is a slip of rosewood about 1in. by ⅛in. x ⅛in., fitted and glued into a shallow groove cut across the neck just below the peg-box, rounded on top and very slightly nicked in the centre for the string.

Tail-rest and Tail-pin

The tail-rest is another slip of rosewood of about the same dimensions let into the edge of the belly for half its depth where the string passes over to the tail-pin: it should be well rounded above, but needs no centre nick; its object is both to prevent the string cutting into the belly and to ease the angle through which the string has to bend at this point. The tail-pin, like the peg, might be turned: but in our "M.1" (Monolin No. 1) it was made by shaping the end of a stick of rosewood ⅜in. in diameter with file and penknife into the form of a miniature shouldered knob (see Fig. 1) with a shaft about ¼in. in diameter, to be fitted tightly into a hole bored through the bottom rib of the fiddle and the tail-block. When the pin has been satisfactorily shaped, the shaft is cut off about ⅜in. long so that it will go right through the rib and block, but no farther. It should not be glued in, as the hole provides a view of the interior of the body which may be useful at any time in locating defects or checking the uprightness of the sound-post.

Bridge and String

The bridge is cut with a fretsaw from a slip of well-seasoned oak. In thickness the bridge is a compromise between an ordinary violin bridge and the shapeless chunks favoured by the "Jap fiddle" manufacturers, which gives it eventually an elevation derived from the drawings of Japanese koto bridges in "Music and Musical Instruments of Japan" (see Fig. 2A).

String-length

The string-length (from nut to bridge) is shown on the drawings as 27in., the effective string-length of a medium-sized 'cello. As the fingering of a one-stringed fiddle is necessarily related to that of a 'cello we think the latter might appropriately supply the standard. The string with which the instrument is mounted is that which seems to be consistently adopted for the Jap fiddles of commerce, namely a "banjo third steel," tuned to Middle C. To the violinist or 'cellist the use of wire strings on a bowed instrument may appear barbarous, but we have proved that, with a properly designed body and bridge, the tone produced by their aid

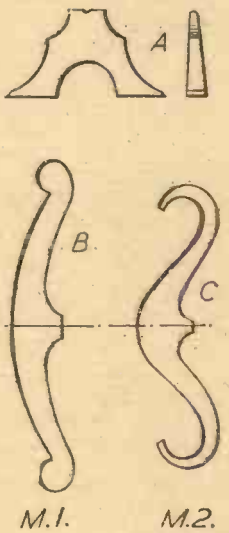
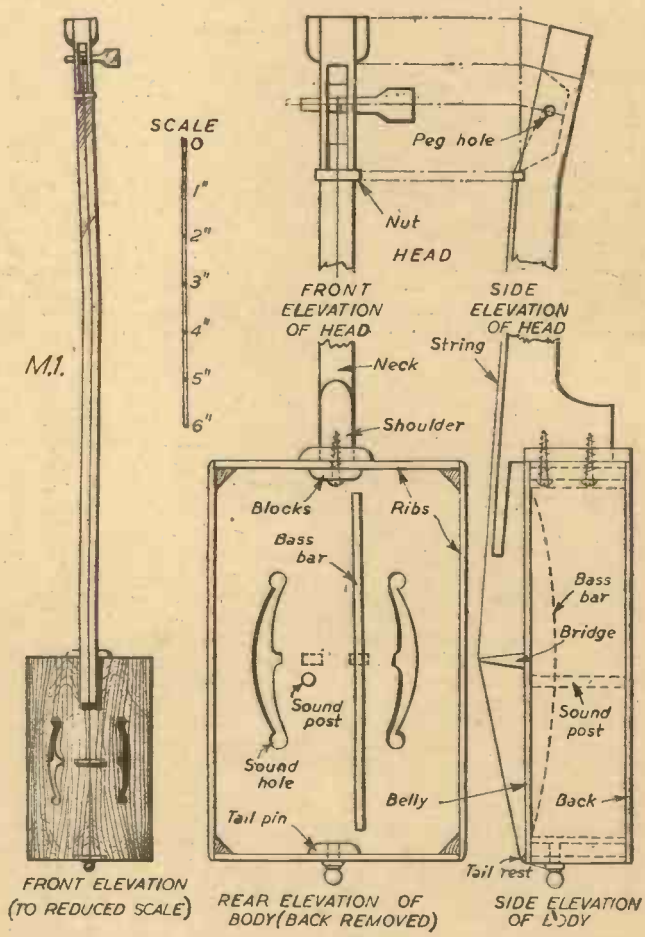


Fig. 1. — (Right) Front, rear and side elevations, showing constructional details of a one-stringed fiddle. Dimensions may be taken by reference to the scale.

Fig. 2.—(Above) The bridge (A) is cut from well-seasoned oak and the sound holes (B and C) are cut with a fretsaw.



can be as pure and soft as anything that can be got out of catgut; and their superiority to gut in durability and indifference to moisture is obvious. The banjo strings have a loop ready made at one end, which can be slipped over the tail-pin; a very small hole is bored in the peg to receive the other end.

Assembly

When the ribs have been put together, it is best, before glueing on the back, to arrange the fitting of the neck. The face of the shoulder which joins on the body must be quite square transversely, and should make an angle of about 86 deg. with the plane of the fingerboard. Lay the ribs on the bench, with the belly on top, then prop up the neck in contact with the body so that it stands as nearly as possible as it will when fixed. Lay a straight-edge on th fingerboard, overhanging the body, and see how high it stands off the belly at the latter's centre (where the bridge will come); the distance should be just over $\frac{3}{8}$in. Adjust the neck up or down until you get this right, then mark clearly on the neck where the top edge of the rib comes. Take away the belly, centre the neck to the axis of the body very carefully, then holding or clamping it in the correct position, make two small bradawl holes, on the centre line, through the top block and rib into the neck (see drawings), deep enough to take the two 1in. or $1\frac{1}{4}$in. round-headed screws which will secure the body and neck together. Taking these temporarily apart, enlarge the holes in the body so that the screws can be pushed through them right up to the head, slightly grease the screws, bring the parts together, and turn the screws home. It is desirable both for strength and appearance to fit and glue into the angles between the neck and the body (after the back and belly are on) blocks of the same wood as the neck, in section roughly quarter-elliptical, about $\frac{3}{8}$in. by $\frac{1}{4}$in. (see Fig. 1). If the wood available allows it, the shoulder of the neck may well finish flush with the body at the back, as in the "M.2" instrument; in "M.1" it does not extend so far, though the strengthening blocks do; the space between their ends is filled in with a kind of packing-piece. The extension of the fingerboard over the body should be about $\frac{1}{4}$in. thick, and reach to within 3in. of the bridge, so that the string may be stopped to $\frac{1}{8}$ of its open length ($3\frac{3}{8}$in.), and thus give the instrument a compass of three octaves.

The back, and then the belly, can now be glued on, and cramped with weights; no nails or pins should be used anywhere. Before the belly is fixed it must, of course, have the sound-holes cut in it and the bass-bar attached. The outline of the former can be enlarged from the illustration in Fig. 2 (approx. half full size) and cut out with a fretsaw; or the terminal eyes may be bored with a bit and the rest carved out with a knife. When the edges of the block and belly (left intentionally a shade large) have been trimmed quite flush with the ribs, the tail-rest and tail-pin fitted, and the bridge made, the sound-post may be inserted. Lower it through the sound-hole farthest from the bass-bar by means of a pin stuck in one end, and pare one or both ends until it will just stand vertically inside the body, without any forcing. It must now be slid into the position described in an earlier paragraph, either by means of a piece of bent wire, or a string tied round it with two long ends, one issuing from each sound-hole.

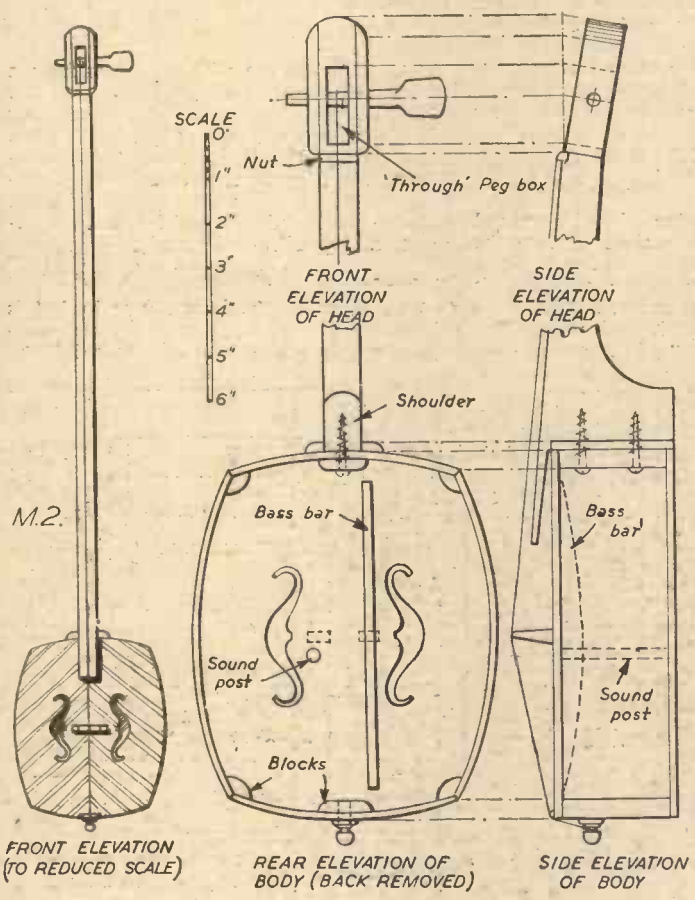


Fig. 3.—Front, rear and side elevations, giving constructional details of a one-stringed fiddle of alternative design.

Varnishing

You can now put a string on and get some idea of the tone of the instrument. If it is fairly good, it will be better when the body is varnished. Take the string off, give all surfaces a final glass-papering and slightly round all arrises, then apply to the body and head only at least two coats of good quality "dark oak" varnish, with a rub down between. A preliminary sizing with a solution of gamboge in methylated spirit is desirable. The neck is not varnished, but its surface is hardened by several applications of French polish each lightly rubbed down with fine glasspaper or pumice-powder. The varnish on the belly should be scraped away just where the feet of the bridge stand.

The Second Model

Wishing to make a second monolin for ourselves, we debated the possibility of giving the body the attractive convex outline of the Japanese kokyu and samisen. We remembered the various decorative uses to which the constructor had formerly put the wood of a Canadian cheese-tub, and "M.2" (see Fig. 3) was the result. The rough stringy birch needs a lot of preparing to get a fair exterior surface for varnishing, but the result pays for the labour. The mitreing is done by trial, and the joints depend mainly on the blocks—fitted and glued in while the ribs are secured with string. The back and belly are of $\frac{1}{8}$in. fretwood—the former "satin walnut" and the latter "silver pine"; the neck being of dark walnut, the colour effect is very good. The head has side additions for its full length, and the peg-box could therefore well be cut right through the head in the Oriental fashion with centre-bit and key-hole saw. The different form of sound-hole (Fig. 2) seems to be demanded by the curves of the body. The tone is less brilliant than that of M.1, but is very pleasing.

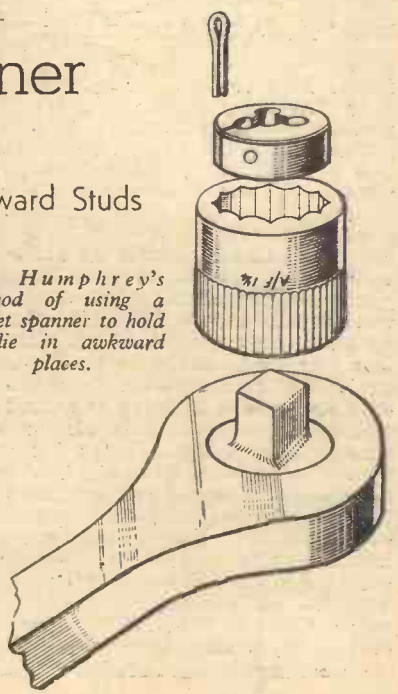
A Socket Spanner Dodge

A Handy Method of Threading Awkward Studs

By S. C. HUMPHREY

QUITE often, it is found, when threading a stud fitted in an awkward place that the "arms" of the die-holder will foul surrounding objects, and if a vertical die-holder and tommy bar are not available the job seems impossible without removing the stud. By using a socket spanner to hold the die, as shown in the sketch, this problem can be overcome.

I have used this combination on cylinder-head studs, stub axle steering-arm bolts, and shackle pins where the thread had become damaged. In operation, a tight fitting split cotter is inserted between the slot in the die and one corner in the socket to prevent it rotating. The ratchet spanner will be found useful where extension bar and tommy bar are not suitable.



Mr. Humphrey's method of using a socket spanner to hold a die in awkward places.

A Model Twin-cylinder Oscillating Engine

Constructional Details of the Single-acting Engine as Originally Made for the Model Steam Launch "Vanesa"

(*Concluded from page 60, November issue*)

THOUGH the process was straightforward, the construction of the crankshaft was not easy. It will be appreciated that there will be trouble if this item is a fraction out of alignment. With a prefabricated shaft, this trouble usually arises if the shaft holes are not absolutely parallel with each other, or if they are oversize, allowing too much play on the sections of shafting when placed in position. One way of overcoming this is to drill all webs together, tracing out the hole positions beforehand; but four webs together constitute a considerable thickness—rather too much for drilling by hand—so the job was tackled as follows: An accurate steel template was made of the web size, holes included (Fig. 8). Then the four brass webs were cut and drilled very carefully to this. Lengths of steel shafting were then prepared and pressed through the web holes. Carefully aligning the webs into position, they were sweated with soft solder. Then holes were drilled right through the webs and shafting, and pin rivets driven through. Finally, the sections of shafting marked X were cut away, the rivet ends filed flush, and the whole cleaned up and given a good polish.

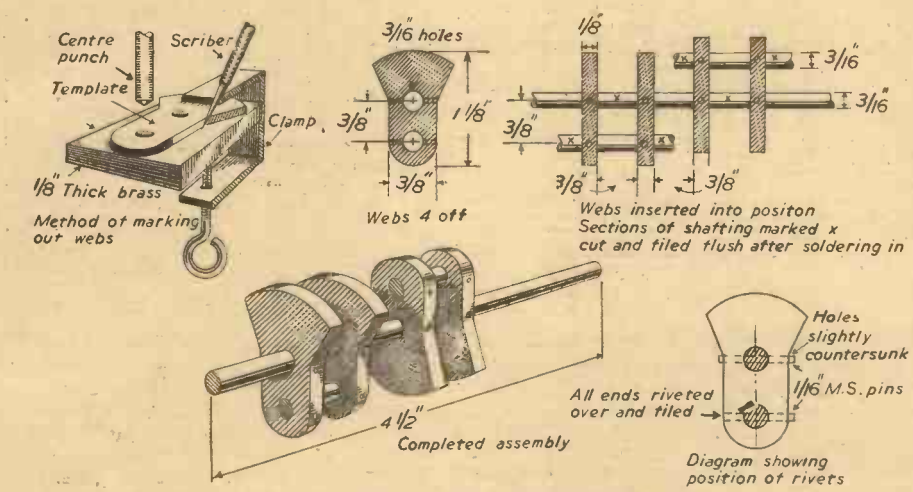


Fig. 8.—Details of the built-up crankshaft.

Flywheel

The flywheel, of the dimensions given in Fig. 9, was beyond handwork, so this I had to have "turned" roughly to my requirements, but the final finish was applied by using the drill brace clamped in the vice to serve as an impromptu lathe. The flywheel is made of brass, and is fluted to a depth of ¼in., leaving a boss ⅜in. dia. through which are drilled two 4 B.A. holes to take the securing grubscrews.

Universal Dog

This, of course, need not be fitted, in which case the pegs should be fitted to the flywheel instead. These are essential, of course, to connect with the propeller coupling. But if the dog is required, the illustration, Fig. 10, shows the actual dimensions. It is made completely of brass, with the pegs and bush sweated into the disc. The unit is secured to the mainshaft with a 5 B.A. grubscrew.

A stage of operations had now been reached where it was possible to assemble the engine, and test for alignment. At the same time the overhanging support bracket was fitted. This is a strip of brass, ¾in. wide x 1/32in., shaped as in Fig. 11. It is secured in position by the same screws that also support the mounting blocks (see Fig. 1). This bracket assists in holding the mounting standards firmly.

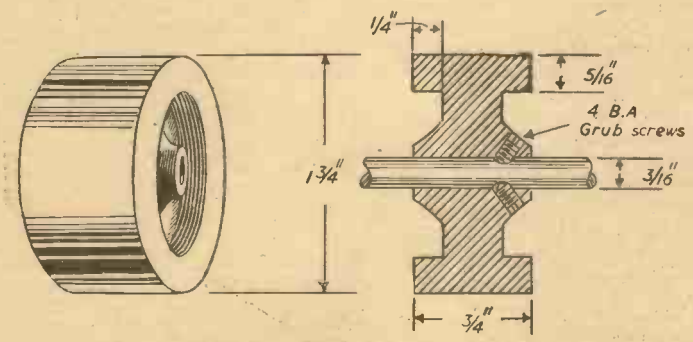


Fig. 9.—Perspective view and section of the flywheel.

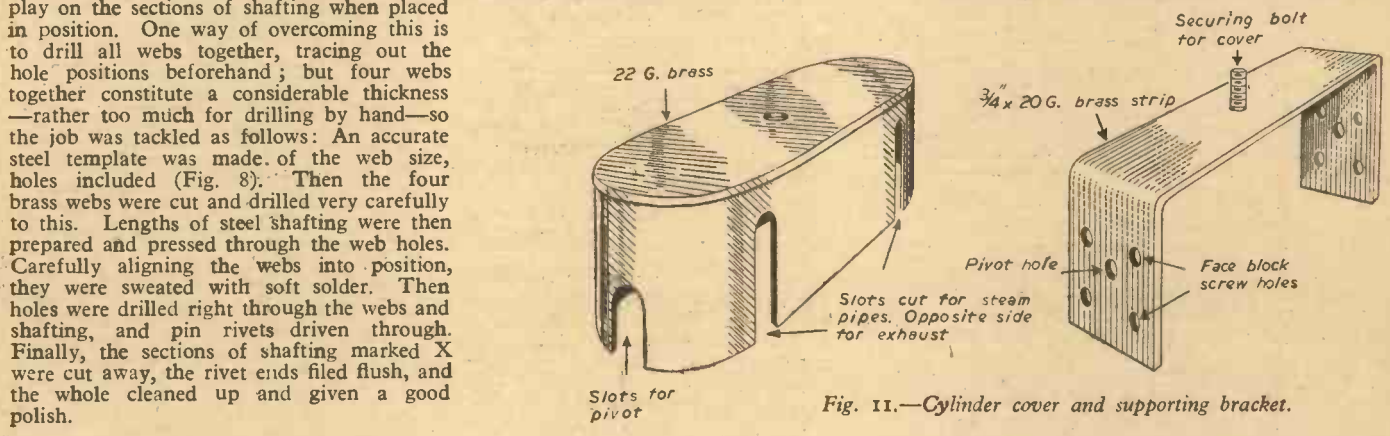


Fig. 11.—Cylinder cover and supporting bracket.

Setting the Steam and Exhaust Ports

The illustration, Fig. 12, displays the actual port positions in relation to the pivot and crank centres, with the corresponding measurements.

The operation was carried out as follows:

Assembling one cylinder unit to the main shaft crank, but without the pivot spring, the crank was rotated to a right-angle. A little "blue" was placed over the steam port on the cylinder face. The cylinder was pressed home against the face block, and then withdrawn, leaving a circular impression, the centre of which was lightly marked with the scriber. Rotating the crank to opposite right-angles, another impression was made and marked. The process was then repeated on the second cylinder assembly. The centres of these coloured impressions are the exact positions for the ports. Removing the blocks from the mountings, the centres were then "centre popped," and a 1/32in. pilot drill run through to a

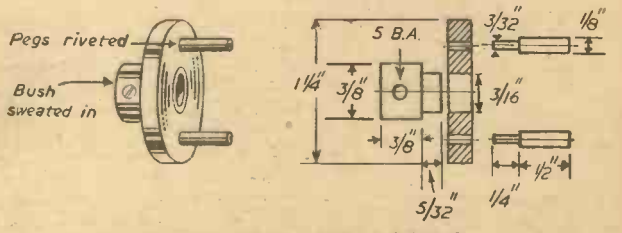


Fig. 10.—Details of the driving dog.

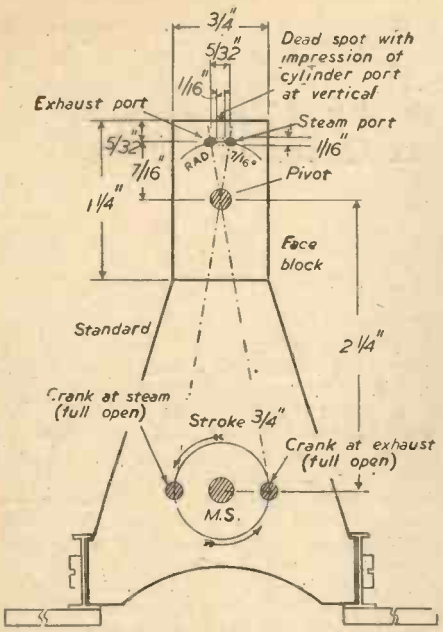


Fig. 12.—Diagram of steam and exhaust port locations. (Note. In the other block the position of the port is reversed.)

depth of 3/16in. The holes were then opened out gradually to the required size as in Fig. 12. It will be noticed on the diagram that the centre dotted circle is "edge on" to the steam port (right) and the exhaust port (left). This represents the position of the cylinder port with the crank at dead centre (directly vertical). To obtain this, an impression was made at centre on the block, then both ports were gradually opened out until the inside edges nearly touched the edge of this impression. The result of this is that when in motion, the ports begin to open immediately the crank comes off centre, which ensures that steam is accepted for nearly half the cycle, and the exhaust begins to clear without delay. This is very important. With a single-acting oscillating engine, steam is accepted on the downward motion only, which is not quite half the complete cycle (about 170 deg.). Therefore, it is important to get as much as possible during that time. If the holes were left in their first drilled state, the cylinders would have to oscillate over a "dead" area of the block before meeting the ports, resulting in some loss of power. (That is why some "toy shop" engines, although fast in motion, do not always produce much power.)

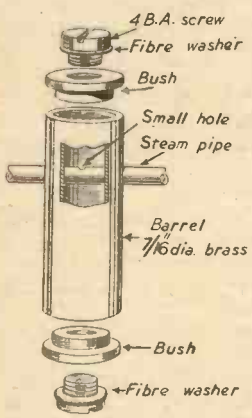


Fig. 14.—Lubricator details.

Likewise, the exhaust should be got away as quickly as possible, hence the exhaust port should be a shade larger than the steam port. It would be advantageous to have this port "kidney" shaped. But it is important that care should be taken to keep the "dead spot" at the precise measurement. If it becomes less than the width of the cylinder port, the block is rendered useless, as the steam merely passes through from the steam port to the exhaust port. In the event of such an error occurring, remove the blocks, fill all holes with brazing and re-drill.

Steam and Exhaust Pipes

These have now been arranged as shown in Fig. 6 of the March, 1953, issue (*Vanesa* details). This arrangement is more satisfactory in the main, but if builders prefer the original style, the illustration, Fig. 13, shows the layout, which also includes the condensation drum. This is not a condenser in the strict sense of the word, it merely traps water, which would, until the engine has warmed up, shoot up the funnel. A simple form of superheating has obviated this trouble in the present arrangement. The construction, however, remains the same. The pipes are 5/32in. for steam, and 3/16in. (copper) for exhaust. Having first been annealed, they were bent to shape with the aid of wooden formers. They lead into the blocks via holes drilled at right-angles, the ends first having a step filed on as shown. A good tight fit was ensured before soldering in. The "condenser" is merely a 2½in. x ¾in. length of brass tube fitted to the ends

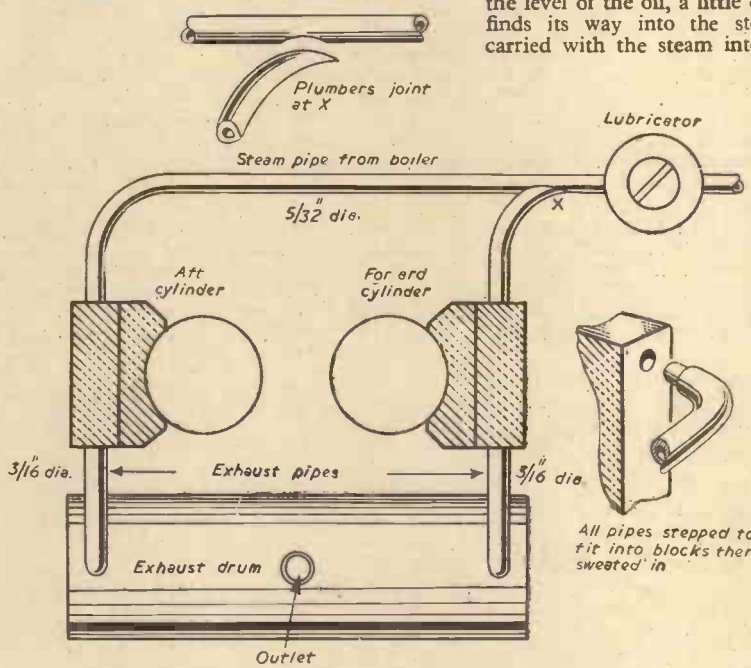


Fig. 13.—General arrangement of steam and exhaust pipes.

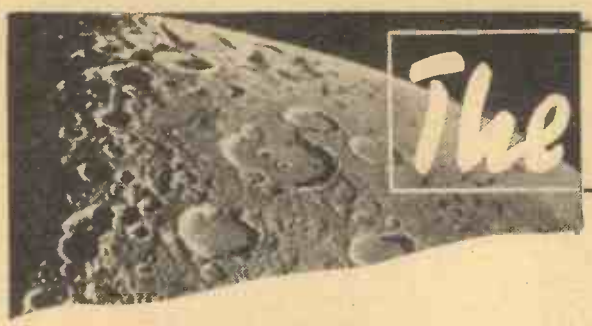
of the exhaust pipes. A 4 B.A. screw plug is fitted for draining-off purposes. The exhaust outlet from the drum is a vertical ¼in. dia. pipe. The extension from this to the funnel was another length of ¼in. tube fitted with a well-fitting sleeve. The regulator is an ordinary stopcock fitted via cone unions to the main steam pipe. The extended handle is for convenience in handling via the hatch cover of the engine room skylight (see Fig. 9, March issue).

Displacement Lubricator

This is a 1½in. length of 7/16in. dia. brass tube bushed, and fitted both ends with 4 B.A. screw plugs for draining and filling (Fig. 14). Two holes were drilled ⅛in. from the top to enable it to be threaded on to the main steam pipe, and soldered. Incidently, the new position is now centrally between the two cylinders (Fig. 6, March issue). One filling of oil is sufficient for one running of the engine, after which it has to be drained and re-filled. Heavy cylinder oil is used. The function is basically as follows: The part of the steam pipe that is inside the cylinder has a small hole or "nick" in it, and a portion of the steam enters through this into the lubricator, condenses and sinks to the bottom, forcing up the level of the oil, a little of which at a time finds its way into the steam pipe, and is carried with the steam into the cylinders.

Cylinder Cover

This is optional, but if required the general arrangement can be seen in Fig. 11. The function of this has already been explained; a step further would be to enclose the whole engine. I have not yet done this myself, but it would be an advantage to conserve heat. The cover would of necessity have to be of very light material. So much for the engine details. The installation of the engine in conjunction with the boiler is shown in Figs. 8 and 9 of the March, 1953, issue of PRACTICAL MECHANICS. Finally, I would point out that if the builder chooses to fit the driving "dog," the propeller shaft will have to be a little shorter. Watch this point, therefore, when fitting. As an alternative, bring the engine slightly forward on the bed plate.



The Lunar Craters

The Possible Causes of Their Formation

By WILLIAM ELLWOOD

THE craters of the moon. How many years ago is it since man made his first suggestion as to their origin? Certainly no later than the birth of the first telescope. Two theories, diametrically opposed to each other, have been propounded without any clear lead being established by either.

The first idea is that the craters were formed by volcanic action. Whilst agreeing that such action would at one time be intense on the moon—bringing into existence mountain ranges such as the Apennines (Fig. 1); it is difficult to believe that the same agent was responsible for the gigantic walled plains, typified in formation by Ptolemy (Fig. 1) with a diameter of 115 miles. Others range between 50 and 100 miles in diameter. Even allowing for the low gravitational force at the moon's surface —one sixth that of earth—the maximum diameter of a Lunar crater or plain should barely exceed 30 miles. Earth possesses few craters exceeding 5 or 6 miles in diameter. Eruptive forces in the moon could hurl debris six times higher than would be the case on earth, but that does not guarantee a crater six times as wide, let alone almost 20 times as suggested by Ptolemy! Also, when considering these walled plains, the volcanic cone or mountain in the centre is entirely absent. This does not help the volcanic theory. Again, it is illogical to suggest that the craterlets could be formed by volcanic agency. Many of these small circular craters are formed *in the walls* of the plains and ring craters. This infers that the debris after being hurled miles above the moon's surface, still possessed enough heat energy to start an eruption of it's own, after it's return to the surface! Such a circumstance is extremely unlikely. It is a peculiarity, and in some instances a defect of human reasoning, to invoke the concept of violence when confronted with extraordinary physical or mental conditions. This idea of violence—past violence in this case—is present when trying to interpret lunar configurations.

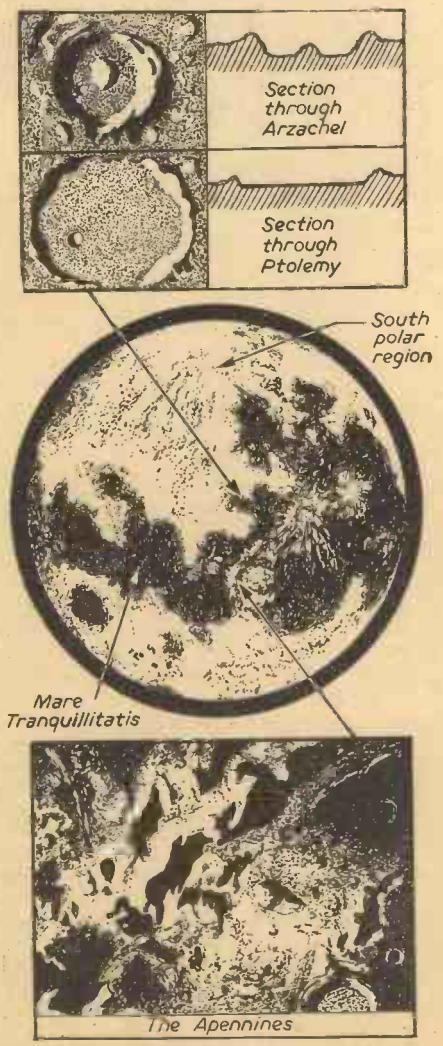


Fig. 1 (Left).—The disc of the moon is shown as seen through a telescope; that is, in the inverted position.

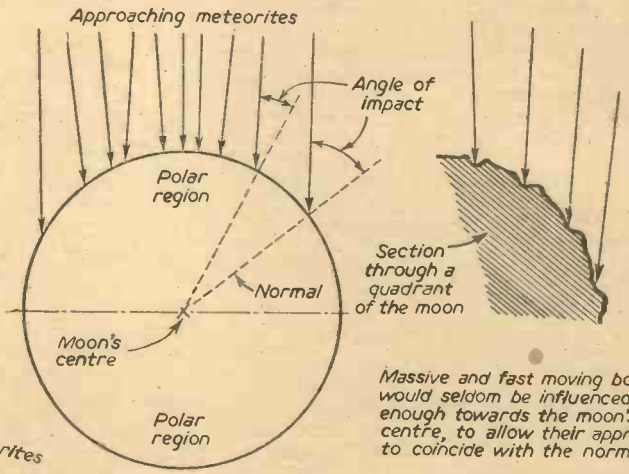


Fig. 2 (Right).—An incessant meteorite attack on the moon's polar regions.

Massive and fast moving bodies would seldom be influenced enough towards the moon's centre, to allow their approach to coincide with the normal.

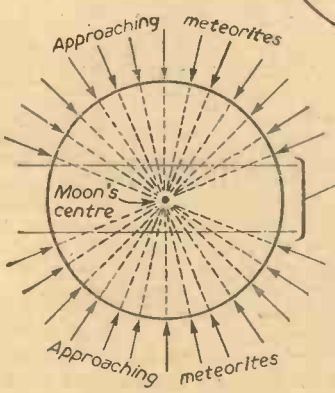


Fig. 3.—An attack emanating from nearly all surrounding space.

Equatorial regions comparatively immune from attack

Bombardment by Meteorites!

Volcanic action being unable to explain *all* lunar phenomena, the mind takes a leap into space—almost literally—and commences a shattering bombardment of the lunar surface by meteorites of all sizes, ranging from small fragments to colossal bodies over 50 miles in diameter.

If such vast meteorites ever wandered within the vicinity of our planet and it's satellite, it is sensible to suppose that a good number of them would be attracted to earth rather than the satellite, due to the larger mass of the former. A vast wanderer of this description could pierce earth's atmosphere and crash, without appreciable loss in mass suffered by ignition of it's exterior caused by air friction. As stated previously, no evidence is present of any such catastrophe.

As great areas of the moon's equatorial belt are comparatively unmarked, whilst *both* polar regions are pitted with innumerable craters, it seems that these terrific attacks came directly from southern and northern space, relative to the moon. This infers an amazing if not impossible coincidence.

The meteorite idea suffers still further when we must admit that all the walled plains and ring craters are of nearly circular formation. An attack mounted from north or south would no doubt account for circular craters at the poles, but the greater the angle of impact became towards the equator (Fig. 2), the meteorites would tend to plough furrows in the surface at the time of impact, rather than form circular craters. The only alternative for the meteorite theorist, is to imagine an incessant attack (over 30 thousand craters have been mapped) from nearly all surrounding space aimed unvaryingly at the moon's centre, and guaranteeing at the same time the immunity of the already mentioned equatorial regions known as *maria* or seas (Fig. 3). Even with this point suitably settled, there remains the central mountains of the ring craters to be accounted for. Arzachel with an interior mountain of 5,000ft. is a good example (Fig. 1).

The meteorite theory as a whole is fraught with difficulty, and as a result, general opinion tends to favour the not-too-happy alternative of a volcanic causation.

There is, however, another explanation which may be more acceptable than either of the foregoing theories. It concerns the relationship of moon to earth and the result-

ing action of the satellite's former hydrosphere.

Covering of Water

It can scarcely be doubted that the moon at one time possessed a heavy covering of water. Present-day thought entertains the fact that volcanic action is a necessary function in the creation of a hydrosphere. It is, therefore, natural that as a result of such action, no more severe than that experienced on earth, the moon acquired a covering of water many thousands of feet in depth. We may mention here, that should the prominences of earth's crust or lithosphere be smoothed out to form a uniform surface, the whole globe would be covered by water to a depth of some 10,000ft. Applying similar conditions to the moon, it becomes strikingly obvious that the great mass of earth would exert a tremendous influence on the waters of the moon. This influence would cause the water to pile up at two positions on the lunar surface (Fig. 4). The seas at *a* would be pulled towards earth. At the same time, the body of the moon would be attracted somewhat less strongly in the same direction, but sufficiently to cause the seas at *b*, at a position farthest from earth, to increase considerably in depth. This is identical to the action which gives earth its tides (plus the sun's influence of course), only, in our case, the reciprocal attraction of earth to satellite is far less pronounced.

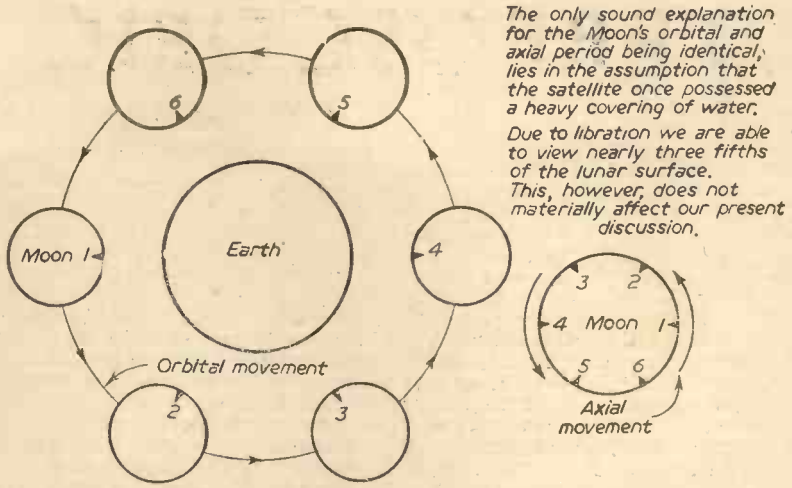


Fig. 5.—Diagram showing how one face of the moon is constantly presented towards earth.

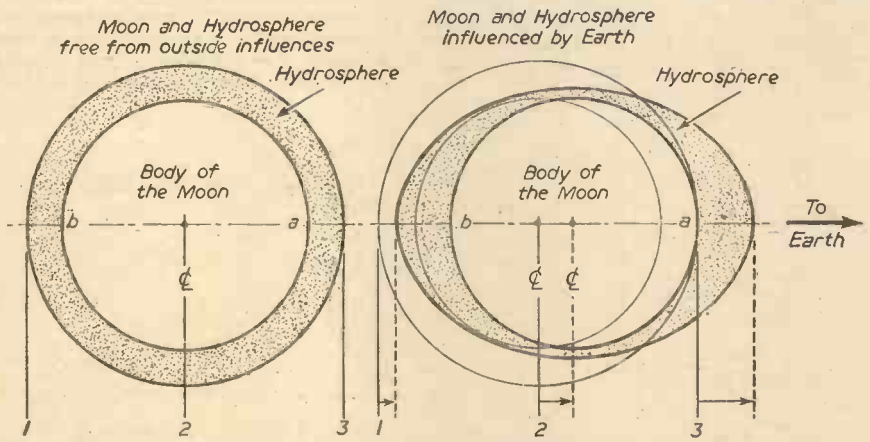


Fig. 4.—Formation of tidal bulges on the moon. The hydrosphere is exaggerated to aid clarity.

One-faced Moon

It is probable that long ago the tidal waters of the moon would achieve fantastic depths in the bulges. The effect of such water masses on the surface of the revolving satellite would be a slowing up or retarding of the moon's axial rotation, until finally, the time taken for one axial revolution would correspond with the orbital or periodic time (Fig. 5). The result of such action is to leave us with a "one-faced" moon which has persisted even after complete water dispersion, though there can be little doubt that this condition was achieved ages before water vanished from the moon's surface. This appears to be confirmed by the vast grey plains of the equatorial belt where the remaining waters would accumulate and lie almost stationary, relative to the moon's surface, until final dispersion into space. This last condition would be inevitable, due to the small mass of the satellite. There remains, nevertheless, the intriguing question whether any water remains on the opposite or unknown side of the moon. After the "one-faced" condition was obtained, earth's gravitation would no longer assist in dispersing water on the opposite hemisphere!

The moon's polar regions would be the first to suffer water denudation as dispersion continued. The equatorial belt or, more correctly, that region of the lunar surface lying almost at right-angles to the moon's orbital plane, would suffer denudation last of all.

This gradual drying up, spreading generally from north and south, would neither be instantaneous nor complete. Innumerable depressions in the swampy and semi-plastic surface of the moon would still be full of water. Time after time the main water masses would be dragged back and forth across these areas according to the moon's position in its orbit. The plane of this orbit makes an angle of 5 deg. 9 min. with the ecliptic or orbit of earth round the sun.

Tidal Action

If we take one of these depressions (Fig. 6) we find that, so long as the time for the moon's axial rotation is less than the periodic time, the imprisoned water must pursue a clockwise movement (anti-clockwise for the southern hemisphere). All irregularities on the circumference of this depression or lake would be smoothed out by tidal action due to earth's gravitational force. The material of these irregularities and further material scoured from the now fairly circular bowl or "crater" would be deposited evenly round the circumference by tidal action. Infrequent but widespread inundations of the whole area by the still active main water mass would add further debris and silt to the outer walls, eventually giving them a remarkable but not impossible height—the average being 4,000ft. above the surrounding surface. As the flood receded, water would in many cases be trapped in cavities *in the walls*, thereby commencing the formation of the craterlets previously mentioned.

Inside the main "crater" or walled plain the slowly circulating water would, century after century, continue to erode the inner walls. As the water level gradually dropped much of the eroded material would be deposited on that area of the crater floor where least movement of circulating water would occur, that is, in the centre. *None of the central cones or mountains rise to the same height as the surrounding walls.* In the case of a very large walled plain, the huge volume of water involved would possess the characteristics of a land-locked sea, and no mountain would be formed. The eroded material in this instance would be deposited fairly evenly over the entire floor. It is important to remember that the floors of the walled plains and ring craters are invariably *much lower* than the surface outside the walls. This strongly suggests that the original site was a depression in the moon's surface!

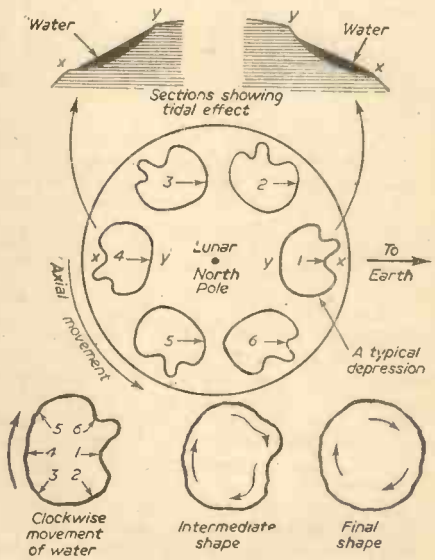


Fig. 6.—Birth of a lunar crater.

Viewing the evidence as a whole, it would seem to support the latter theory more convincingly than that of a volcanic or meteorite causation. It uses the moon's former hydrosphere as the tool and earth's gravity as the wielder of that tool. Final water dispersion would leave vast grey plains, such as Mare Tranquillitatis (Fig. 1), as an everlasting testimony of the long extinct but once mighty hydrosphere of the moon.

STEREOSCOPIC PICTURES

A Brief Description of the Systems Used for Obtaining Them

By "PHYSICIST"

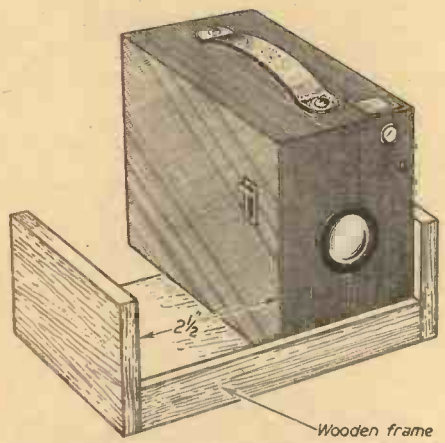


Fig. 4.—Simple wooden frame which enables stereoscopic pictures to be taken with an ordinary camera.

THE industry and activity with which the major American film companies have recently gone in for three-dimensional films has raised hopes that, at last, the cinema may be able to capture some of the life and feeling of the theatre.

The development of three-dimensional moving pictures represents the latest phase in an art, which, surprisingly enough, was the subject of experiment by Friese-Greene way back in the 1890s, and long before that the Victorians were enjoying stereoscopic still pictures.

The Eye and Stereoscopic Vision

When we look upon a distant scene, the light which enters each eye is formed by the lens of the eye into an image on the back of the eyeball (Fig. 1). This region of the eyeball, which is known as the retina, is composed of a myriad of tiny nerve endings, and the light falling on each one sets up impulses within it which are transmitted to the brain.

That the brain is receiving two images can readily be proved, either by quickly closing and opening each eye alternately in rapid succession whilst looking at a near object, whereupon the object will appear to jump sideways at each changeover of the eyes, or by displacing one eyeball by gently pressing with the finger, when two distinct images will be seen.

The fact that each eye is receiving a slightly different image, whilst with both eyes open we only see one, indicates that the brain is blending the two images into one.

But, now look at a distant scene and close one eye, and with most people the view immediately loses depth. Some people find that closing one eye destroys the illusion of depth more than when the other is closed, and an unfortunate few are barely able to see in depth at all.

When a photograph is taken with a camera we are virtually recording the scene as it would be viewed through one eye. The camera lens replaces the lens of the eye and the photographic plate replaces the sensitive region at the back of the eyeball. The resulting picture, whilst being artistically attractive, lacks perspective or depth.

Stereoscopic Still Pictures

Suppose, however, that there are two cameras, one replacing each eye, assembled so that the lenses are the same distance apart as the pupils of the eyes, which for a normal person is about 2½in. (Fig. 2). Two photographs of the same scene can be taken simultaneously, or, if there is no movement, at different times. Provided the photographs are arranged so that the one taken with the left-hand camera is viewed exclusively by the left eye and the other exclusively by the right eye, a three-dimensional effect will be obtained.

This technique was well known to the Victorians and the viewing apparatus they used was called the stereoscope. It usually consisted of a wooden frame in which the two photographs could be mounted side by side, each one some distance behind a magnifying lens (Fig. 3). The viewer looked with one eye through each lens and the distance between the photographs and the lenses was adjusted until the illusion of depth was produced.

With stationary objects there is no need to have two cameras, and stereoscopic pairs of photographs can be taken even with an inexpensive box camera. The camera is mounted on a wooden frame (Fig. 4), fitted with side pieces spaced a distance such that with the camera pushed close up to one side piece, the distance between the other camera wall and the other side piece is 2½in.

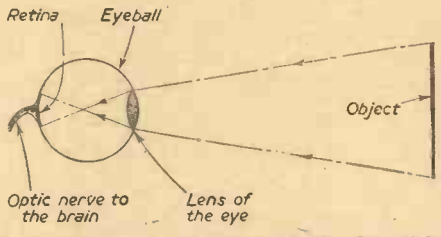


Fig. 1.—The eye. Diagram showing how light from an object enters the eye via the lens and forms an image on the retina at the back of the eyeball.

Separate exposures made with the camera pushed up against each side of the frame in turn will give prints which produce a three-dimensional effect when viewed in a stereoscope.

Effective as the stereoscope may have been, its usefulness is limited by the fact that only one viewer could look in at a time and there was only one position from which to view. Consequently, it could never be applied in the cinema, where the screen is viewed by an audience seated over a wide range of position.

Anaglyph Method for Still and Moving Pictures

Another system for obtaining the illusion of depth, known as the anaglyph method, was used in the 1920s and dispensed with the viewing frame. The photographs were transferred to printing blocks and printed one on top of the other, but slightly offset laterally with respect to each other. One photograph was printed in red and the other in green-blue ink.

The stereoscopic effect was produced by viewing the composite print through spectacles, in which one of the eyeglasses consisted of a piece of red glass or celluloid and the other of green-blue glass. The green-blue light from one print was prevented from entering one eye because it could not pass through the red eye glass, whilst the red light was similiarly prevented from entering the other eye. Each eye, therefore, saw only one image and a three-dimensional effect was produced.

This system was successfully adapted to moving pictures in the middle 1930s, when a film called "Audioscopics" was made and in which a series of startling effects were produced.

Unfortunately, there were several practical disadvantages to this system. Apart from the communal use of viewing spectacles, the fact that one eye was constantly receiving a red image and the other a green-blue image was liable to cause eyestrain and fatigue; nor was it possible to make coloured pictures by this method. Therefore, in spite of the comparative simplicity in making and showing films by this method it has not been further exploited.

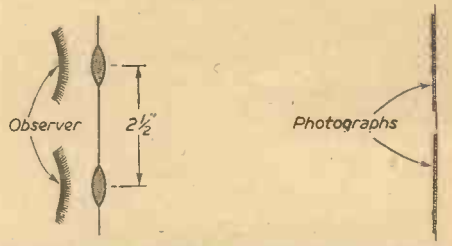


Fig. 3.—Diagram showing the position of the lenses and photographs in a stereoscope.

Polaroid Method for Stereoscopic Pictures in Natural Colour

The way to make and project colour films in depth has long been known, but the practical application had to wait until the discovery of a new material, known as "Polaroid," enabled suitable viewing glasses to be made cheaply.

Light is propagated as a series of vibrations and in a beam of light these vibrations occur in all directions perpendicular to the direction of the beam. It is possible, by

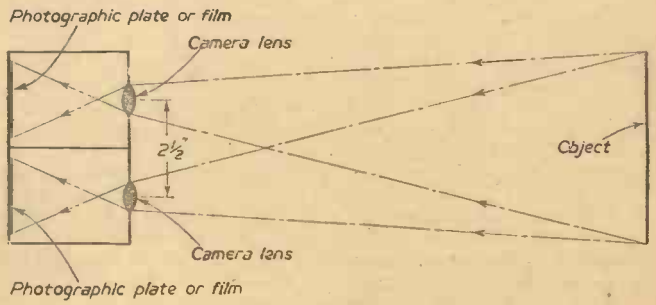


Fig. 2.—Principle of the twin lens stereoscopic camera. Note the marked similarity to the eye in respect of image formation.

passing the beam of light through an apparatus known as a Nicol prism, to confine the vibrations to one direction only, and such a beam is said to be "plane polarised." Of course, one does not notice any difference in the beam of light, but if a further Nicol prism is placed in the path of the emerging beam and rotated, a setting is found where no light gets through the second prism.

The discovery a decade or so ago of the material known as "Polaroid," which proved to be a substitute for the Nicol prism, and could be produced in large sheets, meant that stereoscopic colour films became a possibility.

In this system, the picture is recorded, via a twin lens camera, on two synchronised films. The projection of these films is more complicated than hitherto. With the existing projection equipment, two projectors have to be run synchronously, with one of the two films in each and adjusted so that the right amount of separation of the images on the screen is achieved. A suitable "Polaroid" filter is placed in the path of each projector beam, so that the light in each beam is plane polarised and the filters are adjusted so that the plane of polarisation in one beam is at right angles to that in the other.

The screen is viewed through spectacles having glasses made from "Polaroid" and these are adjusted so that the image from the left-hand projector is viewed by the left eye only and vice versa, and the stereoscopic effect is thus produced.

The advantages to the audience in this system are obvious. Natural coloured pictures can be shown and eyestrain due to mono-colour fatigue is relieved, but scrupulous care must be taken during projection to ensure that the correct separation of the image is obtained on the screen, or other types of eyestrain and headaches are apt to occur.

The present projection difficulties, which require each cinema to have four projectors, synchronised in pairs, if there are not to be breaks in the projection of the film, will no doubt be overcome by the use of twin track projectors with split beams of light.

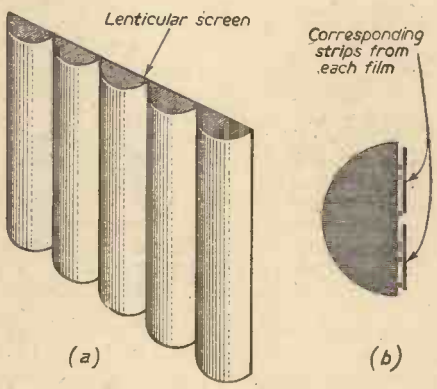


Fig. 5.—(a) Showing a section of a lenticular screen.
(b) Enlarged diagram of a cross-section of one lens of the screen.

Lenticular Screen Technique

Nevertheless, there are aesthetic and other considerations which have encouraged the development of other systems for producing stereoscopic effects. It has been rightly argued that the ideal system would be one in which the audience were freed of the obligation to wear spectacles, or other viewing aids, and such a system has been evolved in which the image separation is done automatically at the screen, and is reputed to be in use in two Moscow cinemas.

Basically, the screen can be imagined as being made up of a large number of long narrow, vertical, cylindrical lenses and immediately behind each lens, corresponding strips of each film are projected side by side (Fig. 5), so that the left eye sees only one image strip behind each lens and the right eye sees only the other. A complete image is thus seen by each eye and a three-dimensional effect is produced.

Presumably, in this system, back projection is employed and suitably spaced grids in each projector beam break up the two pictures into strips of the right dimensions.

There is no record of this system having been used anywhere other than in Russia and it is difficult to see how a large audience dispersed throughout the cinema can look at the screen and each receive a truly stereoscopic picture.

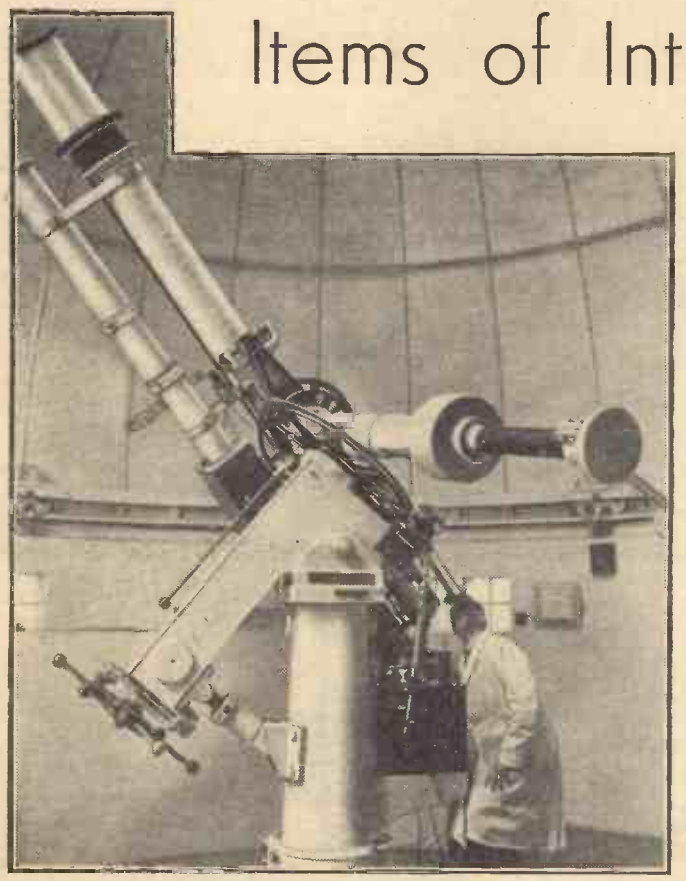
Wide Screen and Stereophonic Sound

A recent American invention which uses a wide curved screen is being used in cinemas there and is said to give an illusion of depth which is enhanced by the use of multiple sound tracks and loudspeakers distributed throughout the auditorium.

The pictures are taken and projected on conventional cameras and projectors, and the illusion of depth is produced because, owing to the size and shape of the screen, the eye is not able to focus on all of it at once.

This system has recently been demonstrated at a London cinema, and it is reported that more are being fitted with the special equipment.

Items of Interest



Interior of the Solar Dome in the Royal Observatory at Hurstmonceux Castle, showing the Newbegin telescope with Greenwich 4-inch photographic heliograph for photographing the sun.

Powerful New Plane Engines

IT is reported that Rolls-Royce, Ltd., has developed two new versions of the famous Avon engines, which power some of the world's fastest aircraft, including Neville Duke's record-breaking Hawker Hunter, the Comet II and the Canberra. Details of the performance of the new R.A. 21 and the R.A. 22 are still secret.

The Comet II, which has Avon axial flow turbo-jets of 6,500lb. thrust each, gives a cruising speed around 500 m.p.h.

The new engines are designed to develop considerably more thrust. The R.A. 21 has produced 8,050lb. thrust test rating and the R.A. 22 7,150lb. thrust test rating.

Measuring the Metre

THE international standard meter is kept in a vault beside the observatory of Meudon, close to Paris. Several countries have one of the set of keys for opening the door that leads to this vault, and it cannot be opened unless the representatives of all the countries employing the metric system are present at the same time.

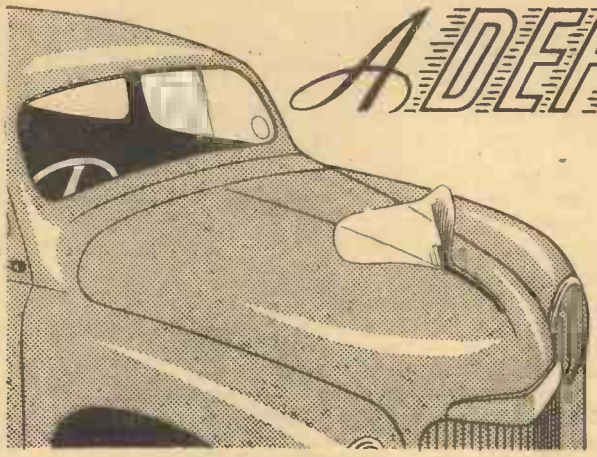
An inaccuracy crept in when the first metre was made. It was intended the metre should measure one ten-thousandth part of the quarter of the earth's meridian passing through Paris; and it is two-tenths of a millimetre short.

But it will no longer be necessary to keep the standard metre with such care. At a recent congress, wavelengths were studied which could be used to give the measure of a metre with the greatest possible accuracy. The spectroscope revealed that the vibratory phenomenon of spectral lines was of extraordinary regularity, and it is on that basis the calculation of the metre will be made. The red cadmium band has a wavelength of 0.64384696, and a metre would be equal to this length multiplied by 1,553,164.12. It's all very simple. Thus the metre can be reproduced anywhere in the world and be absolutely accurate.

Oil Consumption in Britain

LAST year Britain used about twice as much oil as before the war, and exported over 12 times more than in 1938.

In 1938 the import of refined oil was 82 per cent. of the total. To-day it is 21 per cent. In 1938, also, two-thirds of U.K. petroleum imports were from the Western hemisphere. Now they come from the Middle East, while the West supplies only one-fifth.



A DEFLECTOR for your car

A Useful Accessory Which Keeps the Windscreen Clean by Deflecting Flies, Mud, etc.

By C. T. MACKLIN

WITH few tools, average skill, and a piece of 3/16in. Perspex, 10½in. x 4½in., it is possible to make quite a professional-looking deflector for the bonnet of your car. This useful accessory assists in keeping the windscreen clean by diverting the stream of air caused by the forward movement of the car to points beyond the area of the windscreen, and carries with it mud and flies which would otherwise settle on the screen.

The angle to which the deflector is shaped largely depends upon the distance of its fixing point from the windscreen, the longer distances having a more acute bend. With a fixing point of 3ft. 8in. the following type has proved successful, but it will be readily seen how the actual shape can be adapted to suit different conditions.

Marking Out and Cutting

The shape is first set out on the backing paper on the sheet of Perspex (Fig. 1) and waste removed with a coping saw. The edges should be cleaned and polished before removing the backing paper.

A former should be made upon which the softened Perspex may be shaped. This can be of wood or clay as shown in Fig. 2. A spadeful of clay from which stones have been removed is excellent as it can easily be rolled to a slab 1¼in. thick, after which the waste clay in the centre is removed with a hacksaw blade. The same tool is afterwards used to make a smooth surface. The clay should be allowed to harden before shaping the Perspex.

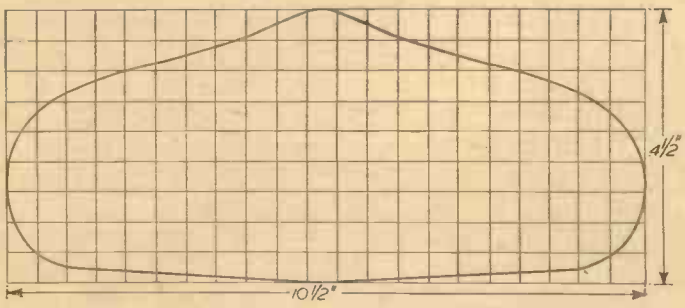


Fig. 1.—How to mark out the shape.

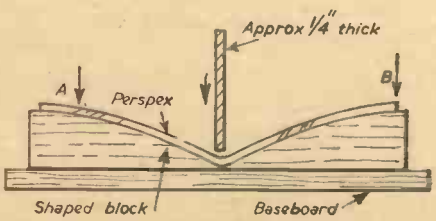
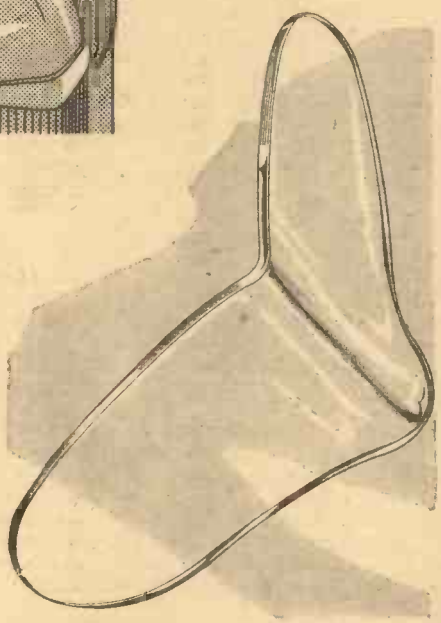


Fig. 3.—Method of bending the Perspex.



The deflector, bent to shape, and ready for fitting in place.

Alternatively, blocks of softwood can be shaped and fixed to the baseboard. This makes a good job, but, perhaps, may be too permanent for merely one shaping.

Softening and Bending

Having prepared the mould with smooth surfaces the piece of flat Perspex is then softened in boiling water or, preferably, in a gas or electric oven set at a low temperature. For those with no experience in handling this material, first soften one of the waste corners from the original sheet so as to get some idea of the length of time required to achieve plasticity. Plasticised Perspex is pliable at 100 deg. to 110 deg. centigrade, and excessive heat will cause small blisters. It is quite easy to open the oven door to test for softness, and this should be done after two minutes.

Bending the Perspex

When in a pliable state transfer the Perspex quickly to the mould and apply pressure at the points shown, first in the centre with a clean rod or the rounded edge of a thin piece of wood. Another pair of hands should assist by applying downwards with two pads of smooth cloth at points A and B (Fig. 3).

The Mounting Clip

It should be possible to get some sort of standard clip to fix the deflector to the bonnet or the bonnet motif. Alternatively, suitable clips, as shown in Fig. 4, could be made from strip brass. The deflector should be fixed so that it leans backwards slightly, as shown in the illustration at the top of this page.

If the instructions are followed closely, the result should be as effective as the commercial deflectors now on the market, both from the points of view of utility and smart appearance.

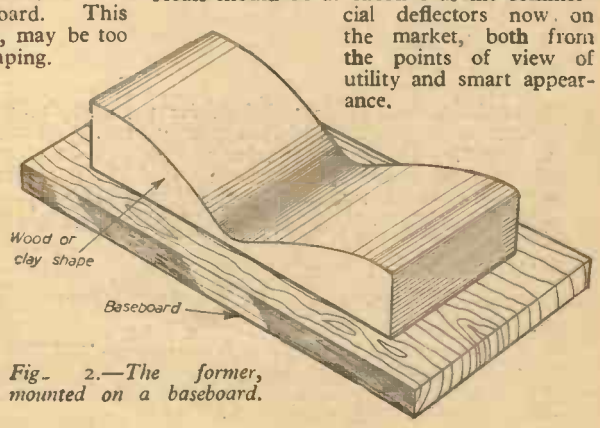


Fig. 2.—The former, mounted on a baseboard.

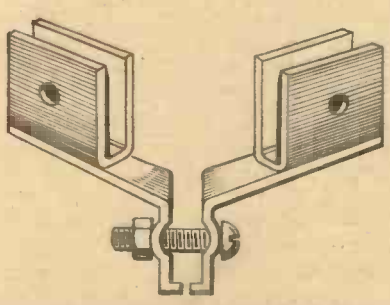


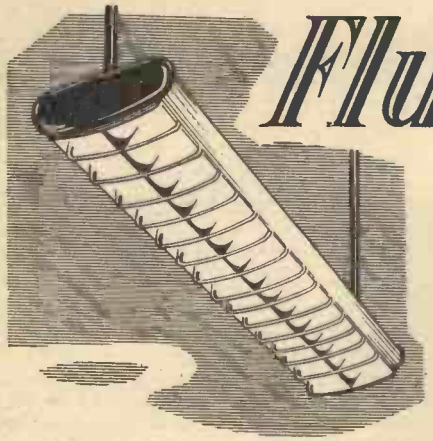
Fig. 4.—Brass clips for fixing the deflector in place.

"Plastics Art and Craft"

READERS interested in working with Perspex, Catalin, Casein Plastics, and cellulose acetate, and the special purpose plastics such as Nylon, Crinothene, etc., and especially those who wish to make articles for the home or accessories such as that described on this page should obtain a copy of *Plastics Art and Craft*, published by C. Arthur Pearson Ltd., at 8s. 6d.

This well illustrated and comprehensive book explains how to make a number of articles such as trinket boxes, cigarette boxes, table lighters, bangles, serviette rings, stud boxes, powder bowls, hair brushes, etc.

The use of the necessary tools is also fully described.



Fluorescent lighting

With Notes on the Construction of Fluorescent Lighting Fittings for Domestic and Workshop Use

By W. McMILLAN

IT is now over twelve years since the first commercial fluorescent lamp appeared on the market, and during the last few years of the war this type of light source provided better lighting for vital production, as well as saving electric power for other uses. To keep tube production at a peak, only one type of lamp was made—a 5ft. tube which consumed 80 watts and gave as much light as a 150-watt bulb. The 5ft. tube is still the most popular size, although its light output and operating life have been greatly increased since those early days, but now a complete range of lengths has been introduced, from the 18in. 15-watt to the 8ft. 125-watt.

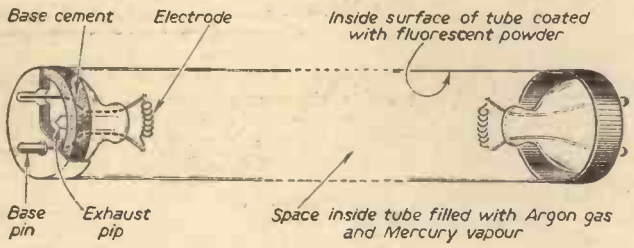


Fig. 1 (Left).—A cut-away view of a modern fluorescent tube showing the electrodes.

Fig. 3 (Right).—A "glow" starter switch and details of its canister and socket.

Before proceeding to a description of simple fluorescent lighting fittings for the home constructor, details of the construction and operation of fluorescent tubes and their associated equipment are given. This will help the constructor to understand the behaviour of the equipment and provide valuable data for the repair and maintenance of existing commercial fittings.

The Fluorescent Tube

In contrast to the ordinary filament lamp the light from which is only a by-product of heating the metal filament, the production of light from a fluorescent tube is achieved in two stages. A current passing through the filling-gas first produces ultra-violet radiation which strikes the powder coated on the inside walls of the tube. The powder then absorbs the radiation and converts it to visible light, the colour of which may be varied by varying the chemical composition of the powder. The fluorescent tube does this job of "production and conversion" very efficiently and, in fact, its efficiency expressed in light-units per watt is three to four times that of filament lamps of comparable wattage.

Fig. 1 shows a cut-away view of a modern fluorescent tube showing the electrodes which act as anode and cathode each alternate half-cycle, the powder coating, the exhaust pip and the end caps. The internal filling is of argon gas at a low pressure, and mercury vapour which contributes to the production of ultra-violet energy.

Ballast Equipment

If such a discharge tube were to be connected direct to the power supply, more and more of the gas-filling would ionise, allowing the current to build up to enormous proportions, until the electrodes were completely destroyed. In practice, however, the current is controlled by a "ballast" which is wired in series with the tube to keep it operating within its rated limits. The ballast may be a wire-wound resistor of high wattage rating, and in some fittings a filament lamp is used, this producing light also, improving the overall efficiency of the circuit. These resistance and lamp ballasts are not recommended as usually more power is lost in the ballast than is taken by the tube itself, thus taking away the advantage of high efficiency.

Choke ballasts are the most suitable, and are almost universally used, as theoretically there is no loss of power in a pure inductance. In the practical case, even the best ballast dissipates a few watts, but these are of a negligible order. Thus all the power taken from the mains is passed to the tube for conversion into light, and the circuit is a high efficiency one.

In effect, there is an inductance and a resistance across the mains, and this results in a power factor of less than unity. As the voltage across the tube is roughly half the mains voltage, the power factor (PF) is generally of the order of 0.5. Although this fact does not show on the domestic electric meter (kWh), the authorities recommend the correction of the power factor to reduce the "wattless current" in the mains. Correction is effected by wiring a suitable condenser across the supply at a point near the tube circuit, and units are marketed, containing both choke and condenser known as high power factor (HPF) ballasts.

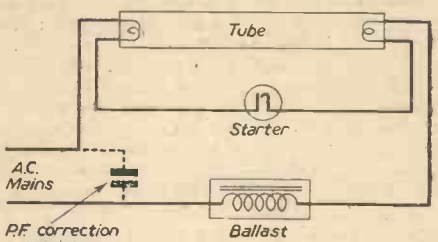
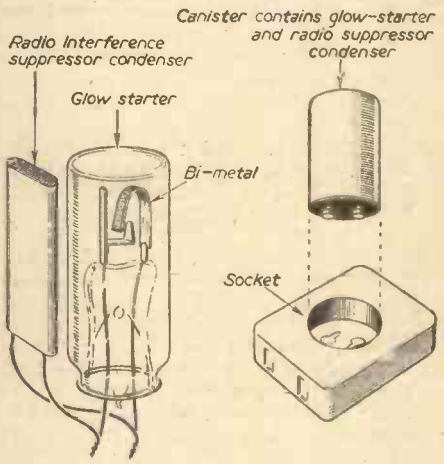


Fig. 2.—Starter circuit.

Starter Switch

Because of the length of the path between the electrodes, the tube will not light merely by switching on the power, as the mains voltage is not sufficiently high to start ionisation of the gas. To overcome this the circuit in Fig. 2 was devised and operates as follows: Mains are switched on, starter switch closes, completing a series path with the tube electrodes which heat up to operating temperature in a few seconds. The starter then opens and, interrupting an inductive circuit, produces a high-voltage "kick" which is sufficient to ionise the gas and start the discharge.



The most common type of starter switch is the "glow-switch" (Fig. 3), which consists of a piece of bi-metal sealed in a gas-filled glass bulb. On switching on, the mains voltage appears across the starter and ionises the gas-filling producing heat which bends the bi-metal. The bending metal short-circuits the starter completing the circuit to the tube electrodes. Being short-circuited, the gas is extinguished and cools, bringing the bi-metal back to its original shape, again opening the starter, providing the kick to start the tube conducting. The action is not repeated since the voltage now across the starter is the "tube voltage" which is too low to re-ionise the gas.

Instant Starting

It has been found that most tubes will start successfully without the inductive

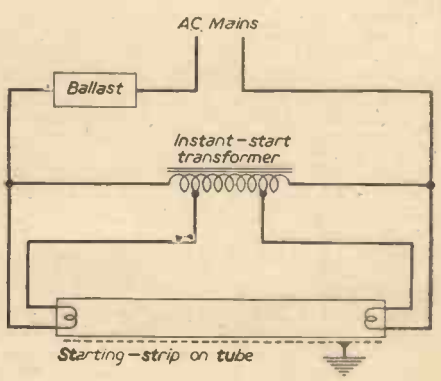


Fig. 4.—Circuit for instant starting, using a transformer for heating the electrodes.

kick, provided that the electrodes are brought up to operating temperature, and any static charges on the surface of the tube are neutralised. The circuit in Fig. 4 shows a method of heating the electrodes, using a transformer. This circuit enables the tube to start within less than half a second of switching on, and has been classed as the instant start circuit. For reliable operation the tube should be near an earthed fitting or have a thin metal strip fixed along its length, the strip being earthed. Special graded "instant start" tubes are now made with this strip already fitted. The earthed strip provides a leakage path for the minute static charges which form a barrier to starting.

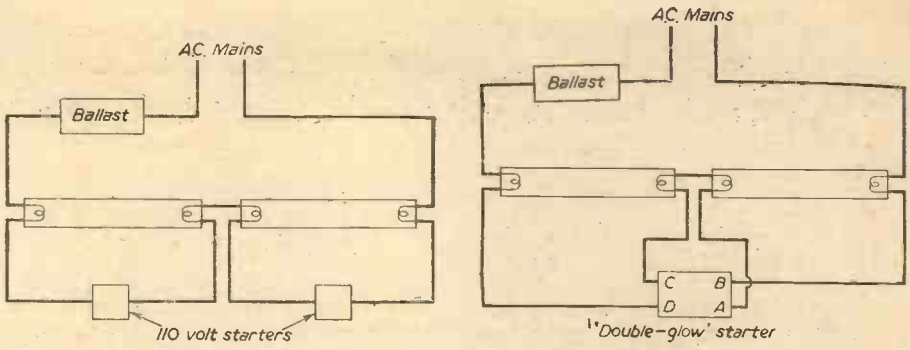


Fig. 7.—Circuits for series operation of fluorescent tubes.

Fittings

In the simplest case, a fitting can be made by mounting the ballast, starter and tube holders on a stout wood batten about 2½in. by 1¼in. cross section, the length being cut to the nominal length of the tube used. Such a fitting is shown in Fig. 5 with (a) a simple ballast circuit, and (b) a HPF ballast unit which incorporates the starter. The wood batten should be given a coat of size, an undercoat and a hard white enamel top

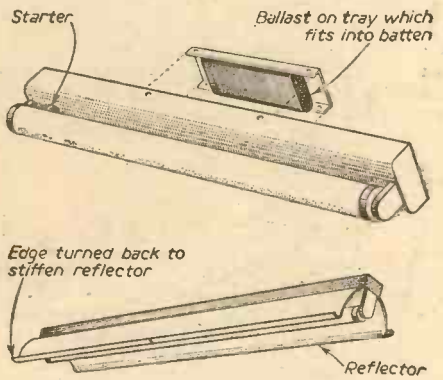
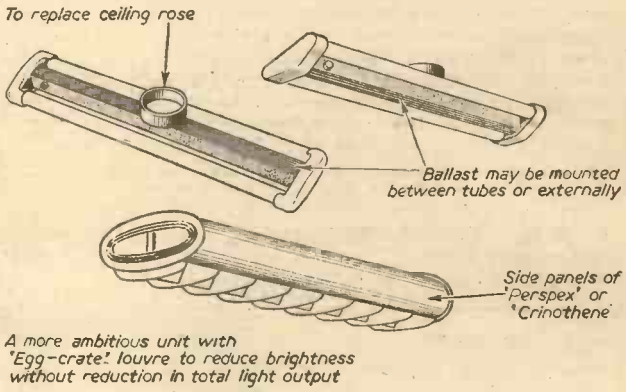


Fig. 6 (Left).—Details of a commercial type batten fitting.

Fig. 8 (Right).—Two types of simple fittings using series pairs of tubes.



coat so that it may be easily cleaned and act as a good reflector. Where the ballast is considered too clumsy or heavy for ceiling mounting it may be concealed in the loft or cupboard, although the leads should not be unreasonably long. This leaves only the tube and starter mounted upon the wood batten.

A commercial type batten fitting is shown in Fig. 6. When complete, this is a self-contained unit ready to connect to the mains. Construction may be of 20 swg aluminium or mild steel, with the end pieces riveted or welded to form a rigid structure. Rigidity is of prime importance, since any tendency to bend might allow the tube to slip from the holders. The metal should have an enamel finish for best reflecting properties.

To all of these fittings a reflector can be added if required, of aluminium or steel, the general shape of which is shown. Slots should be cut in the top of the reflector to allow about 10 per cent. upward light to prevent what is known as "tunnel effect."

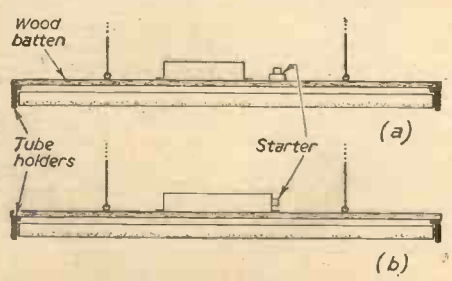


Fig. 5.—Simple fittings made by mounting the ballast, starter and tube on a wood batten.

Series Operation

Where limited space is available, or where a short fitting is required, two of the short tubes may be wired in series and mounted side by side. Circuits for such a combination are given in Fig. 7. The first has two separate "glow switch" starters of the 110-volt type, and the second uses a "double-glow" starter (Atlas patent), which has a 4-pin base. For two 18in. tubes in series, a 30-watt ballast is used, while for two 24in. 20-watt tubes a 40-watt ballast is required, and two 24in. 40-watt tubes require an 80-watt ballast. The importance of using a ballast of the correct voltage rating cannot be overstressed, as any departure from the rated running conditions shown in the table results in short tube life and poor performance.

Two sketches are given (Fig. 8) of simple fittings using series pairs of tubes, the dimensions of which vary according to the size of tube chosen and the size of the ballast. The cross section of the ballast will govern the dimensions of any fitting to incorporate it, although a smaller and lighter fitting is obtained by remote mounting of the ballast, in which case its size is not critical. Nearly all ballasts other than the 80-watt type are of small section—usually about 2½in. by 1¾in., with the 80-watt about 3½in. by 2in. Because of these variations between different brands, it is wise to buy the ballast first and build around it. The sizes of other components are standardised, making replacement easier. Good ballasts should last indefinitely, the usual cause of failure being the breakdown of the PF condenser. Starters should outlast several tubes and their life will be preserved if, when the tube reaches the end of its life, it is not kept switched on, trying to light. The end of tube life is marked by heavy black rings at its ends, a yellow glow and an inability to light soon after switching on. If kept switched on, the starter will keep trying to start the lamp, damage itself, and overheat the ballast also.

Installation Hints

Where the fitting is constantly in the field of vision, eye-fatigue through glare is likely to be experienced to a slight extent. A metal reflector as already described should be fitted to conceal the tube from that direction, or an egg-crate louvre may be applied as in Fig. 8. Equally, the apparent brightness of the tube surface may be reduced by a diffusing cover of Perspex or Crinothene, and this treatment is recommended for all domestic installations where the tube is seen. "Indirect lighting" is the ideal form, where

(*Continued on page 133*)

Table of Tube Sizes and Operating Data

Nominal length in inches	Rated Watts	Tube current (amps.)	Volts across tube	Average light output through life (lumens)	Average operating life (hours)
18	15	0.3	56	420	5,000
24	20	0.35	62	620	5,000
24	40	0.88	50	1,160	5,000
36	30	0.34	103	1,200	5,000
48	40	0.41	108	1,700	5,000
60	80	0.85	106	3,000	5,000
16in. diameter circle tube	40	data not available		1,360	5,000

The figures for light output apply to Daylight and Warm White colours only. Natural, Peach and Mellow tubes are slightly lower, but have better colour properties.

The 18in. and 24in. lamps may be operated singly on either 110 volt or 200/250 volt mains, or two in series on 200/250 volt mains with suitable ballast. No ballast is made for single tube operation of the 24in. 40-watt tube, which should therefore be used only in pairs.

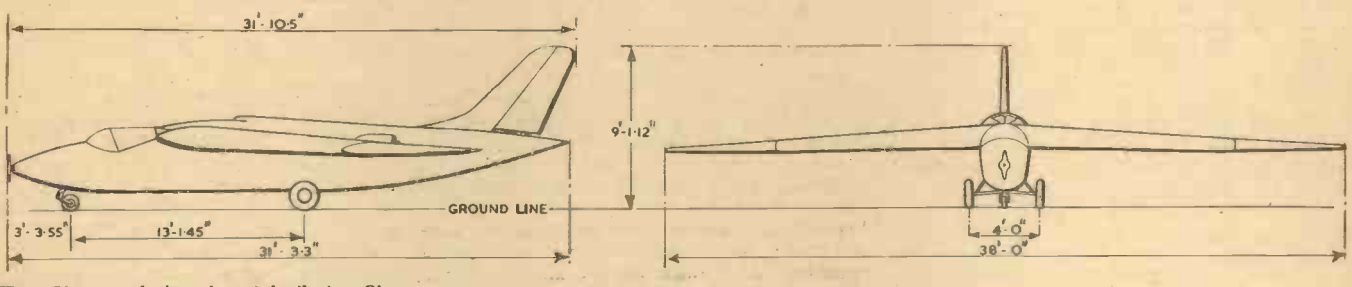
New Short Research Aircraft

Brief Particulars of the Sherpa Swept-back Wing Monoplane

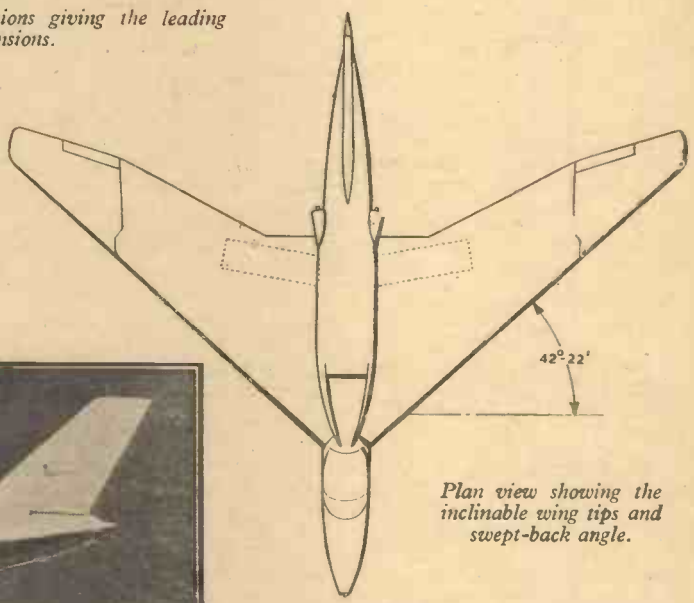
A NEW aircraft, which may revolutionise the shape and performance of future aeroplanes, has made its first flight in Belfast. It is the Short Sherpa, a research aeroplane, designed as a forerunner of high-speed aircraft flying at very high altitudes.

The Sherpa, designed and built by Short Bros. & Harland Ltd., of Belfast, has two revolutionary features. It is the first aircraft ever to fly with an "aero-isoclinic" wing—a new technique patented by Short's—and instead of conventional ailerons and elevators, it has inclinable wing tips which act as controls.

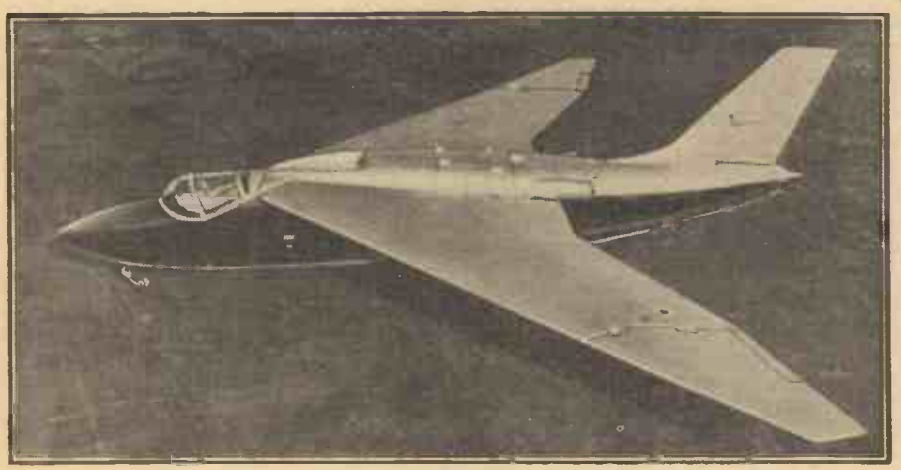
The aero-isoclinic wing has been designed by David Keith-Lucas, Shorts' chief designer. Instead of being stiff it is relatively flexible, and the inclinable wing tips serve as both ailerons and elevators. These tips comprise about one-fifth of the total wing area and make it possible to dispense with the normal tailplane and elevators.



Side and front elevations giving the leading dimensions.



Plan view showing the inclinable wing tips and swept-back angle.



The Short Sherpa aircraft fitted with the new "aero-isoclinic" wing.

When a normal swept-back wing bends upwards due to air loads it automatically loses incidence and lift at the tips. This gives rise to a form of instability which can best be illustrated by an aircraft pulling out from a dive. The additional load which comes on the wing due to the pull out causes the tips to bend upwards, and on losing lift at the tips, which are well towards the rear of the aircraft, it pulls out still more sharply.

This is overcome on the Short isoclinic wing by making it twist as it bends. For this reason the wing has to be more flexible than usual and special types of ailerons have to be used.

Additional Manœuvrability

It is expected that the inclinable wing-tip controls will be markedly superior to flap-type controls at transonic speeds and will make the aircraft more manœuvrable at high altitudes.

The Sherpa itself is a research aircraft and is not capable of high speed, but the lessons learned from its tests will form the basis of design of future high-speed civil and military aircraft.

Turbomeca Engines

The Short Sherpa is a swept-back shoulder wing monoplane, with two small Turbomeca jet engines mounted side by side in the centre of the upper part of the fuselage, just behind the cockpit.

This aircraft is the third new aircraft to be produced by Short Bros. & Harland in the past 12 months, and is the second wing-research aircraft to come from their design team. The Short S.B.5—the adjustable wing 'plane, which is investigating swept-back wing problems—has been flying for some months.

The Sherpa was flown on its first flight by Tom Brooke-Smith, chief test pilot to Short Brothers.

Plastic Wheels for Lawnmowers

SELF-LUBRICATING plastic wheels—for use on a 33lb. lawnmower—which are stronger than aluminium or cast iron have been produced from styrene copolymer materials at half the cost of wheels made from other materials and metal. The wheels, designed by the Newark Stove Co., Newark, New Jersey, are moulded of Kralastic, and when finished and fitted with rubber tyres weigh only 18oz.

The wheels are injection-moulded in two halves, with the axle housing moulded as part of one half in a sleeve-like projection. The wheel halves are removed from the mould, de-gated, and riveted together. The tyres are slipped around the wheel rims. The steel axle shaft (dipped in light oil during assembly) is inserted into the sleeve and fastened in place by nuts and washers. The oil seals the sleeve, preventing abrasive particles from entering, and eliminates wear and scoring of the bearing surface. The oiled axle rides directly in the housing and gives self-lubricating properties to the mower.

The finished wheel survived a shock test without evident damage, in which under a weight of 70lb. it was rolled over ¼in. lugs fastened to a hard surface at a speed of 27 r.p.m. for 60 hours. To determine the expected service life the mowers were put through a field test of 200 hours, approximating two to three years of normal service. This test showed a minimum of wear and no squeaking.

Glass-working for Beginners

The Properties of Glass, and the Simple Tools and Processes Used for Working It

By E. HARRIS MORGAN, B.Sc.

(*Concluded from page 67, November issue*)

THERE are two main methods which can be employed for joining tubes of unequal diameter. The first method is to draw out the larger diameter tube as shown in Fig. 23a. It is then cut off at the point

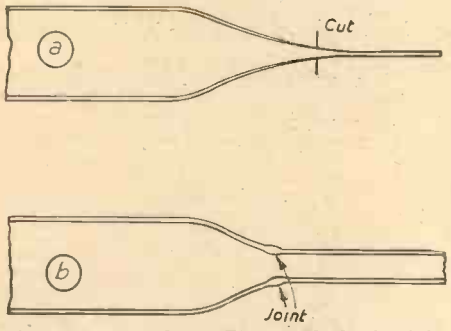


Fig. 23.—a and b. First method of joining tubes of unequal diameter.

which corresponds to the diameter of the smaller tube and the joint is worked in exactly the same manner as for tubes of

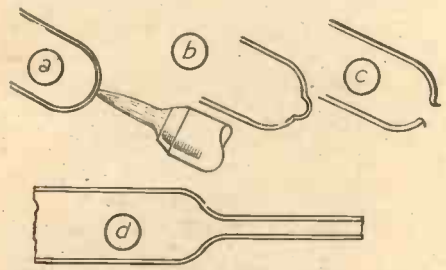


Fig. 24.—a, b, c and d. Second method of joining tubes of unequal diameter.

equal diameter. Fig. 23b shows the appearance of the finished joint.

The second method is more complicated, but repays the extra work which is put into it.

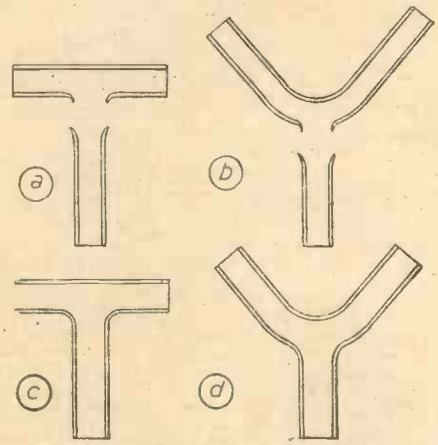


Fig. 25.—Making "T" and "Y" joints.

The end of the larger diameter tube is first closed and rounded. Whilst still hot, it is heated at the end by means of a small pointed flame (Fig. 24a). When a red spot appears at the end of the tube, it is blown out into a small bulb (Fig. 24b). This small bulb is heated in a slightly larger flame and blown out with a single strong puff. The thin glass is cleared away from the edges of the hole which now appears as in Fig. 24c. The smaller diameter tube (already flanged) is heated up together with the large diameter tube and, when quite soft, they are pressed together and pulled slightly apart as before. The working of the joint follows the normal procedure as described previously. The finished joint appears as in Fig. 24d.

"T" and "Y" Joints

The procedure to be followed for making "T" and "Y" joints is similar to the second method for joining tubes of unequal diameter. In this case, however, a hole is blown in the side of the tube as shown in Figs. 25a and 25b. Two of the open ends are blocked with bungs and a rubber blow-tube connected to the third free end. The joint is made and finished in the normal way. Figs. 25c and 25d show the appearance of the finished joints.

Sealing Wires Into Glass

In order that a seal with good mechanical properties may be obtained, a metal which

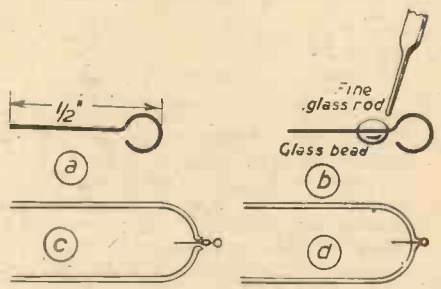


Fig. 26.—Sealing platinum wire electrodes into glass tubes.

has the same coefficient of expansion as glass must be used. Other properties of the metal (such as its capacity of being "wetted" by

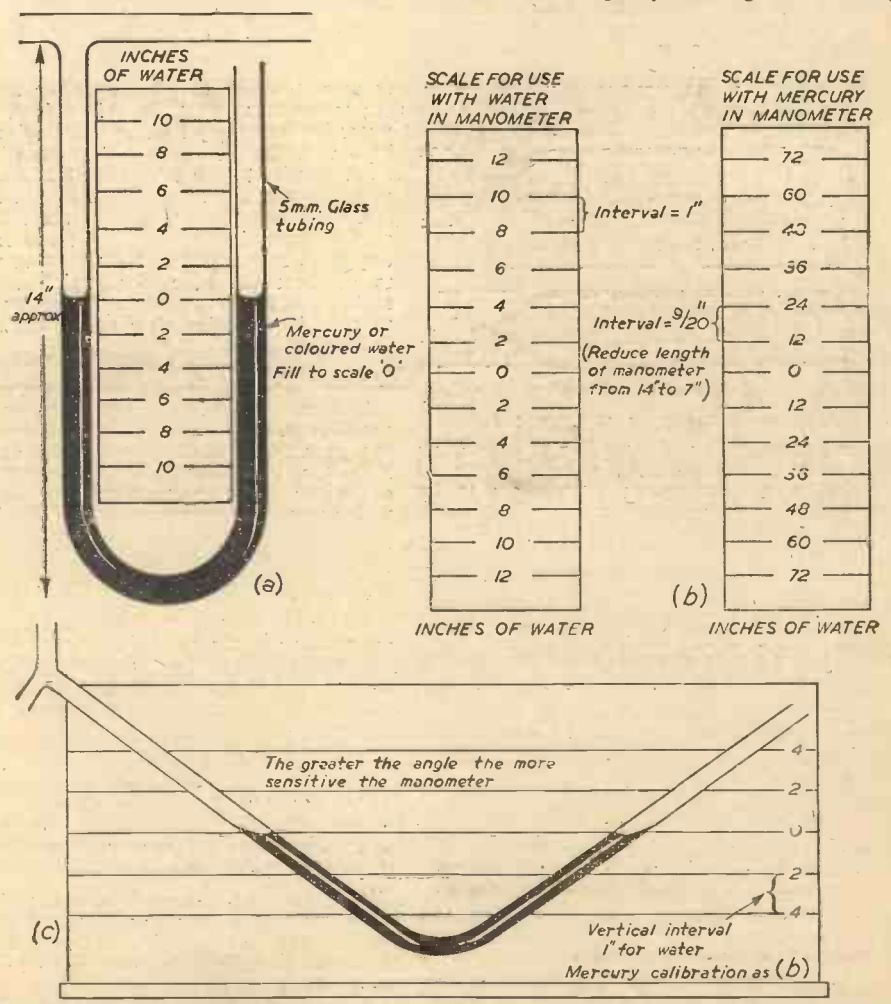


Fig. 27—a. The manometer with scale calibration for water. b. Scale calibration for mercury. c. A sensitive manometer.

glass) must also be taken into account. In general, however, the only really suitable metal for soft glass is platinum. Platinum is a very expensive metal, but fortunately we can make the seals by using very short lengths of platinum wire.

The first part of the process is to blow a hole in the glass at the required point. This is accomplished by heating the glass with a fine pointed flame while maintaining an air pressure inside the apparatus. In this way the glass is blown as soon as it softens, and a very small hole is produced.

A short length of platinum wire is now taken and one end bent as in Fig. 26a. The wire is held in a pair of pliers, and, while being heated is touched with a fine spindle of glass as in Fig. 26b. When cool the wire is placed in position as in Fig. 26c and the work heated and manipulated to form a good seal. Fig. 26d gives a view of the completed seal.

Making Simple Apparatus

The reader who has mastered the techniques described in this article will be able to carry out the construction of many useful simple pieces of apparatus, some of which will not at first appear to be so very simple, but careful planning of the order of work will reduce most operations to the application of known methods. At first, of course, there will be many failures, but this is true of any craft, and only patience, practice,

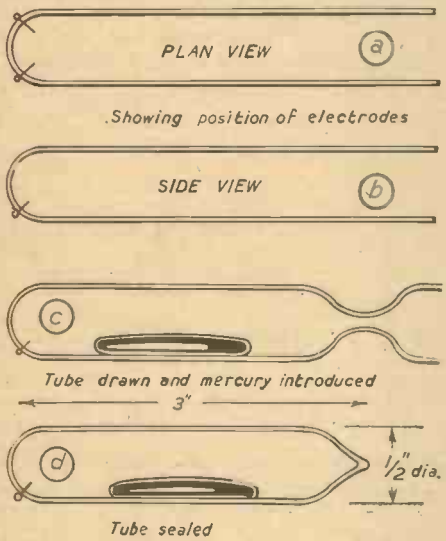


Fig. 29.—Details of a mercury tilt switch.

and a thorough understanding of underlying principles can enable the high degree of skill of the competent glassworker to be attained. Most of the failures which occur in glassworking are due to either lack of thoroughness in annealing, or to the too rapid heating of the glass. Glassworking processes cannot be hurried; in fact, "The Slower the Better" might be a good motto to hang over the work bench.

A few simple pieces of apparatus are described below for the purpose of practice in the craft.

The Manometer

Fig. 27a gives details of a manometer suitable for measuring the gas pressure at the supply point or the air pressure developed by the blower unit. The gas pressure is about seven inches of water, and in this case the manometer is filled with water. The optimum air pressure for a blowlamp is about forty-eight inches of water. This means that if the manometer is filled with water it will be unduly long, but it may be made of convenient length if it is filled with mercury, and in this case the dimensions given in the diagram may be used. It

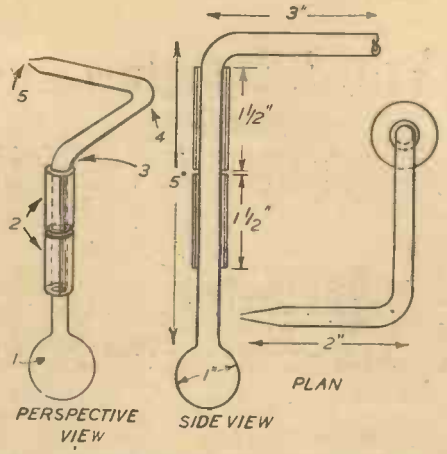


Fig. 28.—Details of Hero's steam engine.

should be noted that if the manometer is filled with water, each scale inch should actually be one-half inch. In the case of a mercury-filled manometer the calibration will, of course, be different. Fig. 27b gives details of the calibration of a mercury manometer. In Fig. 27c is shown a more sensitive manometer which measures lower pressures. The method of calibration is indicated in the figure. A small spirit level should be fitted to the base board of the manometer, and the instrument should be calibrated and used with the base board horizontal.

Hero's Reaction Steam Turbine (*circa* AD 100)

The piece of apparatus described below is a modification in glass of a very early steam engine working on the jet reaction principle. Full details of the instrument are given in Fig. 28. It is included as an exercise in some of the simpler processes. To operate the instrument, the bulb is half filled with water by alternately heating and cooling the bulb with the jet under water. The lower short length of glass tubing is held in a pair of pliers and the bulb heated over a small flame. When the water boils, the reaction of the steam issuing at the jet causes the engine to spin rapidly. By taking care not to overheat the bulb, the engine can be refilled and used repeatedly. Do not attempt to refill immediately after using; allow the bulb to cool first.

Mercury Tilt Switch

This switch is of simple construction, but provides an exercise in closing a tube, sealing in wires, and drawing-off and sealing. Figs. 29a, b, c and d give the sequence of operations in the construction of the switch, with appropriate measurements. (The latter are not important, and can be varied to suit individual requirements.)

Thermostat

The thermostat is an instrument used for maintaining a constant temperature in, for instance, a bath of liquid. The model described here has a fair degree of accuracy and can be varied to control over a wide range of temperature. Fig. 30a gives the essential measurements and the associated circuit. A relay taking as low a current as possible should be used to prevent excessive drain on the battery. The sequence of operations is as follows: The wide bore tube is sealed to the narrow bore tube; the end of the wide bore tube is closed and rounded, the narrow bore tube is bent into a U-bend; the platinum electrode is sealed in position. The sliding electrode should be an easy fit in the narrow bore tube, and is held in position by a rubber band. The bulb of the thermostat is filled with toluene and the narrow tube with mercury. The temperature at which the instrument operates is varied by altering the position of the sliding tube for fine adjustment, or by altering the amount of mercury in the narrow bore tube for coarse adjustment.

Conclusion

The articles described above are merely given as exercises in glassworking, and it is appreciated that the reader might not wish to construct all, or even any of them, for

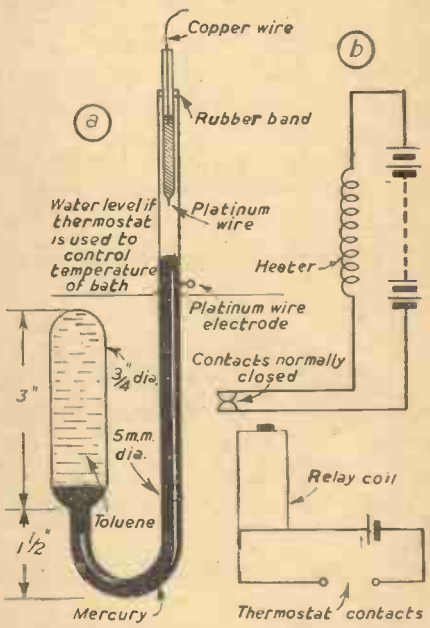


Fig. 30.—a. A simple thermostat. b. The wiring diagram of the associated circuit.

actual usage. The processes involved do cover, however, the essential techniques, and it is a simple matter to extend these techniques to the construction of many other pieces of apparatus; for instance, a model gasworks, or the hot water system of a house.

Whatever job is tackled, the reader is advised to plan the work thoroughly. A diagram of the apparatus (preferably full-size) should be drawn and the order of operations worked out so that no awkward situations arise during construction. Above all, work to the diagram, so that the finished article is the neat and exact piece of work that is the hallmark of a good craftsman.

CHROMIUM PLATING FOR THE AMATEUR

By M. P. DAVIES

The complete chromium-plating plant ready for use.

CHROMIUM plating on a small scale is usually looked upon as a little beyond the scope of the amateur. However, if the following methods are carefully followed, quite pleasing results can be obtained that will repay the time and trouble taken. It must be realised that the quality of the work obtained by the amateur cannot, in general, compare with that of the commercial plating shop.

Plating in General

A commercial plant may cost anything from £2,000 upwards, and would be staffed with highly skilled operators and technicians. The current generators would be capable of producing 1,000 amps or more and be of massive proportions, while the plating vats themselves would be capable of containing from 100 to 2,000 gallons of solution.

Each vat would have its own rinse tank, also of ample proportions. Massive copper busbars would be led to the tanks and be of adequate section to carry the large current used for the plating. In the case of chromium, every square foot (and the back of the article being included in the assessment of area) may take anything from 90 to 100 amps. Some car radiator shells and grilles have been known to require 1,000 amps.

Technical Terms

While on the subject of current, one should not confuse the terms current and voltage. Current meaning the flow of electricity or its volume. A comparable example being the quantity of water which passes a point every second on the Thames, say, compared with similar conditions on the Amazon. Voltage or pressure of electricity could be compared with the water rushing from a fire hose, this having a much greater pressure, but much less volume than a river. So, also, with chromium plating, the current may be high, but only a low voltage would be necessary, say, 3 to 6 volts. It will, therefore, be realised that the equipment will offer no danger of electric shock to the user.

Actual Practice

In actual practice nearly all chrome work is nickel plated previously, and very often the nickel has an undercoat or thin flash of copper. Present-day nickel plating solutions are the result of considerable research, because it was found that the early nickel would not stand up to the rigorous conditions imposed on the plate in the chromium tank.

Polishing

An important part of the process for producing bright chromium is that of polishing. Every article seen sparkling in chrome, owes its lustre, at one time or another, to the skill of the polisher, whose main job is to remove light scratches and blemishes found on the article as sent from the grinder or machine shop. These he will replace with very fine scratches made with his polishing "mop." These scratches would be visible only under a lens, but the article would normally appear highly polished. The polishing lathe itself is often driven by a 3 h.p. motor at 3,000 r.p.m., and is usually equipped to take two mops. After the article has been nickel plated it is returned to the polisher for final polishing or "colouring," and is then ready to enter the chromium tank, after which it is ready for dispatch.

The Amateur's Plant

Small fittings, such as nuts and bolts, small model parts, terminals, etc., are suitable for the process with the equipment described below. This layout has been devised in the simplest manner so that readers with the barest workshop materials and technical knowledge may experiment.

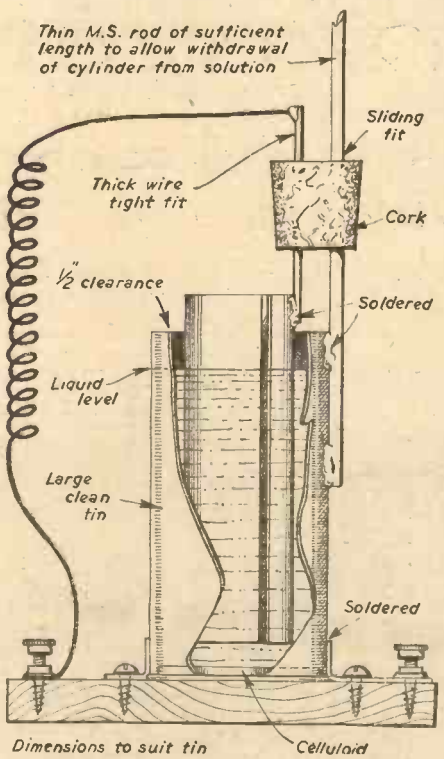


Fig. 1.—Sectional view of the variable resistance.

In the first place, no nickel plating and no polishing lathe is included, but any reader possessing these adjuncts would, of course, be able to produce a more professional finish.

The metals suitable for plating are the following: steel, copper, the brasses, nickel and German silver, but not aluminium. It will be necessary to have the following items: a charged 6-volt accumulator, a quantity of chromic acid, a little battery acid, some spirits of salts, two pieces of lead strip, some thin and some thick bared copper wire, and various odd pieces of easily acquired materials. It will thus be seen that the whole equipment is quite inexpensive.

Variable Resistance

The only part of the apparatus that will have to be made is the variable resistance, and details of this are given in Fig. 1. It consists of a cocoa or similar tin fixed to a baseboard by means of two right-angled tin strips which are soldered to the tin, one being longer to take a terminal as shown. It may be safer to solder up the seams of the tin as well. A vertical rod is also soldered on to allow a cork to slide up and down, which operation will later control the current to the plating "tank." On the cork is mounted a split cylinder of tin which may freely enter the cocoa tin but not make metallic contact at the bottom owing to a disc of celluloid (see Fig. 1).

The jam-jar containing the chromic acid should stand in a container of water, such as a tin or saucepan, mounted on two bricks, as in Fig. 2, and some source of heat provided underneath. A small spirit burner would be suitable. The glass-engraved type of thermometer is more suitable for use because the chromic acid would spoil the wood and markings of the ordinary kind. A pail would serve as a rinse tank.

Further Details

Scrape the lead strips bright with a knife. They are to be the anodes and, having made the variable resistance, wire all up, as in Fig. 2. Cut a piece of tin about 2in. x 2in. and solder to one end a short length of copper wire (about 3in.) in order that the tin may be hung on the centre thick copper wire and be immersed in the chromic acid. The centre thick wire is normally called the cathode bar or rod. This square piece of tin will act as a starter to condition the anodes for plating.

Warning

A timely word of warning is needed at this stage. The chromium process gives off considerable fine spray, injurious to the nose and throat. Ample ventilation should be given while the current is on. The ideal would be an extractor fan as in large plants. The skin and clothing should also be kept clear of the chromic acid, which substance

is liable to cause ulcers and skin troubles if neglected. Washing soda could be used as an antidote followed by clean water rinsing. There being some fire risk, the solid acid, particularly, should not be spilt about on sawdust, rag, etc.

Method of Operation

Warm the saucepan or container until the temperature of the water reaches 35 deg. C. (98 deg. F.). Remove heat, and allow the chromic acid to warm up, adjust heat again until the acid has reached 35 deg. C. The cylinder being out of the resistance solution, hang the tin starting plate on the centre rod of the jam-jar; his can be done simply by bending a hook on the end of the starting plate wire.

Lower the resistance cylinder slowly into the soda, until the starting plate gases quietly. Allow to continue for two minutes. Meanwhile, twist some thin wire round the actual job to be plated, preferably on a part of it that will not show later, raise the resistance again, take out the plate and leave in the rinse tank. Hook on the actual job as before, lower the resistance until there is a steady turbulence and gassing seen round the wire. Allow the plating to continue for half a minute only as a trial. Raise the resistance out of the soda, take out the job, and rinse well.

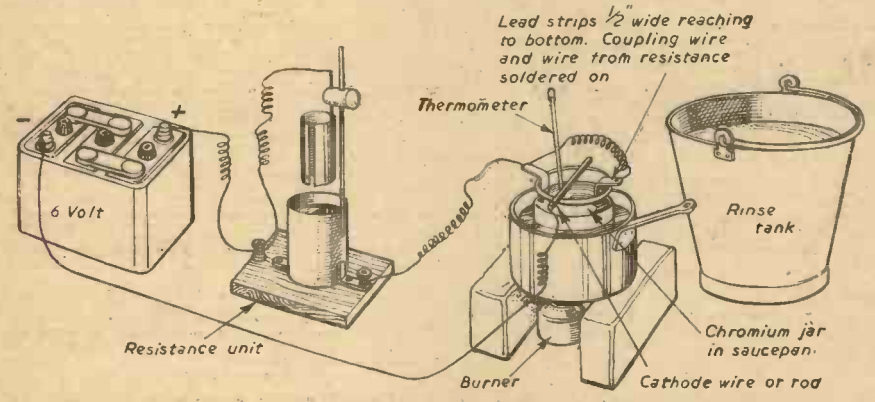


Fig. 2 (Left).—General arrangement of the chromium-plating plant, showing an ordinary pail used as a rinse tank.

Fig. 3 (Right).—How a small part to be plated is provided with a wire shield.

The result will be known as dull chrome, as the article was not polished. When one is confident of the procedure, plating can be continued for three minutes, but the temperature should not be allowed to rise over 45 deg. C. (113 deg. F.). Although no voltmeter or ammeter has been mentioned, these could be a help to those readers who possess them. After the first satisfactory job has been turned out by the gassing method, the voltmeter could be put across the anodes and centre rod, and its reading could be used as a rough guide for similar sized work, though normally instruments can be dispensed with.

The job to be plated must be free from paint, dark stains, grease and scale, but apart from this, no great care need be taken, when doing dull chrome, except for a cleaning up and wipe over.

Polishing is Necessary

If the usual bright chrome is required, the article must be polished to the best of the reader's ability, wiped over with a rag, and then plated.

All electrical joints should be perfect, the centre cathode rod should be kept clean, and preferably damp, to assist contact.

There are quite a few snags likely to arise, especially when articles of varying shapes are attempted. Chromium plating was never very simple, for technical reasons alone, but the reader will at least be able to make a start and gain interesting experience.

Polished fittings should not be left in the chrome solution, without the current being on, but should be started up instantly they enter the jar. The reason for this is that the chromic acid is apt to remove the fine polish before the chrome plate can protect it. This precaution is not so necessary with work that has been nickel plated, or with steel fittings. It is sometimes a help, in the case of irregularly shaped articles, to increase the current some 50 per cent. of their normal requirements. This "strike," as it is called, should only last for a few seconds from the time the article goes into the jar.

The chromium process in general has a poor electro-chemical efficiency, some 15 per cent. only, and suffers from failure to plate in recesses of the article, while at the same time "burning" the parts that stick out.

Faults That May Arise

Should the article come out unchanged, or just plated in parts, it should be stripped of any chromium and repolished, followed with another try, using a little more current. If it comes out dull grey all over, it is probably a sign of excessive current. The current should never be interrupted during the process of plating. Sometimes trouble is found with very small screws and parts, these coming out burnt, even with the lowest current (it is of course realised that the current is at a maximum when the resistance cylinder is right down, and vice versa. These small parts should be shielded, by having a wire ring round them to absorb excess current as in Fig. 3. As one becomes interested and gains experience in the work, troubles are usually overcome. Should larger work be in mind, everything would, of course, be increased in size and quantity, and the expense would be considerable. It would also be limited by the current available.

Stripping Faulty Chromium Plate

A jam-jar containing a solution of spirits of salts in water, of about one to one concentration is all that is necessary. The faulty part should be immersed in the solution until the fizzing stops; the chromium will then have been dissolved off. Rinse and dry the article.

Quantities of Chemicals

Whatever size jar is used, the chromic acid solution should be made up in the proportion of 5oz. pure dry acid to the pint of water. A trial run should be made, first with the starter plate, then with a piece of scrap brass or copper. If no chromium plate appears a small addition, no more than a teaspoonful, should be made, of accumulator acid (not concentrated sulphuric acid).

The resistance solution comprises 4oz. washing soda per pint of water, and the stripping solution should be one-part spirits of salts (hydrochloric acid), to one part water.

The Theory in Brief

Ionic migration of chromic acid takes place as a result of an applied potential to two electrodes in solution, hexavalent chromium being reduced at the cathode, to trivalent chromium, with or without deposition of metal.

New Small Car in Production

The "finished" end of the 8 h.p. Standard production line at the Canley, Coventry, factory of The Standard Motor Co., Ltd., where the new family car is already coming off the assembly lines in volume production.

LETTERS TO THE EDITOR

The Editor does not necessarily agree with the views of his correspondents.

Prism Binocular Adjustment

SIR,—Your reply in October's PRACTICAL MECHANICS to Mr. R. Robinson concerning double images in a prism binocular deals only with the least likely cause of the trouble.

You are quite correct in stating that doubling is due to lack of parallelism in the optic axes, and all prism binoculars incorporate some means of adjustment of these axes. Most commonly it is achieved by sliding of the prisms longitudinally on their seatings, and in the better makes of instrument this is usually controlled by four adjusting screws in each body, bearing on opposing faces of the prism cover plates, their slotted heads being concealed by the leather covering of the instrument. These screws also serve to retain the prisms on their seatings, and obviously one must be backed off a trifle before its opposite number is screwed in. Excessive tightening must be avoided.

Some cheaper binoculars do not have externally accessible adjusting screws, the prisms being held on their seatings by spring leaves engaging in slots in the body interior. Adjustment is carried out by assembling the instrument without the endplates, the prisms then being accessible through the ends of the body. After adjusting, the prisms are cemented in position and the endplates replaced.

Another type of adjustment, sometimes met with in good-class instruments, is for the O.G.s to be mounted in double eccentric rings, by means of which their optical centres can be offset in any desired direction, the prisms in this case being mounted immovably.

For a binocular to be properly collimated the optic axis of each half must be truly parallel to the mechanical axis of the central hinge, as only in this condition do they remain parallel to each other throughout the whole range of eyepiece separation. This is extremely difficult of achievement for an amateur without proper testing equipment.

If, however, the owner is only concerned with adjusting the instrument for his own particular eye separation, this can be done sufficiently accurately by the following method. Some provision for the firm clamping of the binocular is essential.

With focusing adjusted and eye separation set to the user's P.D., mount the binocular in the clamping device and direct it at a distant well-defined object, such as the extreme tip of the neighbouring church steeple.

Look through the R.H. telescope with the *left* eye, and at the same time observe the distant object with the right eye. Adjust the binocular bodily until the magnified image seen by the left eye is perfectly superimposed over the target seen by the unaided right eye. A little practice is necessary to ensure that the operator's own ocular convergence is not called into play.

When the two images are perfectly superimposed, clamp the binocular firmly, and check to ensure that the clamping has not disturbed the setting.

Now look through the L.H. telescope with the right eye, and observe the target directly with the left eye. If adjustment is needed the two images will not be superimposed and the optic axis of the L.H. telescope must be adjusted by whichever system is provided until they are. Patience is necessary, and an occasional check through the R.H. telescope to ensure that the binocular is not being moved bodily during the adjusting operation.

When adjustment is carried out by this system it will satisfy the condition that the optic axes are reasonably parallel for the one particular user, though they may not be so if the binocular is used by a person of greater or lesser eye separation. Complete collimation so that adjustment is correct for all users is a job for the fully equipped expert.—F. TAYLOR (Stonehouse, Glos.).

Space Travel

SIR,—*Re* your leader in the October issue. It is a mysterious thing that the people in whom one would expect to find plenty of imagination are so strangely lacking in it. As accomplished men of science they think, perhaps, that it is fit and proper that they should appear dignified and aloof. If they "let themselves go" they are afraid of being regarded as "woolly minded." Let us away with this stupid inertia and look at some facts. The famous American astronomer, Simon Newcomb, was frankly pessimistic as to the feasibility of heavier-than-air flight. Sir Joseph Banks could see no future in steam at sea. Possibly Banks fancied himself as a marine expert, for we recollect that he accompanied Captain Cook on his first circumnavigation of the world.

True, Banks was not an engineer; he was a naturalist; in this line he had plenty of foresight and vision, and many of the botanical gardens in different parts of the world owe their origin to his personal energy. In his later days he became President of the Royal Society, and in this capacity he must have made acquaintance with many eminent engineers. Perhaps this explains why he showed good prescience in co-related matters. He was, for instance, a staunch patron of the switch-over from oil-illumination to gas. In the application of steam at sea, the celebrated Doctor Lardner was unable to see quite as straight as one might have expected in a man of his attainments.

Again, he was a frigid spectator in talks on the proposal for a certain trans-ocean cable.

Lay one on the bed of a river and, possibly, across the Straits of Dover—but the Atlantic!—P. BOWN (Northampton).

Wimshurst Machine

SIR,—I was interested in Mr. R. E. C. Davies' comments on small Wimshurst machines, appearing in your August issue, and I thought the following might interest him.

I have in my possession a miniature Wimshurst machine which my father made in 1906. The plates are of ebonite, 3in. dia. and 3/32in. thick, and have 16 tinfoil sectors. In place of brass balls the conductors are made of "Sparklet" soda water syphon bulbs mounted on varnished glass rods. Some time later he added little Leyden jars made of specimen tubes.

When made, the little machine, if warm and dry, would excite at once, giving a steady stream of ½in. sparks and would light four 4in. vacuum tubes. It would charge small Leyden jars giving quite a smart shock, and carry out the usual experiments.

The machine would also drive a little static motor, something like a horizontal Wimshurst machine, which he made to a description published about 1912.—G. N. GEE (Kidderminster).

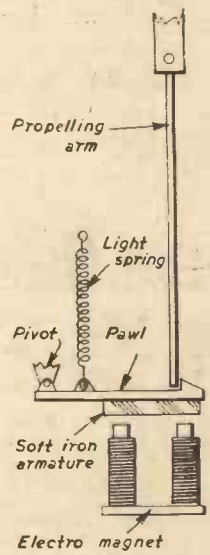
Magnetic Door Catch: Dynamo Bulbs

SIR,—*Re* page 524 of PRACTICAL MECHANICS for September: Magnetic Door Catch, I am afraid your reader will find that his magnet will not remain permanent for long if the plate actually touches the magnet when the door is closed. It should be arranged so that there is a sliding action off the poles.

With regard to Icarus's remarks on page 5 of THE CYCLIST in the October issue, I have recently fitted a dynamo set to my cycle and I mounted the lamp (which is on the front fork) on a 1in. wide rubber band over which I clamped the lamp bracket. This avoids excessive vibration, which must tend to shorten the life of the bulb.—K. N. HOWARD (Emsworth, Hants).

"The Obedient Dog"

SIR,—With reference to the electrical novelty "The Obedient Dog," in the September issue, the mechanism described seems very wasteful on battery current.



Modification to "Obedient Dog" mechanism.

By reversing the electrical action, i.e., using the battery to *release* the dog rather than hold it in its kennel, the battery is only in use for a fraction of a second.

This modification may easily be effected by the use of a small pawl which will hold the propelling arm in position. The electro-magnet is then used to pull the pawl away and thus release the propelling arm. The simple arrangement is shown in the accompanying sketch.

Of course, with this set-up the contact strip should *not* touch the contact stud as described in the article, and should only make when the dog is called.—A READER (Surbiton).

An Orbital Cosmos

SIR,—With reference to Mr. Ellwood's article "An Orbital Cosmos," there is no need to propose an orbital cosmos in order to explain the red shift. A static universe will do; the shift toward the red being considered due to a loss of energy in the radiation covering the great distances of space, the greater the distance the greater the loss. It is not the red shift which rankles, but the stupendous velocities associated with the shift. I personally am not satisfied with the expansion concept, but I would hesitate to settle for an orbital cosmos which retains the high velocities.

The discrepancy between star ages and distance of nebulæ from the centre of supposed expansion is now to some extent reconciled by the new size of the universe recently put forward.

Finally, evidence suggests that the *known* universe is spherical in form, and while it is difficult to say what form the *ultimate* universe will take since it is not visible, there is no suggestion that the nebulæ are in a lenticular form moving about a perihelion position. Incidentally, perihelion is used in a wrong sense here; we should coin a word. I suggest *pericosmion*.—FRANK W. COUSINS (Greenford).

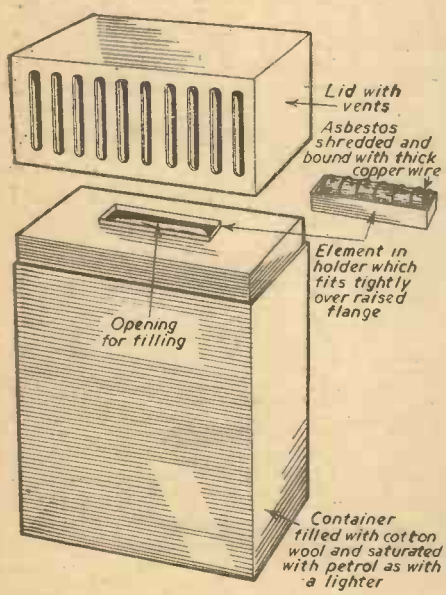
Writing on Lantern Slides

SIR,—*Re* query from Mr. S. G. Moore (Co. Durham), Queries and Enquiries, October, the usual way to prepare a cinema slide is, if white letters on black are required, to paint the glass with mentholeum or some other water paint, even whitewash, but care should be taken to avoid lumps. White is preferred to reflect the heat if high intensity light is used. Allow to dry then draw guide lines lightly with a soft pencil and write with a skewer.

If black letters on white are preferred place a piece of Cellophane between two carbons and type as required; afterwards place Cellophane between two glasses and bind with passe-partout. Avoid touching printed message as it is likely to wipe off on the side touched and reduce the density.—L. TEARINGTON (Pinner).

Pocket Hand Warmer

SIR,—In response to J. F. Ford's inquiry in the October PRACTICAL MECHANICS, I should like to describe a gadget of Japanese manufacture which came into my possession in Germany during the war.



Mr. R. Gower's pocket hand warmer.

The container should be of convenient size to fit the pocket without being too tight. The element holder should fit tightly on the flange and the asbestos must not be bound too tightly with the copper wire.

Ignition is by means of holding the warmer with the element up against a glowing ember and it will *not* light with a match or similar means.

The action is that the petrol vapour causes the asbestos to glow, which in turn heats the copper wire, the hot air then passing through the vents in the lid, to the benefit of the user. The element will last for about three months, when a new one should be made. The "warmer" will keep hot for about 6-8 hours.

There was also another very good but simple idea which I saw on a German army motor-cycle, and this was two flexible tubes, with one end fixed into the exhaust pipes (near the cylinder port) leading up into a pair of "muffs"; the end inside the handlebar muffs was, of course, closed.

The exhaust gases passed up the tubes and the inside of the "muffs" was quite warm. No gloves were needed.—R. GOWER (Worthing).

A Blowpipe for Brazing

SIR,—With reference to the article in PRACTICAL MECHANICS, September, 1953, issue, "A Blowpipe for Brazing," by P. Screaton, in the first paragraph it mentions all that is required are a vacuum cleaner and a domestic gas supply. May I

Fig. 1.—A non-return valve fitted in a gas supply pipe.

point out that there would be an element of danger in using this tool *unless* a non-return valve is provided in the gas supply to flexible gas pipe, as indicated in Fig. 1.

Without this valve being fitted there is a chance of causing an explosion and fire.

The air supplied to blowpipe is at a pressure of 10½in. of water, and can be increased.

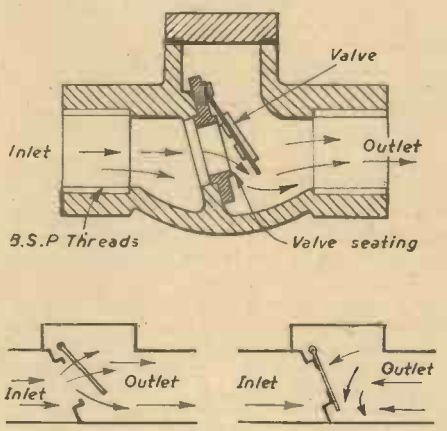


Fig. 2.—Section and details of a non-return valve for gas supply.

The average gas pressure is 5in. of water. If, for example, the gas opening was blocked by a piece of coke or cinder, the air pressure being greater than gas pressure will flow into the gas installation and via gas meter into the mains.

Air and gas mixed is an explosive mixture. Anyone lighting a burner anywhere on the installation will light the explosive mixture, causing flame to fire back to the meter causing an explosion and fire.

This is not what might happen, but has happened many times in factories, and is easily done when using hearths or cinders.

So as a safety measure for stopping this happening the non-return valve is fitted.

I believe people using gas and air in this manner are legally obliged if required by the gas undertaking of their area to fix or have fixed a non-return valve which will prevent air entering gas service pipes and mains.

There are several types of non-return valves, and one type is shown in Fig. 2, which indicates the action of the valve in stopping air getting into the installation.—P. MAGUIRE (Southall).

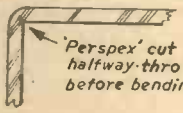
Stencil Cutting

SIR,—PRACTICAL MECHANICS has devoted a considerable amount of space describing stencil cutting, but the latest development has not been mentioned. An electronic stencil-cutting instrument has been perfected by Messrs. Roneo, Ltd., giving results not possible by the photographic method. Half-tone originals can be faithfully reproduced and duplicated on the standard machine. The cutting machine reminds one of the pictures-by-wire machine. The original to be copied is wrapped round a slowly rotating cylinder with a carbon-coated stencil wrapped round a second cylinder which revolves with the first.

An electric eye is made to traverse the original, and its impluses control the intensity of an electric spark which traverses the surface of the stencil. This spark actually cuts the stencil and its intensity decides the depth of cut.—E. J. RABE (London, W.7).

Bending Perspex

SIR,—Bending Perspex and similar sheeting presents few problems until the angle becomes sharp, as for instance a right-angle bend required when making boxes, inspection covers for switchgear, and so on.



An ordinary cheap wheel-type glass cutter will do the trick (not a diamond). Cut on *inside* of bend, not too deeply—but just sufficiently to provide room for the inner side of the material to compress in. Then plunge in near-boiling water and bend round a wooden former.—B. FREESTONE (Akeley).

Bromide Printing Medium

SIR,—In reply to Mr. T. O. Edwards, London, S.W.9, I suggest that he contacts H. Silverstone, 20, Oxford Road, Manchester, 1. This firm's summer catalogue, 1951, lists the following: Aluminium Bromide: This is ordinary photographic material, but has the bromide emulsion on aluminium base instead of paper base. Normal grade, 9½ x 9¼. Price 10s. per packet of one gross, post 1s. This is exposed and processed in the same manner as standard bromide paper, and appears to offer the ideal solution to the problem.—H. GREGORY (Sheffield).

BOOKS Received

How to Fly. By Laurence C. Bagley. Published by Blackie and Son, Ltd. 94 pages. Price 7s. 6d. net.

THE subject of flying is of particular interest to every young man to-day, and in this interesting book the author presents to the reader an explanation of the whys and wherefores of flying in simple language. Intended for young trainees under instruction, the reader is told exactly what to do, and why. With the aid of numerous line drawings and coloured plates, the text is fully explained.

Making Pottery and Glassware in Britain. Published by Scott Greenwood and Son, Ltd., 83-86, Farringdon Street, London, E.C.4. 81 pages. Price 6s. 6d., or post free 7s. 2d.

MOST people have a love for beautiful china and glassware, and this book, the chapters of which were originally written for the benefit of salespeople, explains the difference between china and earthenware, and cut glass and pressed glass. It also describes the production of decorated china from raw clay, and of cut glass from sand. The various processes are illustrated by very clear half tones. Readers interested in the subject, apart from those engaged in the trade, will find this a very fascinating and instructive book.

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

SITUATIONS VACANT

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

METHODS PROCESS PLANNING ENGINEERS required by a large light engineering company on the south coast engaged on batch production work; sound general knowledge; good opportunity for right man. Applications will be treated confidentially. Staff pension scheme in operation. Box No. 111, c/o PRACTICAL MECHANICS.

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TRANSFORMERS DESIGNED and supplied for all requirements, Trains, Welders, Television, etc. Write or phone your requirements to F. W. Whitworth, A.M.Brit.I.R.E., Model Dept., Express Winding Co., 333, London Road, Mitcham. (MIT. 2128.)

TRANSFORMERS, Rectifiers, Volt and Ammeters, Controllers, Cut-outs, Battery Chargers, Power Units; lists; s.a.e. Harry Gilpin, Manufacturer, Portobello Works, Walton-on-Naze, Essex.

PERSPEX for all purposes, clear or coloured, dials, discs, engraving. Denny, 15, Netherwood Road, W.14. (SHE. 1426, 5152.)

NUTS, BOLTS, SCREWS, Rivets, Washers and hundreds of other items for model engineers and handymen. Send now for free list. Whiston, New Mills, Stockport.

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

COMPRESSORS for sale, 3 CFM, 180lbs. sq. in., on metal base, with driving wheel and receiver, price £3; ¼ h.p. Heavy Duty Motors, price £3; carriage forward. Wheelhouse, 1, The Grove, Isleworth. (Phone: Hounslow 7558.)

HACKSAW BLADES, genuine surplus by leading Sheffield manufacturer; 12 Blades, 10in. and 12in., 3/3; 24 blades, 6/-, post paid. Sawyers Ltd., 115, St. Sepulchre Gate, Doncaster.

"PICADOR" ROTOSAW. Portable circular saw attachment for your electric drill fitted with 4in. circular saw blade, adjustable fence to cut up to 1in. in depth, ideal for wood, plastic, or soft metals; 33/-, each, post paid. Lambs-wool polishing Bonnets, 5in., 4/3 each; Rubber Backing Discs, 5in., complete with key, 4/6 each; Abrasive Discs, 5in., 6 assorted grades, 2/-. Send 2½d. for lists of Saw spindles, Vee Pulleys and Belts, Plummer Blocks, etc. Sawyers. Ltd., St. Sepulchre Gate, Doncaster.

CIRCULAR SAW BLADES, superior quality, Sheffield made, 4in. 8/6, 6in. 13/6, 7in. 18/9, 8in. 18/9, 10in. 25/6, 12in. 31/6; all post paid. Please state size of bore and teeth per inch. Sawyers, Ltd., 115, St. Sepulchre Gate, Doncaster.

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MYBLO 6IN. SAWBENCHES; rise and fall spindle, 12in. x 9in. table, ripp and mitre fences, V-drive, £6/15/-; from your tool dealers or direct from makers: P. Blood & Co., Arch Street, Rugeley, Staffs.

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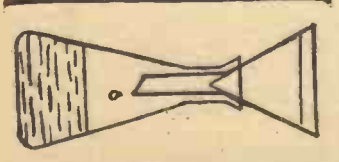

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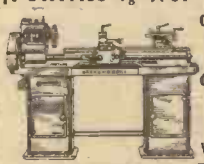

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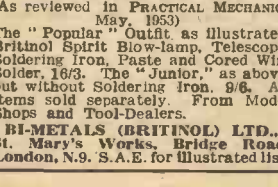

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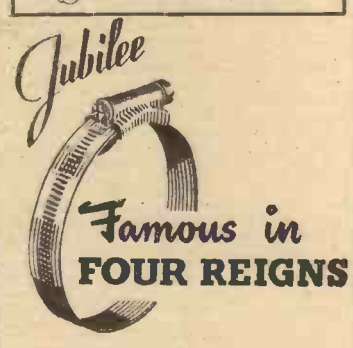

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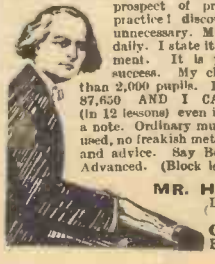

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Metalfix Adhesive

METALFIX is a new combined adhesive and cold solder which, it is claimed, joins wood, plywood, plastic, leather and all metals quickly, neatly and permanently. It can be sawn, drilled, chiselled, planed, painted and polished and is useful as a filler or for making joins that withstand heat, water or acid. It is available in two kinds: as a combined adhesive and cold solder in tubes at 1s. 3d. and in bottles at 1s. 3d. and 1s. 9d., and in transparent form for invisible repairs to glass, china and pottery in bottles at 1s. It is obtainable at all good handicraft shops and hardware stores.

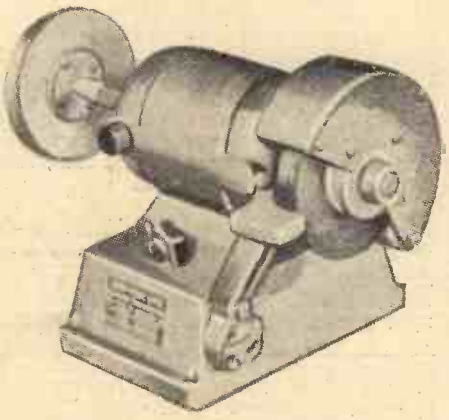
Sew-Tric Small Electric Grinders and Polishers

THESE useful machines are made in several types. The one illustrated is a 3in. bench grinder and polisher with adjustable speed control. It is powered by a 1/12th h.p. motor and has a full load speed of 6,000 r.p.m. The price is £5 10s. Similar to this is the 3in. bench double grinder and this model is priced at £5 16s. 8d.

Also available are a 4in. bench grinder and polisher, fitted with 4ft. flexible shaft; a 4in. bench grinder with tapping attachment taking up to 4 B.A. and a 4in. bench double grinder. Each of these three machines is powered by a 1/6th h.p. motor with adjustable speed control and has a full load speed of 5,000 r.p.m. The flexible shaft for the first of these three costs £2 10s. and the tapping attachment is the same price. The 4in. double grinder complete is priced at £8 15s. 4d.

Another Sew-Tric grinder available is the portable model with foot-control and flexible drive. This is powered by a universal motor of 1/10th h.p. running at 12,000 r.p.m. The flexible shaft is composed of a 5 mm. inner shaft, housed in a steel wound casing. The handpiece is machined from solid steel and is supplied with a chuck of 0-⅛in. capacity; it can also be supplied with collets. The price is £9 10s.

Opticians, jewellers, watchmakers, dental mechanics, toolmakers, model makers, etc., will find these machines useful for grinding, polishing, sharpening, milling, carving, burring, tapping, engraving and cleaning on parts made of metal, wood, glass, plastics and stone.



Sew-Tric 3in. bench grinder and polisher.

Enquiries should be addressed to Sew-Tric Ltd., Sew-Tric House, Honeypot Lane, Stanmore, Middlesex.

Change of Name

WE have been advised by Mr. S. Portass of the Portass Lathe and Machine Tool Co., Buttermere Works, Sheffield, 8, that in future his company will be known as Messrs. Charles Portass and Son.

The "Whitticase" Combination Pocket Level

THIS instrument consists of a light metal stock, 9in. long, with one glass level which is fixed in a tapered bush or ring. This bush is easily removed and adjusted by a slight pressure of the thumb from the back towards the face of the level. The tapered bush is used instead of a complicated arrangement of screws and gears for moving the level glass to any desired degree, marked on the face. One feature of this level is that any broken glass can be replaced in a few minutes at a small cost.

It is manufactured with an inverted V base, and thus is unique for alignment of shafting and check falls in pipework for plumbing, heating, etc. Another advantage is that it can be read at a distance above the user's head. Again, for roofing work, the advantages are immediately apparent to the practical joiner.

The level is made of a rustless metal, and has two countersunk holes, one at each end, in order that it may be secured to a straight edge of any length. With the level glass turned round the user has a perfect plumb-rule.

The "Whitticase" combination pocket level.

The retail price of this instrument is 17s. 6d. and the sole distributor is Howard Stacey, 212-213, Grand Buildings, Trafalgar Square, London, W.C.2.

Club Reports

Ramsgate and District Model Club

THE "At Home" week held at the club's premises September 21st-26th was a great success, bringing once again the activities and amenities of the club to the notice of the townspeople.

Tuesday and Friday evenings were allocated to the general public, other evenings being reserved for people by invitation only. On Wednesday evening the Mayor and civic dignatories who attended were highly impressed by the club's activities. On Saturday afternoon and evening neighbouring clubs—from as far away as Rochester and Folkestone—paid us a visit, thus enabling us to renew many friendships and make new ones. Several new senior members were enrolled.

The general standard of models and exhibits entered for the cup competitions was very high, three cups and a shield being won by adult contestants, and a junior cup was won by a member of that section.

The scale model of Ramsgate Harbour, 32ft.=1in., and the "oo" railway with its engines, rolling stock, automatic signalling and surrounding scenic effects, made entirely by members, created much interest.

The officers, council and members of the club as a whole are to be congratulated. E. CHURCH, Hon. Sec., 14, St. Mildred's Avenue, Ramsgate.

Hitchin and District Model Engineering Exhibition

THE successful exhibition of the club's models and loan exhibits from other organisations was held at the Town Hall, Hitchin, from October 1st to 3rd.

A wide selection of models was on view and consisted of live steam locos. in the larger gauges, marine section, and general models including a cathedral made of matchsticks. Several working layouts were available, including 12mm. gauge, oo gauge, and o gauge. A working layout of the Talyllyn Railway was also on show. Visitors also had the opportunity of viewing some excellent model aircraft. The Championship Cup was won by Mr. G. J. Clark for his pregrouping o-gauge wagons.—O. P. WILMAN, The Arcade, Hitchin, Herts.

FLUORESCENT LIGHTING

(*Continued from page* 119)

the light from the tube is thrown entirely on to the ceiling, the tube being hidden from view. This is only possible where there is a window or an artificial pelmet to screen the tube. The workshop should present no difficulties in this direction, as the surface brightness of a fluorescent tube is only a fraction of that of a bare lamp bulb—the universal source of light in so many workshops!

It should be noted that the equipment described in this article is suitable for A.C. operation only, although there is low-efficiency D.C. equipment now marketed. The advantages of fluorescent lighting are not so marked on D.C., as so much power is wasted in the ballast.

All equipment described in this article is obtainable from Messrs. Dynalite Electrical, of Welling, Kent, and similar material of other brands may be obtained through most electrical dealers.

QUERIES and ENQUIRIES

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.

Formula for Hectograph Ink

PLEASE send me details of a simple method of reproducing a limited number of copies of manuscript and sketches.—E. Vincent (Reading).

THE duplicating apparatus which you need is called a "hectograph." First prepare the pad and inks:

The Pad

Water	12	ozs.
Dextrin	1½	„
Sugar	2	„
Glycerine	15	„
Gelatine	15	„
Zinc Oxide	1½	„

The Ink

Methyl violet	10	parts
Nigrosin	20	„
Glycerine	30	„
Gum Arabic	5	„
Alcohol	60	„

Make a "pad" mixture and pour this into a flat-bottomed metal tray, such as a biscuit tin lid. It will set on cooling, giving a perfectly flat smooth surface.

Now take a piece of paper, write the matter to be duplicated on this, using for the purpose the special ink. When the ink is dry invert the paper and press downwards on the hectograph surface. Then strip off from the surface. The ink impression will be left on the gelatine surface. Finally, take a clean sheet of paper, press it down on the hectograph surface and then remove it. It will have duplicated on it the original written matter. Up to 50 copies can be obtained in this manner.

The hectograph and ink formulæ given above are not the only possible ones. There are many others that may be used. You will find particulars of these in any volume of recipes and formulæ which you will, no doubt, be able to refer to in your local reference library.

Fluid in Heated Vapour Type Radiators

WHAT is the name of the gas or spirit used in electrically-heated vapour type radiators, how inflammable is it, and what is the pressure allowed in this type of heating unit?—George Beaumont and Sons (Fenay Bridge), Ltd.

WE presume that you refer to liquid-filled electrically-heated radiators. These may give approximately 80 per cent. of their heat by convection and the rest by radiation. They may be filled with water or oil. These radiators are not particularly suited to thermostatic control, especially the water-filled ones, because the high specific heat of the liquid results in the temperature of the radiator rising comparatively slowly when switched on. The radiator will, however, continue to give off heat for some time after being switched off and thus provide a certain amount of heating during brief interruptions of the supply. The radiators are suitable for continuous heating rather than for short period heating. The water-filled type may need topping up from time to time and are susceptible to damage from freezing of the water if not warmly housed in winter.

The temperature of an oil-filled radiator rises more rapidly than the water-filled type. The oil should have a low viscosity and a high flash point. Whilst there may be a very slight risk of fire from a defect in an oil-filled radiator, this risk can be considered to be almost negligible in a well-designed radiator. The allowable pressure in such a unit will, of course, depend on the construction of the unit. In general it will be rather low.

Charging Lorry Type Batteries

I WISH to charge 12-volt lorry type batteries using a motor-generator set with a D.C. output of 250 volts at 17 amperes. Please let me have a suitable charging circuit and explain how to calculate for the necessary variable resistance to vary the charging current.—E. M. Smith (Bolton).

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

IN order to charge a 12-volt battery fully, we advise using a charging voltage of about 17 volts per battery. If you always had 12 to 15 batteries to charge at the same time you could connect the batteries in series to the dynamo through a switch, fuse, ammeter and battery cut-out, with a variable resistor also in series to control the charging current. The ohmic value R^1 of this resistor could then be made equal to 120/I ohms, where I is the minimum charging current required. Alternatively, if the motor generator set is to be used only for charging the batteries and 12 to 15 batteries could be charged in series at the same time, a variable resistor could be connected in the shunt field circuit of the dynamo to control the charging current. It is not possible to state the ohmic value of field-regulating resistor required without knowing the field current and having the magnetic curve of the dynamo. However, the regulating resistor should have an ohmic value rather greater than the resistance of the shunt field windings.

We presume, however, that it is required merely to charge one battery at a time. In this case a variable resistor should be connected in series with the battery, ammeter, switch, and cut-out across the dynamo. The volt drop across the resistor will require to have a nominal value of 250–12 = 238 volts. In order to limit the charging current to a minimum value of 5 amps, the ohmic value of the resistor R^2 should have a maximum value of $\frac{238 \text{ volts}}{5 \text{ amps}} = 48$ ohms approximately. The resistor must be capable of carrying the maximum charging current without reaching a dangerously high temperature. If it is required to govern the charging current between 5 and 17 amps, the resistor should be capable of carrying 17 amps.

Tables supplied by makers of resistance wire show that 12 s.w.g. nickel-chrome resistance wire will reach a temperature of more than 200 deg. C. when spirals of this wire carry 17 amps. This wire has a resistance of 0.062 ohm per foot, so that 750ft. would be required. The wire could be wound in a spiral of about 1in. in diameter suspended between supports covered with asbestos or mica, in a ventilated frame. A considerable amount of power will have to be dissipated in heat at the resistor and a bulky resistor will result. If the maximum charging current is 10 amps, half this length of wire could be used. Loops on the wire could be brought out to contacts on a tapping switch to control the charging current, about half the resistor being tapped. The length of wire required could be reduced by using a resistor in the shunt field circuit of the dynamo to reduce its voltage if this is to be used solely for charging.

Dashboard Warning Light for Dynamo Charging

WITH reference to your articles in the August and September issues of "P. M." on "Car Battery Charging Control," I find no mention of a detail that I always find puzzling. This is the red warning light on the dashboard which goes out when the dynamo starts to charge.—H. Cusden (London, N.W.6).

THE ignition warning light is connected between the ignition coil side of the ignition switch and the dynamo side of the cut-out contacts. The path of the current through the bulb is indicated on the diagram by the heavy line, and it will be seen that, when the ignition switch is turned on and the dynamo is at rest, there is a circuit by which current can flow through the bulb from the battery by way of the dynamo windings. When the dynamo is rotated it starts to develop a voltage which will, at tick-over speed, be less than that of the battery but of the same polarity. Consequently the bulb will receive the battery voltage, say, 6 volts, on one side, and the dynamo voltage, which might, under these

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circumstances, be 3 volts on the other, leaving only 3 volts available to light the bulb. It will then glow at a reduced brilliance. When the dynamo speed is raised so that it develops the same voltage as the battery it will be able to fully oppose the flow of any battery current through the bulb, which will be extinguished. A further increase in dynamo revolutions will bring in the cut-out, the contacts of which short out the bulb and so prevent any current from the dynamo passing through it in the reverse direction.

The bulb itself is often of the low-voltage flash-light type and is protected against overload by a wire resistance wound around the bulb holder. It should not be tested by subjecting it to the full battery voltage when removed from its holder.

Mechanical Horse-racing Game

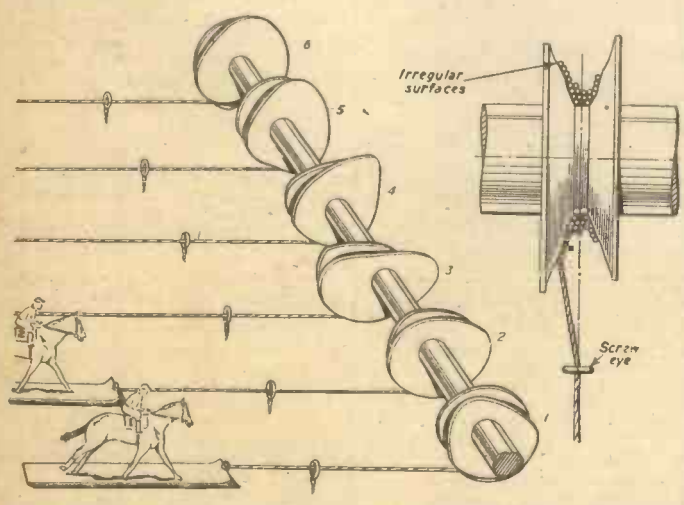
IN an attempt to relieve the tedium out here, we are anxious to build a mechanical horse-racing game.

We have already built one using simply a plain bar, with six pieces of asbestos string attached to it, and towing six horses, mounted on wooden platforms.

The bar is rotated by means of a motor, the ropes coiling around the bar. The difference in the way they coil results in different horses reaching the winning post first.

This arrangement does not give enough variation. Can you suggest an alternative?—Sgt. C. G. Armistead (M.E.A.F.10).

OBVIOUSLY the arrangement which you require must be simple to construct and must ensure that the arrival of the six horses at the winning post must be differently disposed in each race. We think that these conditions can be met by letting the cords from the horses be wound, not upon a parallel roller but upon bevelled cam-shaped cheeks or, more correctly, between such cheeks, all the cams having different profiles. The sketch shows the principle of the idea and some possible shapes for the cams. You may be able to cut the cheeks from either plain boards or from thick plywood and glue them on your existing roller. The bevelled edges should not be finished too smoothly.



Suggested arrangement of bevelled cam-shaped cheeks for horse-racing game.

It is improbable that each individual cord will behave in exactly the same way although, in each race, it is wound upon the same cam. We think that the races will be more realistic than at present because the speeds of the horses will vary owing to cords climbing the bevels and then slipping back to smaller diameters. All the cheeks should have the same external circumference.

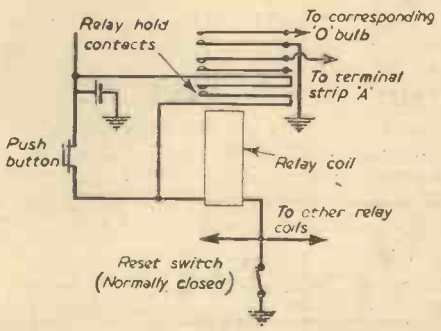
"Electronic Brain"

I AM making the "electronic brain" described in the June and July editions of PRACTICAL MECHANICS. I have, however, run into the following difficulties, on which your advice would be much appreciated.

(a) The steel ball switches. These in my experience do not guarantee contact every time. I therefore propose substituting switches, preferably of the press-button variety. Where may these be acquired?

Where may the correct Cellophane be obtained, also what power bulbs are recommended?—A. Wemyss (Chelsea, S.W.3).

I DOUBT whether press-button switches of the required pattern are available. These switches would have to be of the two-make type. *Toggle* switches of this type should be obtainable through any good electrical supplier. A simple press-button, as used for a bell-push, could be used in conjunction with a suitable relay. In this case, the relay would have to be of the three-make type, and a circuit diagram for one unit is given below.



When the push-button is pressed, the relay is actuated and the contacts close. The "hold" contacts short out the push button and the relay remains closed. When the game is finished the reset switch is actuated, thus removing the "earth" from all the relays. It should be noted that the reset switch is common to all the relays.

The Cellophane originally used was purchased in a stationer's shop, and it was not anticipated that there would be any difficulty in obtaining further supplies. I suggest that you get in touch with either The Strand Electric and Engineering Co., Ltd., 29, King Street, London, W.C.2, or Plastics, Ltd., 11, Whitworth Street, Manchester, 1.

Failing a satisfactory supply of Cellophane, the alternative is to use several thicknesses around the lamps to get the requisite depth of colour. (This should only be necessary with the green Cellophane.) If several thicknesses of Cellophane are necessary, it would be a good plan to use coloured Cellophane or gelatine to form the letters on the glass. This method would be less troublesome than attempting to build up the letters out of several thicknesses of Cellophane.

The lamps used are the standard 2.5 volt 0.3 amp. For best results, they should be overrun. This cuts down the bulb life but gives a much brighter light.

Fireproofing Thatch

I WANT to re-thatch my house with grass, but before doing so I should like to know if there is a satisfactory way of making the thatch fireproof.—L. A. Veary (S. Rhodesia).

A SOLUTION which Rural Industries advise as suitable for fireproofing *straw* is put forward as being in all probability suitable for treating *grass*. It would be as well to test a batch after treatment before going right ahead.

Make up the following:

28 lb. ammonium sulphate.
14 lb. ammonium carbonate *lump*.
7 lb. borax lump.
7 lb. boracic acid.
14 lb. alum lump.

Dissolve this in 50 gallons water. Soak your grass in this solution and allow to drain over tank on slats for three hours. This quantity will treat 500 sq. ft. of thatch.

Imperial Chemical Industries market a preparation called "Faspos" which they state is suitable for reeds only.

Information Sought

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

G. C. Roberts writes: "Please advise me how to arrange stage curtains at our Village Hall. The length of the stage is approximately 22ft. and the height of curtain is 9ft. The curtains are in two halves, and I should like to operate them on a drum rather than pulling on the ropes. Operation will be by hand, and not by electricity."

J. Courtney writes from Musselburgh: "I intend to build a hand bench drill to take a ⅜in. or ½in. chuck. Can you give me any information as to proportions of bevel gears and construction of drill in general also suppliers of gears?"

J. Fearn asks: "Could you give me a design for a paraffin vaporising burner, to be used in burning weeds in a market garden? I have a pressure tank with pump, and would like a broad flat flame in the burner. I am a skilled engineer and have the facilities for making necessary parts."

J. P. Owen writes: "Please give me details of how to build photo-electric cell equipment to release the shutter of my camera which is synchronised to electronic flash. The sketch below shows my idea. The object to be photographed interrupts the light beam, the amplifier activates the solenoid, which trips the shutter, which in turn fires the flash.

"The equipment I wish to build is from light source to solenoid in the diagram."