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NOVEMBER 1959

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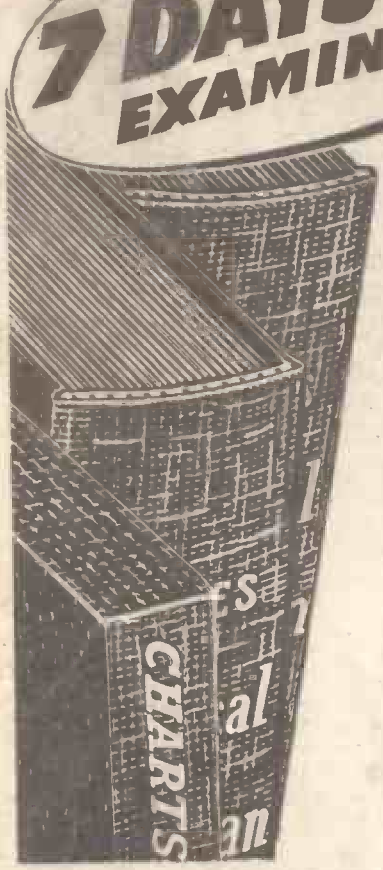

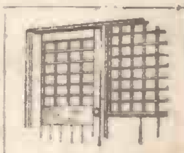

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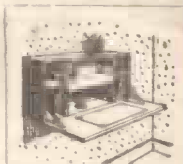

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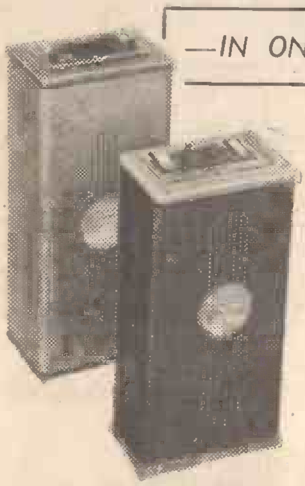

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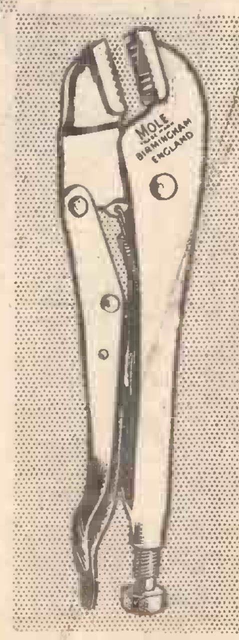

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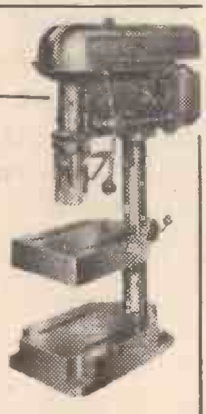

Practical Mechanics

"The Cyclist" and "Home Movies" are incorporated

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CONTENTS :

CONTRIBUTIONS

The Editor will be pleased to consider articles of a practical nature suitable for publication in "Practical Mechanics." Such articles should be written on one side of the paper only, and should include the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed : The Editor, "Practical Mechanics," George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

FAIR COMMENT

THE AIRCRAFT INDUSTRY'S CHOICE

THIS present era is hailed by many as the beginning of the space age and the start of the new industry of astronautics. This new science and industry is bound to pioneer research along trails peculiarly its own, but the results of this research and the new lines of thought they engender are certain to have a profound effect on the aircraft industry as we know it. Future trends of aircraft design may either be towards the speeding up of all aircraft or alternatively towards a much wider division between long distance extremely fast airliners and much smaller and more economical local 'planes. In our opinion, the latter course of events is the most likely.

Already the supersonic airliner is more than a vision of the future and aircraft companies in America are working out designs for a supersonic transport for the American Air Force. It is thought that a liner carrying about 120 passengers at over 2,000 m.p.h. could be flying by 1968, but this estimate is probably on the conservative side as already a supersonic bomber, the Convair B58, is flying in the U.S.

This then would seem to establish rather firmly the fast long-range aircraft of the future, but how can this be reconciled with the "Cheaper air travel for all" pronouncements which have been made recently. The fares for travelling in such a supersonic aircraft are likely to be extremely expensive. The answer would seem to be that the faster and more expensive the new aircraft become, the better the case for building more modest 'planes. Even so, the building of a fleet of gas turbine aircraft is, in itself, unlikely to solve the problem of cheaper fares. At present a new design of gas turbine aircraft is in danger of being obsolete, or at least obsolescent before it has been flying long enough to pay for its initial cost. The only solution to this is that the aircraft must work harder and thus pay more during its short life. This means, in effect, round the clock operation, and to ensure that there is a full passenger list for every flight more people must be persuaded to travel by air and to travel at off-peak times. The only possible way this could be done is by means of cheap fares. It seems likely then that the future of the economy aircraft could be assured, but if the British aircraft industry decides to concentrate on this type of aircraft, can it afford to neglect entirely the supersonic airliner ? America will certainly build them and run them between New York and London, which means B.O.A.C. would have to buy them from the U.S. And what about the prestige value of such aircraft ?

The answer, in our opinion, is for Britain to concentrate on the economy aircraft and also on its "Vertical Take-off and Landing" projects with a view to combining the two as soon as possible to produce an aircraft that can take off from a restricted space, travel swiftly with a large payload to its destination and then land —again in a restricted space. Such a 'plane would be at least as valuable as a supersonic airliner.

A FREE FILM SHOW FOR WIRELESS AND TELEVISION ENTHUSIASTS

OUR companion journals, *Practical Wireless* and *Practical Television* are sponsoring another film show at Caxton Hall, Westminster, on Friday, January 22nd, 1960, at 7.30 p.m. The show is being arranged in conjunction with Mullard, Ltd., and the editor of the "Practical" group of journals will be in the chair.

One of the films entitled "Mirror in the Sky" will be of particular interest to readers of PRACTICAL MECHANICS. It deals with the confirmation of the existence of the heavyside layer and the discovery of the Appleton layer. It continues with the pulse techniques which are the basis of radar and concludes with the radio telescope. Other films are entitled "Photo Emission" and "From Us To View."

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The December, 1959, issue will be published on November 27th. Order it now!

An Italian Mandolin

Another Musical Instrument for you to Make

By A. B. ORR

THE recent rock 'n' roll and skiffle craze has left in its wake not only an increased interest in the guitar but in stringed instruments in general. One of the most charming of these is the Italian mandolin, shown in Fig. 1.

While the method used by Italian instrument makers is beyond the amateur craftsman, the method to be described is simple and can produce a really fine instrument, both in appearance and tone. The method chosen is well known to model boat builders as the bread and butter system. Before starting construction study the drawings, particularly Fig. 2, and the photographs until a clear picture of the various stages is obtained.

Fig. 1.—The finished Italian mandolin.

The Body

This is made from eleven laminations of ½in. thick walnut. When buying this get it planed both sides to finish ½in. thick. Make a start by scaling up the drawings shown in Fig. 4 on to stout cardboard. This done, cut around the outline with scissors. The plank of walnut should be laid on the floor or bench and the profile template laid alongside. Mark the shape of the template on the edge of the plank. Now saw the plank across about a ¼in. from the mark. Lay the plank on top of the first piece and mark the continuation of the profile on the second lamination. Once again saw across about ¼in. clear of the mark. Repeat this sequence with the remainder of the plank until the eleven laminations are cut and the resulting block is marked off as shown in Fig. 6.

After marking the centre line on each lamination, use the plan template to mark off the plan shape on each lamination. This done, the laminations can be cut to plan shape with a coping saw.

The laminations can now be screwed together, starting by screwing the second smallest to the smallest so that no screw holes will be made in the body. Keep the screw towards the centre so that they will not be exposed by subsequent shaping.

Once the laminations are securely screwed together a start can be made on the shaping. This part of the job can be greatly simplified if some sort of grip is screwed to the bench to hold the body while carving. Two small blocks screwed to the bench about 6in. apart and at a slight angle to each other should suffice. Shaping is carried out using a ½in. gouge. Once the rough shape is approached this tool should be replaced by a smoothing chisel or one of the new shapers to remove the gouge marks. A piece of broken glass is useful at this stage. Break a jam jar in a cloth and select a piece of glass with a suitable curve. This makes an admirable tool to work on the curved surfaces. Finish off with various grades of sand-paper until a smooth surface is obtained. Check that there are no bumps and hollows. When shaping, work on the body as a whole and do not concentrate on any one section.

The carved elaboration can now be marked on the body. Fig. 4 gives the shape. A paper template should be made and the outline marked on the body with a pencil.

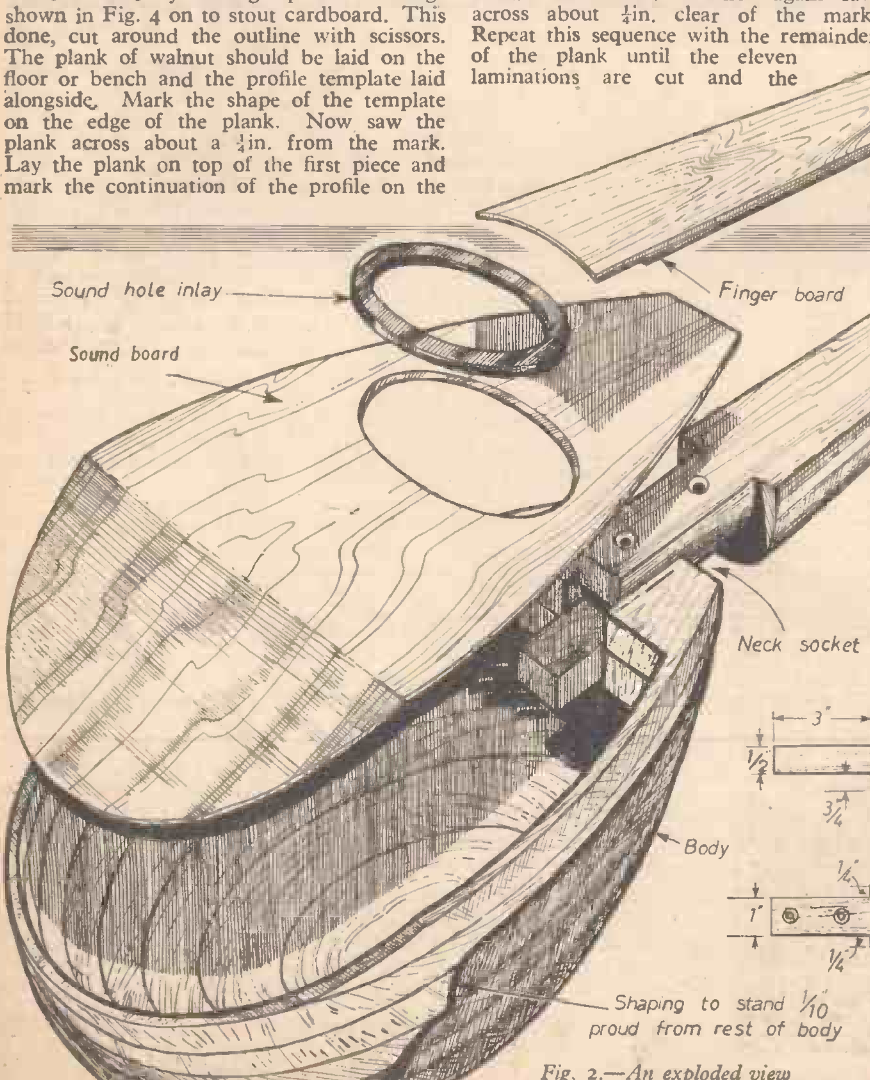
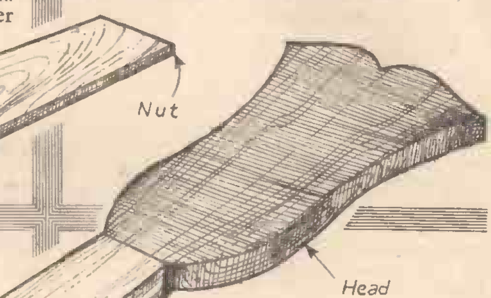



Fig. 2.—An exploded view of the mandolin.

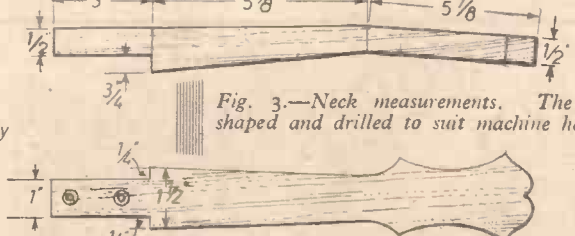


Fig. 3.—Neck measurements. The head is shaped and drilled to suit machine head used.

Using an X-Acto knife or similar, make a cut about 1/10in. into the body along the line. Now carefully cut up to this line until the carving stands out proud by about 1/10in. It is not essential to include this carving and, indeed, if one has not the ability to tackle this sort of thing it should be left out rather than be done badly. It is, however, quite simple if care is taken and, if well done, greatly enhances the appearance of the finished instrument.

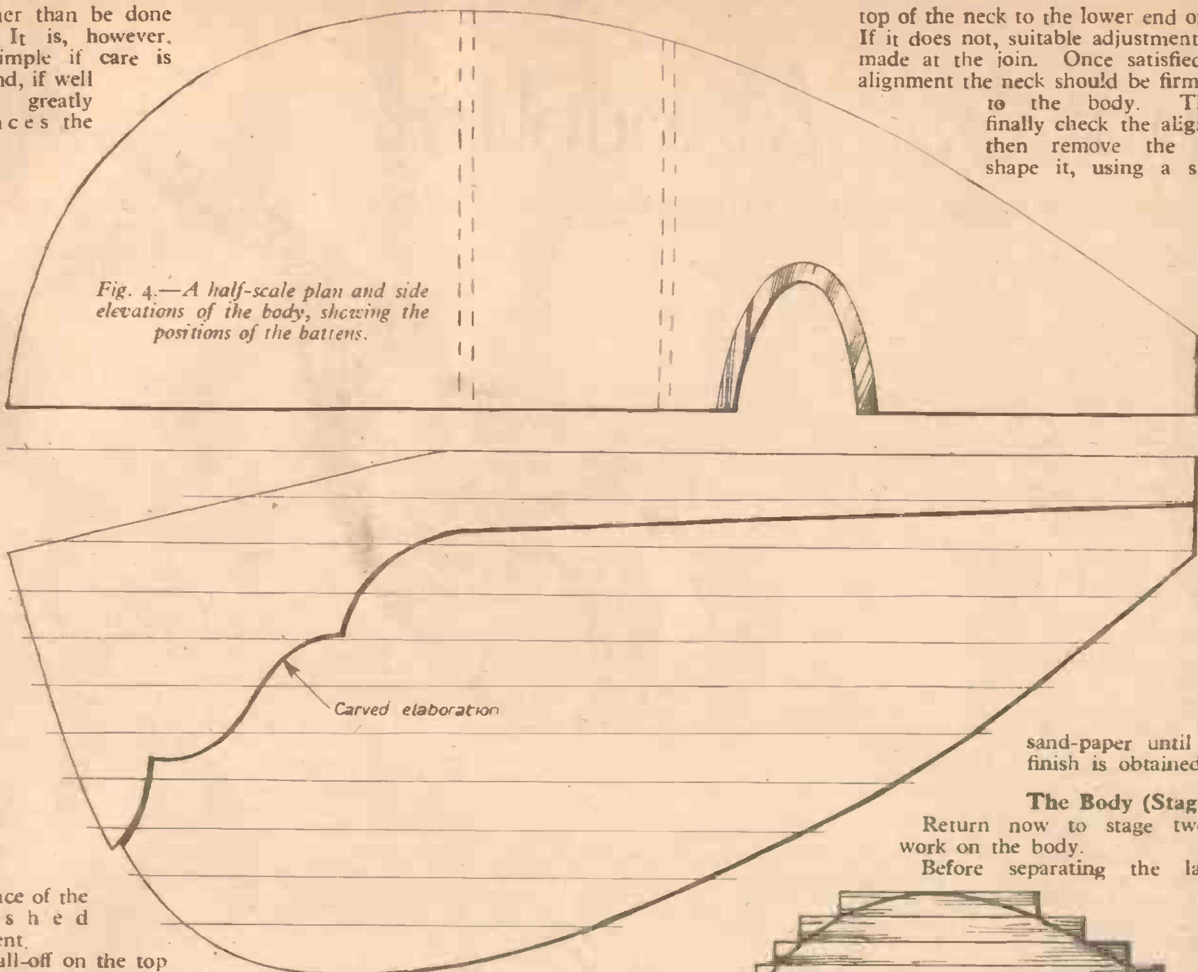


Fig. 4.—A half-scale plan and side elevations of the body, showing the positions of the battens.

The fall-off on the top should now be made. The angle is given in Fig. 4. Mark the line accurately, across the top lamination and, using a chisel or plane, cut away the unwanted section. This completes the first stage in making the body, which is put to one side.

The Neck

This is made from a block of mahogany measuring 15in. × 2in. × 2¾in. At this stage it should be decided what shape of machine head is to be used. The original was fitted with a curved head as this happened to be available at the time. Most music shops stock the straight type of machine head, and if this type is chosen, the head should be altered accordingly. Fig. 3 gives the measurements. These should be marked out on the block. Using a coping saw, cut out the neck "in the square."

Now make the slot in the top lamination of the body to take the neck socket. Photograph (Fig. 5) shows how this looks. Check that the neck is a snug fit in the body. To check that alignment is correct mark the centre line of the neck and hold a length of thread between the top of the neck and the centre of the body at the lower end. If all is well this thread should lie along the centre line from the top of the neck to the lower end of the body. If it does not, suitable adjustment should be made at the join. Once satisfied with the alignment the neck should be firmly screwed to the body. This done, finally check the alignment and then remove the neck and shape it, using a shaper and sand-paper until a perfect finish is obtained.

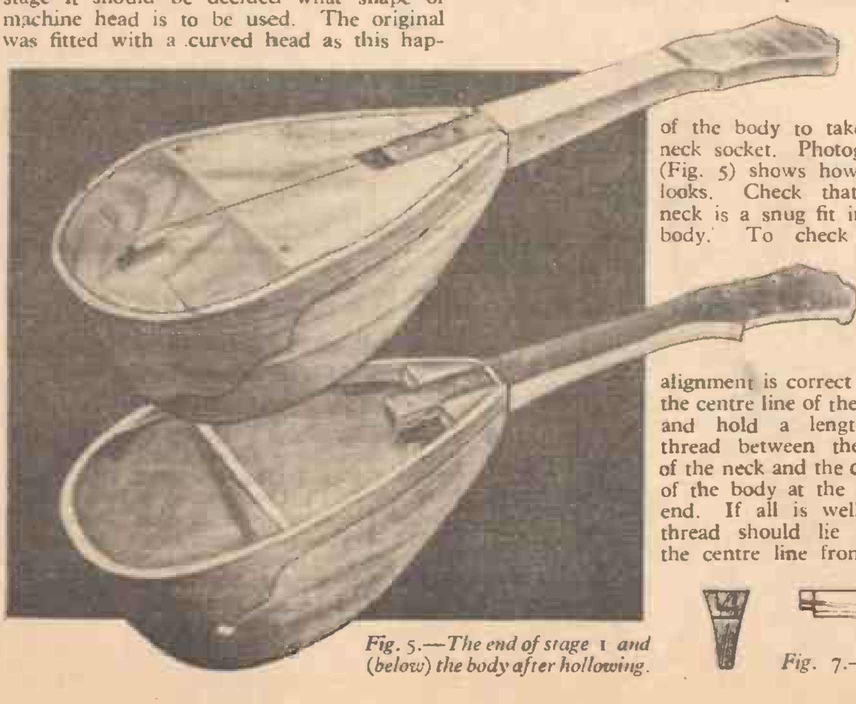


Fig. 5.—The end of stage 1 and (below) the body after hollowing.

The Body (Stage 2)

Return now to stage two of the work on the body.

Before separating the laminations draw a line down each side to act as bearing lines when gluing up the laminations after hollowing. Now separate the laminations and mark a line ¼in. from the side all round except where the neck meets the body. This part is left thicker as will be seen in Fig. 2.

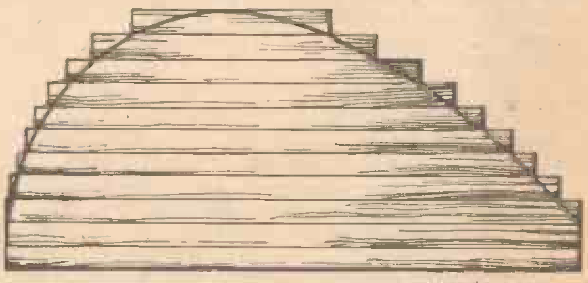


Fig. 6.—Side view of block after marking out.

Leave the top lamination for the time being and make a start hollowing the rest. This is done with either a coping saw or a fret saw. Cut carefully around the line, taking care not to break the lamination. Note that a ledge is left projecting in the second lamination to take the neck socket. This is best marked by lightly screwing the neck in place and marking round it.

Having hollowed the laminations, it only remains to cut out the top one, which will come in two halves, and to scoop out the smallest one. When doing this make the inside curve match the outside, making the wall thickness about ¼in.

The laminations are now ready for gluing. Aerolite 306 is ideal for this job, due to its space-filling properties. Glue the laminations together in pairs, afterwards gluing each pair together. Ensure that the lines marked earlier on each side line up

Fig. 7.—Batten shape.

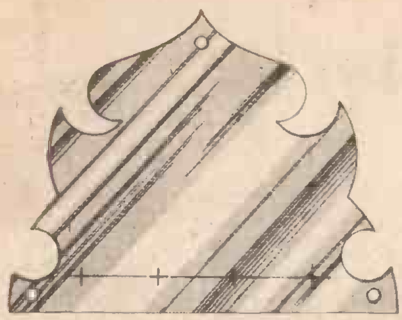
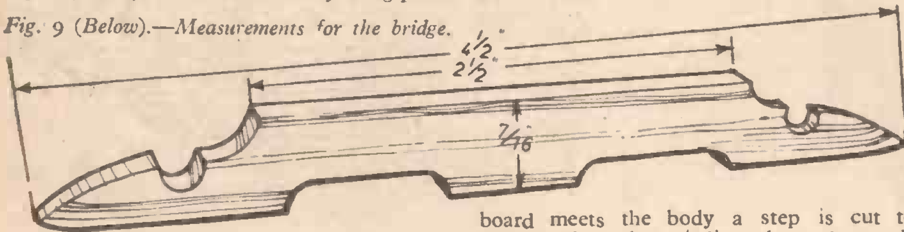


Fig. 8 (Above).—The actual size of string plate.

Fig. 9 (Below).—Measurements for the bridge.



perfectly before cramping. Allow ample time for each pair to dry before removing the cramps to glue the next pair. It is worth while to make a pair of cramps from two 1 ft. lengths of 2in. × ½in. deal, drilled to take a ¼in. bolt at each end. Using these even pressure can be obtained along the length of the laminations. This is one part of the job that should not be rushed. While the laminations are drying work can be continued on the accessories.

Once all the laminations have been glued and are dry the inside can be trimmed. Once again a piece of broken glass is ideal to get at the different curves. The inside should be taken down to about ⅛in. Great care should be taken to ensure that no area is taken down too far. Finish off the inside with sand-paper.

The neck should now be permanently secured to the body. Apply glue liberally to the joint and screw the neck firmly to the ledge in lamination No. 2. Check alignment before putting to one side to dry.

When the glue has dried, trim the join between neck and body and give the body a final finish, removing all superfluous glue.

The Sound-board

This is made from 1/16in. plywood. Select a piece with a pleasing grain. Lay the body on top of the plywood and mark off the shape. Remove the body and cut round the mark with a fret saw. From Fig. 4 mark off the sound-hole and cut out with a fret saw. It only remains to score the top side of the plywood where the fall-off comes, taking care not to cut completely through the ply. Bend to the correct angle, checking by laying along the top of the body.

The sound-board is supported by a cross batten, seen in Fig. 5. This is fitted into notches in the body and is shaped as shown in Fig. 7. It should be glued in place on the body and while it is drying a similar batten should be glued to the underside of the sound-board (see dotted line in Fig. 4). This batten does not fit into the body. The sound-board can now be glued in position on the body.

Finger Board

This is made from a piece of mahogany (⅛in.) measuring 10in. × 2in. which should be laid along the neck and the outline marked off. The finger board runs down to the sound-hole and this end should be trimmed to follow the curve of the hole. Fig. 10 gives the fret positions. The fret wire is located in slots made with a fine tenon saw. Note that where the finger board meets the body a step is cut to accommodate the 1/16in. plywood sound-board. Treat this carefully as there is a danger of breaking the board at the step. Using six ⅜in. screws attach the finger board to the neck and sound-board at suitable points along the finger board. The nut is made from a piece of bone or plastic and is glued in place.

The Bridge

Fig. 9 gives the shape and dimensions of the bridge. It is held against the sound-board by the strings and is located 13in. from the nut.

Machine Head

The seating for this should now be made. No hard and fast dimensions can be given as these will depend on the head used. With the majority of plain heads it is only necessary to drill holes to take the shafts. After making the seating, the head should be left to one side until the instrument is polished.

Inlays

The mandolin will be greatly enhanced if some inlay is added. The original is traditionally heavily inlaid. Inlaying is, however, a tricky job and should not be attempted unless some experience has been had in this type of work. There is one bit of inlay that is simple and that is worth while doing and that is around the sound-hole. This can be done in one of two ways. A strip of ⅛in. × 1/16in. may be steamed and bent to fit snugly around the inside of the sound-hole. The other way is to shape accurately a piece of mahogany and glue it in place. This was done on the instrument illustrated. Mark off the shape of the sound-hole on a piece of ⅛in. mahogany and carefully cut to shape. Now mark a line ⅛in. inside and cut out the centre. By alternate fitting and sanding make the inlay a tight fit in the hole and then glue in place.

Fig. 8 shows the string plate full size. It is made from 1/16in. brass. After cutting out the shape bend the plate to the contour of the body. Drill holes to take the mounting screws in the positions shown.

As the eight steel strings exert considerable force it is essential to see that they are firmly anchored. In the original this was done by using four ¾in. lengths of brass ⅛in. in dia. These were turned to shape in the chuck of a hand drill. Four ⅛in. holes are drilled in the plate to take these studs, the holes being carried through into the wood of the body. The studs should protrude by about 3/16in. The plate should be removed and the studs soldered in place.

Finishing

Remove the finger board, string plate and machine head and begin by giving the neck and body four coats of grain filler, rubbing down with flour paper between each coat. When satisfied that all grain is filled give a final rub down until a silky smooth finish is obtained. A friction polish was used on the original.

The neck can be left in polished mahogany or painted black. If painted use a number of coats of thin paint, rubbing down between coats.

The various parts should now be fitted and the strings added. Each pair of strings is secured to one of the studs.

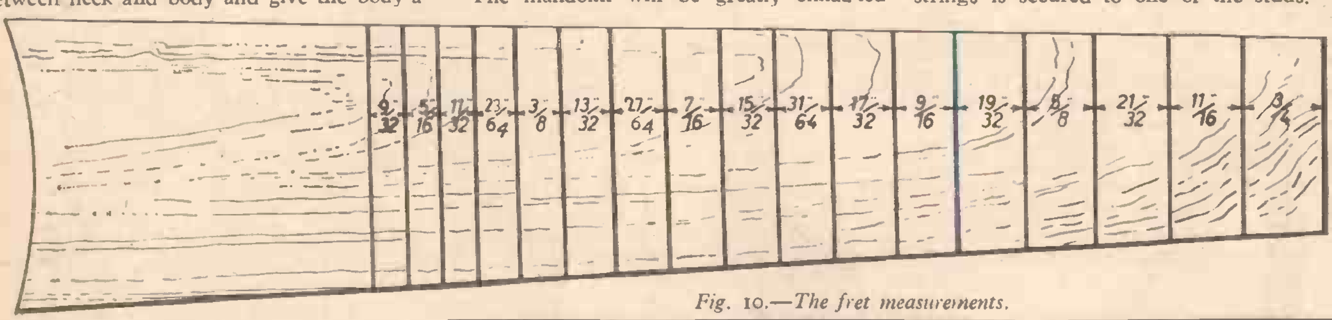


Fig. 10.—The fret measurements.

A Model Control Transmitter

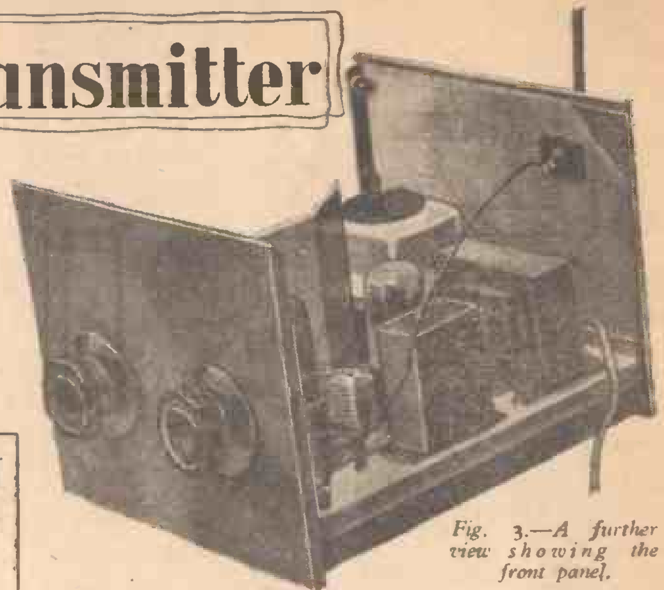


Fig. 3.—A further view showing the front panel.

Mains Powered: Crystal Controlled. A Detailed Description

By F. G. Rayer

WHEN working models of a kind which can be used indoors or in the garden, mains supplies will usually be available to run the transmitter. In these circumstances, the use of mains alone will be an advantage, because of the economical running, compared with batteries. In addition, with mains operation a crystal-controlled circuit can easily be adopted because of the higher voltages and power output of the valves. A very good output can thus be obtained with two stages, in a mains circuit.

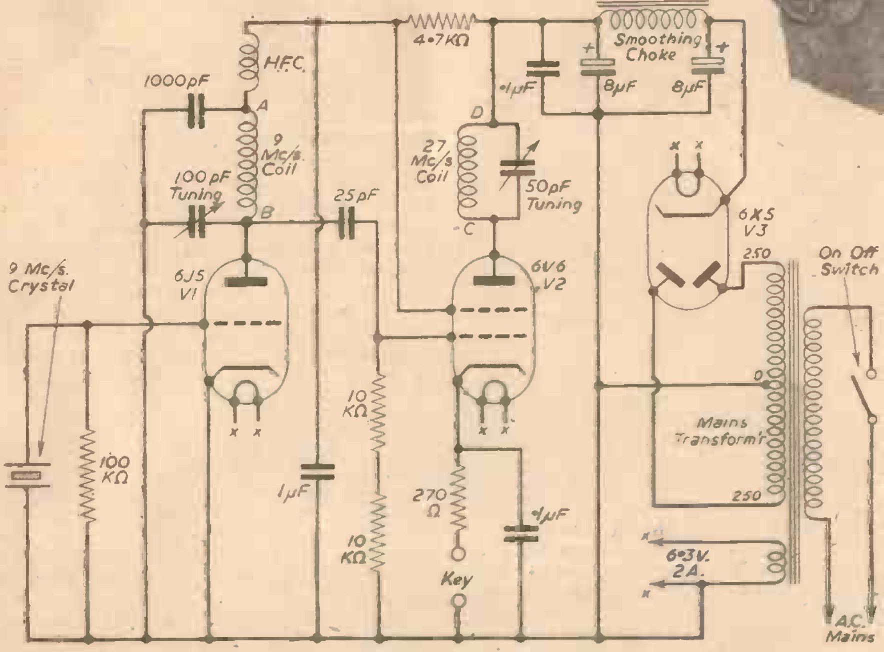


Fig. 1.—The theoretical circuit.

The usual simple type of self-excited oscillator, usually employed in 1- and 2-valve form for model control, and battery operated, suffers from the disadvantage that it will radiate on any frequency to which it is tuned. Harmonics may easily cause interference to TV reception over a wide area. In addition, a 120v. or even 150v. H.T. supply is often used from batteries, which are a fairly expensive item. The use of a crystal-controlled mains transmitter is thus well worth while, when circumstances permit. It can, of course, be used for setting up and testing a model, even when a portable, battery-run transmitter is used as well. Such a mains transmitter is shown in Figs. 2, 3 and 7.

The circuit is shown in Fig. 1, and employs two valves and a rectifier, with mains transformer to isolate the equipment from the mains. The frequency crystal forms the resonant grid circuit of the first stage and therefore controls the oscillation frequency here. With a 9 Mc/s crystal, the 6J5 anode circuit is also tuned to 9 Mc/s. The 6V6 acts as multiplier and power output stage, its anode circuit being tuned to 27 Mc/s. Wrong tuning of either stage reduces output, but does not cause a signal of wrong frequency to be radiated, and this is, of course, the great advantage which a crystal-controlled transmitter possesses over the self-excited tunable type.

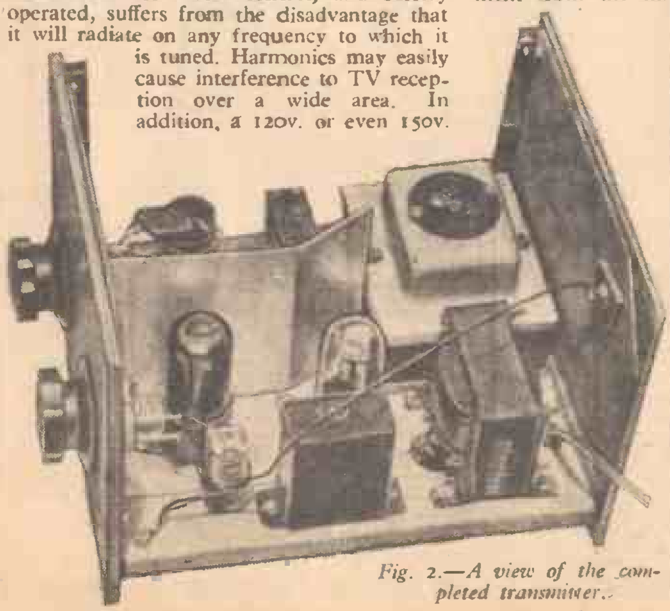


Fig. 2.—A view of the completed transmitter.

It is worth noting that many different valves will operate in this circuit and any triodes, tetrodes or pentodes, of R.F., A.F., or output type, will function. A useful output can also be expected if a triode or other small valve is used instead of the 6V6, though output is naturally higher with the larger type of tetrode or pentode.

If valves other than those shown are used, care should be taken that their maximum cathode current ratings are not exceeded.

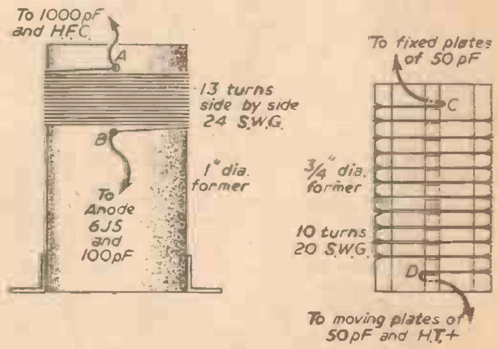


Fig. 4.—Details of the two coils.

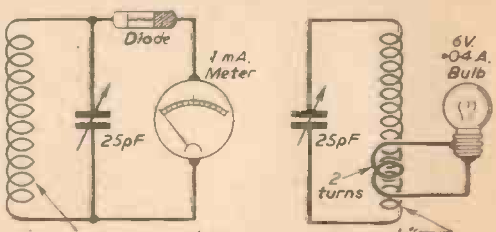


Fig. 5.—Frequency meter circuits.

With the output stage, this can be assured by using a cathode bias resistor of the same value as would be provided if the valve were acting as A.F. amplifier or audio output. In the case of the first stage the anode resistor (4.7k in Fig. 1) should be of such a value that the valve does not pass more than its maximum permissible anode current. This is very important if another power valve, such as a spare 6V6, is used in this stage, because there is no cathode bias.

A rectifier and mains transformer able to supply about 60mA will be satisfactory, this providing some 10mA to 15mA or so for the first stage, and 45mA or so for the output stage. A 300 ohm resistor may be used instead of a smoothing choke, but will cause a little more voltage drop than a choke of fairly low D.C. resistance.

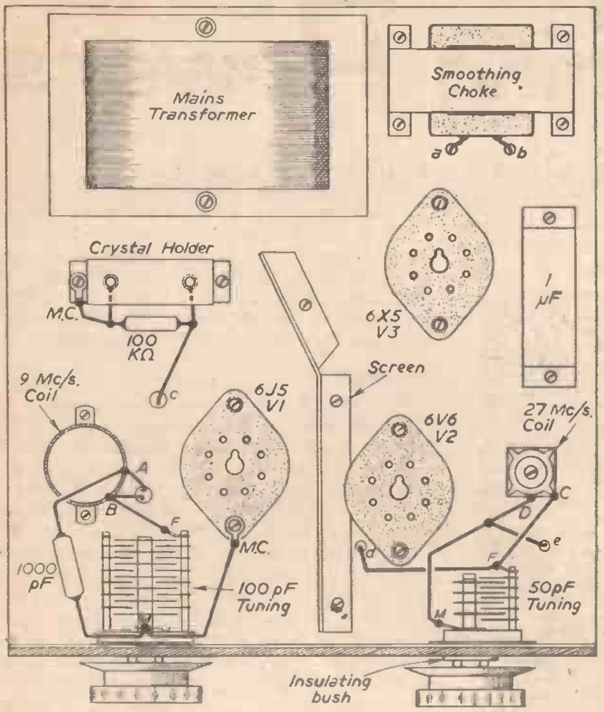


Fig. 6.—Suggested component layout.

Tuning Coils

Both these are shown in Fig. 4. Actual dimensions are not very important provided the coils can be tuned to the correct frequency. Short-wave receiver plug-in type coils may be used in the first stage, if to hand. The coil selected should tune to 9 Mc/s (about 33 metres) with a 100pF tuning condenser roughly half closed.

Crystals of other frequencies may be used, provided the figure falls within the model control band when multiplied by 2, 3 or 4. Greater multiplication is not recommended, as efficiency fails. In all cases the triode anode circuit must be tunable to the crystal frequency.

With the 27 Mc/s coil experiment may be necessary to find a suitable number of turns, if dimensions are changed. If a smooth former is used, a turn or two should be left off.

Construction

A suitable layout is shown in Fig. 6. The screen between stages is recommended when using clear glass valves at maximum efficiency.

The 100pF variable condenser is in contact with the metal panel, which was faced with a 3-ply wooden panel. But the 50pF variable condenser must be insulated, to avoid an H.T. short. With ordinary condensers this can be arranged by placing a Paxolin washer behind the panel, and inserting an insulated bush from the front, or by drilling a clearance hole in the metal panel, but not in the 3-ply. Some surplus condensers are secured to the panel by two small screws passing through the insulated part of the condenser, and if a clearance hole has been made for the spindle, no actual contact with the panel will then arise.

The 9 Mc/s coil is mounted by means of small brackets. The top of the winding "A" is soldered to the 1000pF condenser, and a lead passes down through the chassis to the H.T. circuit. The bottom end of the winding "B" is taken to the fixed plates of the 100pF condenser, a lead also passing down through the chassis to the 6J5 anode.

With the 27 Mc/s coil, the top end "C" goes to the fixed plates of the 50pF condenser, and 6V6 anode. The bottom "D" is taken to moving plates and H.T. positive. Both coils are so wound and mounted that at least 1in. clear space exists between the bottom of the actual windings and the metal chassis. Fairly large pointer knobs or dials should be fixed to the condensers. The spindle of the 50pF condenser is alive from the H.T. circuit.

Other connections and parts will be seen in Figs. 6 and 8, and leads should be as short and direct as possible, especially in the tuned circuits. It will be seen that two 10k resistors are wired in series to obtain 20k, this being slightly more efficient than using a single 20k resistor. Grid and anode leads should be clear of the chassis. The values of the smoothing and by-pass condensers are in no way critical and somewhat similar components can be used, if to hand.

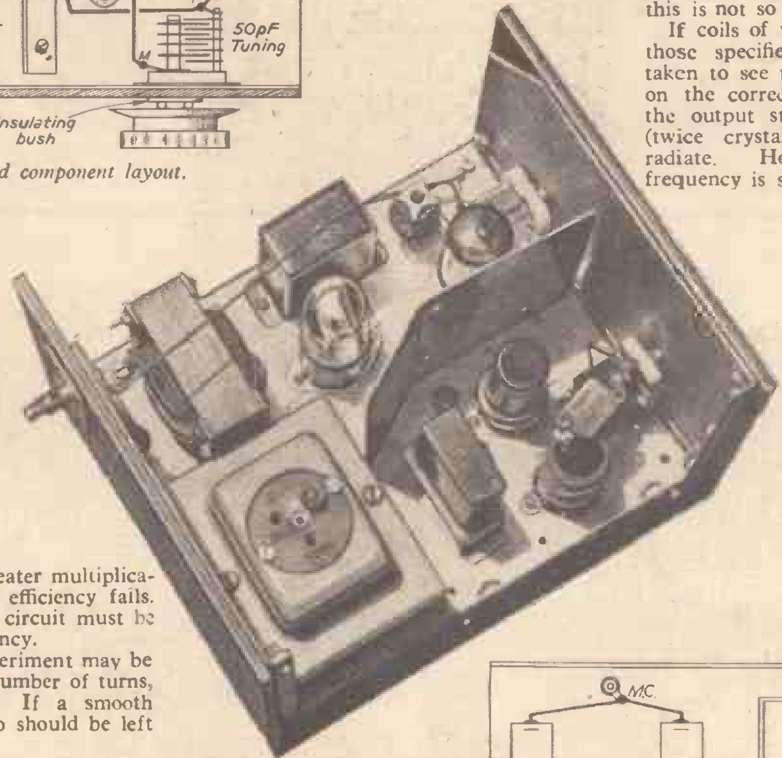


Fig. 7.—Top view showing component layout.

Two terminals, tags or sockets are required to allow the control key to be wired up. A small insulated pendant push switch will be suitable for this. The transmitter only radiates when the switch is closed.

Transmitter Tuning

A bulb loop should be made up to test for R.F. This can consist of two turns of insulated wire, about 1in. diameter, soldered to a bulb-holder, or directly to the bulb itself. A 6V 0.04A bulb, as sold for cycle dynamo rear lights, will be satisfactory.

The 6J5 anode circuit may best be tuned by disconnecting the 4.7k resistor and including a 20mA or similar meter to show the anode current. As the 100pF condenser is opened, a sharp drop in anode current should be noted. This indicates that oscillation has commenced. The optimum tuning point is that producing the greatest dip in current. Wrong tuning will reduce output (but not change frequency) until the valve ceases to oscillate at all. With the bulb loop close against the top of the 9 Mc/s coil, there should be sufficient R.F. to give an indication, when tuning is correct.

The output stage is now tuned. This is simply done by holding the bulb loop in line with the 27 Mc/s coil, and adjusting the 50pF variable condenser for maximum brightness of the bulb filament. As with the previous stage, wrong tuning will reduce output, but not upset the frequency. The output stage will provide enough R.F. to light a .3A. or higher consumption bulb, but this is not so with the first stage.

If coils of very different dimensions than those specified are used, care should be taken to see that they are actually working on the correct multiple. For example, if the output stage were tuned to 18 Mc/s (twice crystal frequency) it would then radiate. However, the difference in frequency is so great that with normal care no trouble of this kind need be expected.

Aerial Coupling

A short vertical rod aerial is most convenient and sufficient for the purposes mentioned. It can be mounted at the back of the transmitter. An insulated lead is taken from it, and is looped twice round the 27 Mc/s coil, near end "D," terminating at a tag bolted to the chassis. The 50pF condenser should be readjusted for maximum output, after adding an aerial.

When testing equipment at short range, no aerial need

(*Concluded on page 94*)

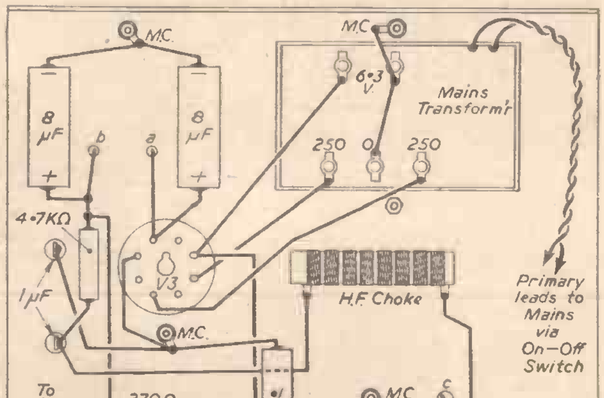


Fig. 8.—Details for completing the wiring.

Photographing Flowers

A. E. BENSUSAN GIVES SOME ADVICE

USUALLY, when we think of flowers we visualise the effect their colours have on us. Therefore, it may be surprising to some readers to find that the photography of flowers, using monochrome materials, is advocated here. In practice, there is virtually no limit to the number of different and attractive studies which can be made using black and white representations of flowers as the main subject matter.

The Camera

Consider first the photography of single or small groups of blooms, to which is applied a close-up treatment. The ideal camera for this type of work is one on which the image can be viewed full-sized, for the arrangement of the subject matter is absolutely vital to the success of the picture. A difference in viewpoint of only an inch or so, such as might be caused by the mounting of a viewfinder above, and possibly to the side of the camera lens, can make a great deal of difference to the final result. Thus, a stand camera or a single lens reflex is the first choice.

A twin lens reflex will also prove useful. if some form of parallax adjustment is used. Not just a prism to ensure that the area covered is the same, but a means of moving the camera bodily from the viewing to the taking position. Following behind are the standard miniature cameras and various other types of instrument. Although all are capable of producing good results, the types mentioned earlier provide easier working conditions and more accurate results.

Fig. 2 (Left).—Using the natural foliage as a base for a close-up.

Fig. 1.—A typical set-up.

Fig. 3 (Right).—A vase of flowers photographed against the light.

Fig. 4.—An out-of-doors picture using flowers and other supporting elements.

If the camera is fitted with double extension bellows, the problem of getting in sufficiently close, to obtain a large image on the negative, does not arise. Otherwise, a supplementary lens must be used to enable the range to be shortened far below that shown on the camera lens focusing scale.

Equipment

The set-up for flower photography is extremely simple. As shown in Fig. 1, only two floodlights are really necessary. One acts in place of the sun to provide a high angle main light while the other, of lower power, merely prevents the shadows from getting too dark and detail-less. Suitable pieces of fabric laid out on a baseboard and clipped to a backing board, provide the foreground and background respectively. The background is always kept completely out of focus and, for this reason, it must be quite plain so as not to spoil the effect with obtrusive highlight or shadow patches.

Accuracy of focus, and complete absence of camera shake, are very important and steps should be taken to ensure that these points are attended to automatically. Where no optical method of distance finding by screen, reflex finder or rangefinder exists, the information should be obtained with a ruler or tape measure. With the camera mounted on a tripod continuity of viewpoint is established, as well as making certain that there is no trace of movement at the moment of exposure. Final adjustments in the positioning of the flowers can then be made with ease.

When arranging the blooms into a tight composition, see that one does not obstruct another and that the arrangement is natural. Do not strip the foliage from the stems, for it can form a useful dark base for the picture, as shown in Fig. 2. Stop the lens down as far as is necessary to keep all the flowers in sharp focus, and then make the exposure with the aid of a cable release.

Pictures of flowers, taken right against the light, are often very effective in a dramatic sense provided that the blooms are sufficiently light-coloured to contrast favourably with the large shadow areas. The back light may be provided by a single floodlamp, but daylight through a window is just as effective. Use a very low-powered secondary light, or a white card reflector to lighten the shadow areas very slightly. Blooms placed in simple but well-proportioned vases are ideal for this treatment, and a picture taken in this way is shown in Fig. 3.

Remember that colour now has no bearing on the subject matter, and the only aim is to interpret the picture in terms of black and white. Therefore, it is essential to use strong compositions with, as necessary, subtle tone effects or harsh dramatic contrasts.

Do not hesitate to use supporting effects for flower photography. Usually the need does not arise with extremely close-up work, where the principal object is either to record the blooms as accurately as possible, or to produce an effect picture by means of a pictorial composition and suitable lighting. With medium distance shots, taken indoors, it is sometimes desirable to use drapes, vases or other similar items to improve either the interest value of the picture, or its pictorial composition.

Flowers Outdoors

Photographs of flowers, taken under outdoor conditions, generally need the assistance of such accessories. Here, the requirement is often that the picture should show the flowers in their natural environment, and some of the surroundings should be included. The placing of the flowers about one-third of the way from the bottom of the photograph ensures that they have a strong place in the picture area, and the focus should be adjusted so that they are quite sharp. If the flower-bed extends for some distance, and the standard of lighting is not good enough to permit the entire bed to be kept perfectly sharp, the accent should be on the blooms nearest to the camera. Some means of framing the picture, by including a tree trunk or branches, helps to concentrate the interest on the main point (Fig. 4).

Full exposure and light development provide a soft and well-detailed negative, with the delicacy of tonal rendering which is so essential to this form of photography. For the same reason, the prints should be rather soft in their gradation and contrasty results should only be tolerated when they are the outcome of the general lighting arrangement, and not the result of too contrasty a paper.

Illumination Photography

Now is the Season to Try This

By H. A. JOHNSON

A CLASS of subject that is coming more into illuminations at resorts is the internally-lit figure. It is made of coloured translucent material and electric bulbs are set inside its hollow body. The result is fairylike and effective.

Built up in panels the figures generally represent storybook characters, gnomes, pixies and the like. They are seldom in one colour, each panel being different—a point that has to be borne in mind when photographing.

Getting pictures of these figures is interesting and satisfying as usually they come out well and look what they are—self-lit shapes set in a velvety black background.

The Film

Reds and colours in the red group, i.e., pink, brown, orange, etc., are often in predominance (probably to produce a sense of warmth) and allowance must be made for this fact. To be able to give a reasonably short exposure and get good tone values, high speed panchromatic material should be used as it is sensitive to red and has a high sensitivity to any light.

Do not let this stop you from trying some exposures even if the film in your camera is orthochromatic, but increase the exposure considerably as this will to a great extent lighten colours on the fringe of the red group, although deep red will still appear very dark.

Fig. 1.—Some examples of the type of figure under discussion.

There is really a lot of latitude in the matter of exposure, but using 29° Scheiner or 30° Scheiner film about 1 minute at f8 will give a negative from which satisfactory prints can be made. Working to this figure, f11 would need two minutes, but f4.5 twelve seconds only; while if you are lucky enough to have a camera with a lens maximum of 3.5 then the exposure could be still shorter.

Remember, however, when taking a set of figures at varying ranges from the camera that a small stop will have to be used to get them all into sharp focus.

The Exposure

After putting the camera on something rock steady, open the shutter and *take the hand right away*, bringing it back only when it is time to close the shutter again. It is almost impossible to keep a hand on a camera for any length of time without bringing in a certain amount of shake which will make the final picture slightly blurred.

During the time that the shutter is open, hold something dark in front of it (about 2in. away) should a car with headlights pass. When the coast is clear remove the shield and carry on with the exposure, deducting the time the shield was before the lens, of course. People in dark clothes and passing fairly quickly across the field of vision do not matter and can be ignored as they will not harm the final picture.

As the internally-lit figures are generally perfectly steady, longish exposures can be given with ease, so if anything always err on the generous side. With orthochromatic material you will have to go a long way before over-exposure can be seen.

Processing

Exposures of this sort are best processed in developers of the Promicrol or Capitol kind which bring up every bit of light-struck emulsion while not clogging the better exposed areas. In effect these developers make a plate of film seem "faster." With them successful pictures have been taken by candle light, which shows how vigorous they are.

Fig. 2.—The subjects are often story book characters.

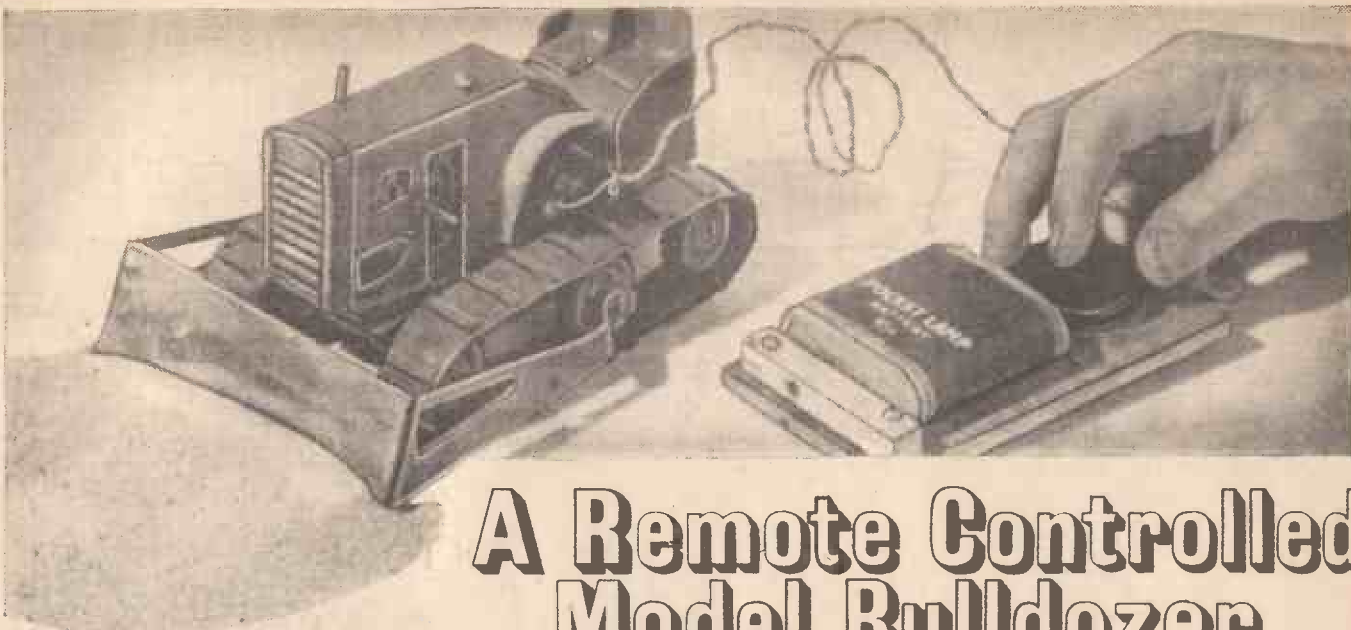
Printing

Print on a normal grade of paper, not contrasty; even so, let the backgrounds go really dark as this improves the effect. Washed out backgrounds are not good.

While the impression of a lighted figure against a really dark background is satisfying, some photographers favour trying to get this sort of picture at late dusk rather than in complete darkness as this very faintly outlines the figures. This, however, is a matter of personal taste.

Though not in the realm of straight picture making these illuminated figures lend themselves well to one or other of the methods of print tinting (i.e., one colour all over), or to definite colouring. When trying the latter, the prints must be first sepia toned.

Why not try your hand now while the illuminations at seaside towns are still switched on?



A Remote Controlled Model Bulldozer

By Graham Bettney

It Will Climb Very Steep Gradients and Pull Five Times Its Own Weight

TAKE a strong piece of tinplate 6in. long and $1\frac{1}{2}$in. wide. Make a slot $1\frac{1}{2}$in. long and 3/16in. wide, $\frac{1}{2}$in. from one end to take the driving wheel, as shown in Fig. 1. Next drill eight holes $\frac{1}{8}$in. from the sides. These are for bolting the bent-over strips of tinplate to make the axle supports, and are bored with a $\frac{1}{8}$in. drill. Two of the holes are for fixing the clockwork engine on to the frame.

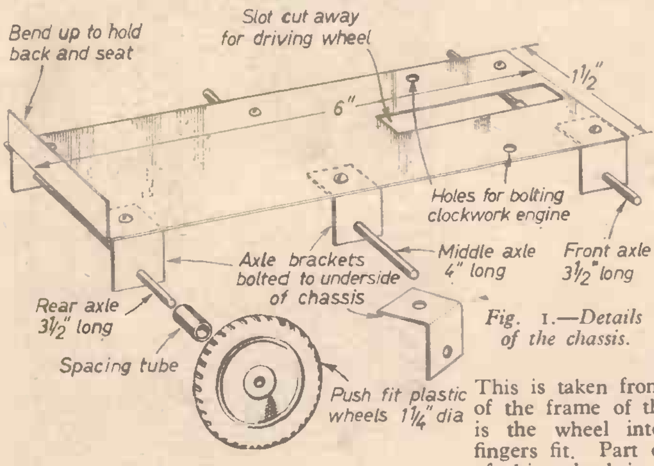


Fig. 1.—Details of the chassis.

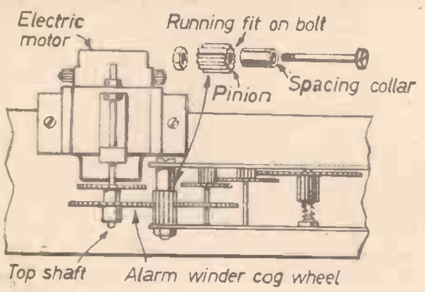


Fig. 2.—Mechanism details.

Two small bent pieces of strong tinplate are soldered on to the clockwork frame at the bottom, one at each side, with a $\frac{1}{8}$in. hole drilled in them, as shown in Figs. 1 and 3. After this has been done, bend six strips of tinplate, also with $\frac{1}{8}$in. holes drilled in them, and bolt in position. For axle supports, as shown in Fig. 1, the tinplate should be bent up $\frac{1}{4}$in. at the opposite end to the slot. This is to hold the back and seat.

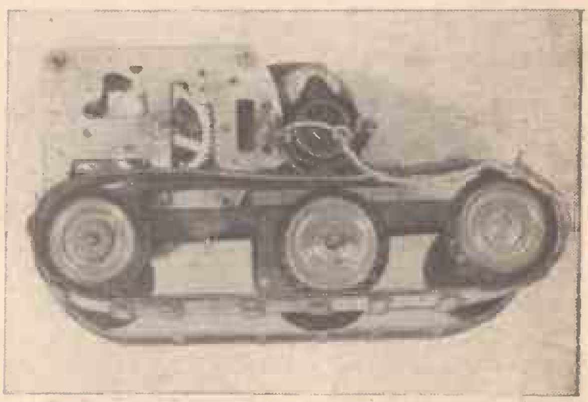
The Wheels

Take an old alarm clock, strip it down until you have the four wheels, as shown in Fig. 3. You will need two other wheels from the clock, the alarm wheel, that is fixed on to the longer pulley shaft of the motor and the finger wheel. This is taken from the outside of the frame of the clock, and is the wheel into which the fingers fit. Part of the tubing of this wheel is cut off, then the wheel is soldered on to the small wheel, as shown in Fig. 3, making sure that it is soldered centrally. It will help to fix a short tube into the centre of the finger wheel, thus making it a better fit, the same thing applies to the fixing of the alarm wheel on to the pulley shaft, but thicker tubing is used as shown in Fig. 2. Care should be taken over the fixing of these two wheels.

The small gear-wheel, shown in Fig. 3, must run smoothly on the nut and bolt as shown in Fig. 2. A small piece of tube is essential to keep the small gear-wheel in position (Fig. 2).

The Motor

The motor is raised on small blocks



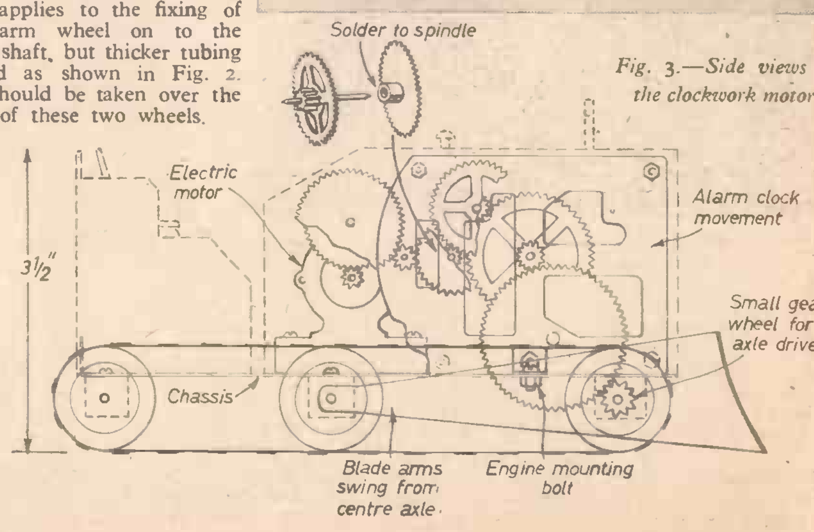
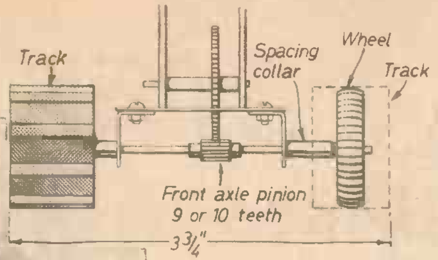
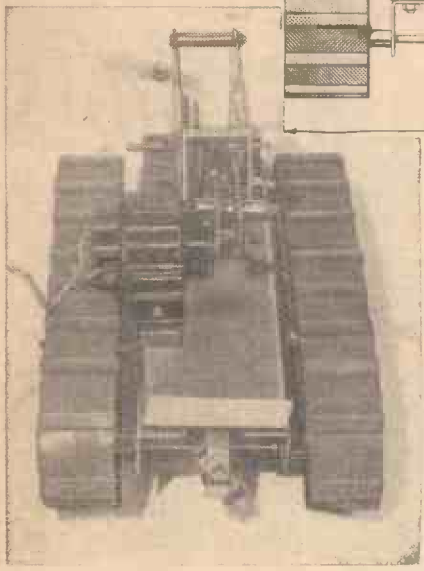


Fig. 3.—Side views of the clockwork motor.

Fig. 4.—Two front views of the bulldozer.





of wood before being bolted in position, this is to allow the tracks to pass underneath the shell of the motor. This can be seen in Figs. 4 and 5. The wheels are plastic (1¼in. dia.) and are of the push-on type. The axles are of ⅛in. dia. brass or steel rod.

The front and rear axles are 3½in. long, and the middle axle is 4in. long, this is to enable the blade shafts to be fixed on to it.

The small gear-wheel for the front axle drive is soldered in position, making sure it is central with the time cog-wheel as shown in Figs. 3 and 4.

Constructing the Body

The bodywork of the prototype was made of good quality cardboard, but other materials could be used. The bonnet is shaped round the frame of the clockwork engine, leaving a space at each side so that the motion of the wheels can be seen. A small hole is made at each side to take the bent pieces of strong wire, one at each side of the bonnet. The other ends of the wire are fitted under the chassis, as shown in Fig. 5. The wires should be bent so as to make the bonnet a tight fit on to the chassis.

The back of the bodywork, that is the back and seat of the bulldozer, is cut and glued into shape, as shown in Fig. 5. A piece of cardboard is glued on the inside to form the slot at the back, it can then be easily slotted on to the bent up end of the chassis.

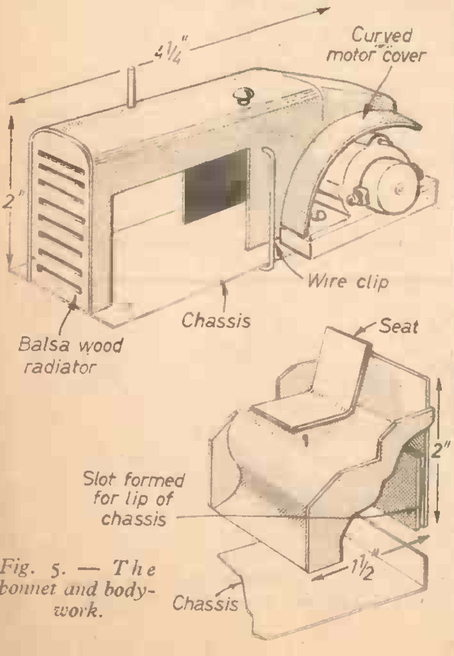


Fig. 5.—The bonnet and bodywork.

Making the Blade

The blade is also made of tinplate. The arms can be cut away in the middle to make it more realistic, as shown in Fig. 6, or they can be left solid. The ends of the arms are bent over and curved a little. The blade is also curved so it fits flush with the arms, the blade is then soldered on to the arms.

When fixing it on the middle axle it may spring off. This can easily be overcome by putting a small piece of rubber tubing at each end of the axle after the arms have been put in place.

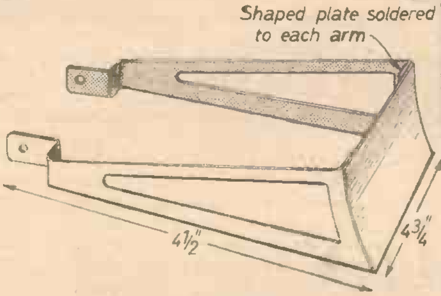


Fig. 6.—Dimensions of the blade.

The tracks are made of 1/16in. × 1in. rubber. The guides on the inside, and the track grips on the outside are of 1/16in. × ¼in. strip rubber. The tracks are also glued together with 1/16in. × 1in. rubber, as in Fig. 7, making sure that a good rubber glue is used and also that the tracks are a pull-on fit over the wheels. If the tracks are slack they will not turn with the wheels.

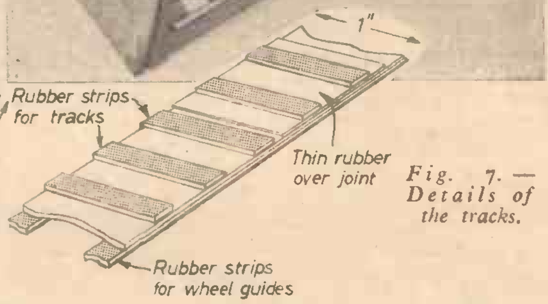


Fig. 7.—Details of the tracks.

Fig. 8.—The control switch.

Making the Switch

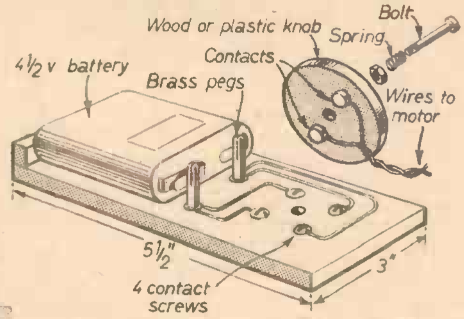
The most important thing is to make sure the two screw heads on the wooden knob—these are the two to the motor—make contact with the four screws in the baseboard, as shown in Fig. 8. If you do not wish to make a switch of this kind a reverse switch can be bought from most model shops.

The two small gear-wheels for the engine drive and axle drive are from broken mechanical toys, but can be purchased from most model toy shops. So can the Mighty Midget Motor, which is used on this model.

To make the model complete bore a ⅛in. hole on the top of the body work and press a small piece of plastic tubing into it to form the exhaust. The air filter on the opposite side to the exhaust is the top of a small knitting needle and is inserted the same way as the exhaust. This can be seen in Fig. 5.

When painting the tracks of the model make sure you do not paint the track grips; otherwise the model will tend to slip when climbing over a smooth surface.

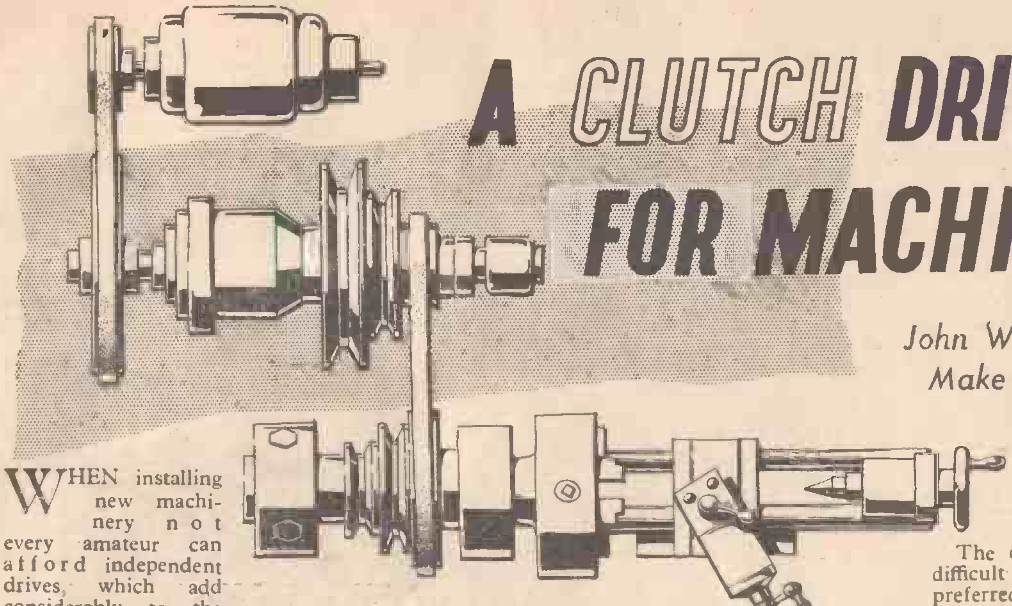
If a little patience is used in construction it will give a first-class performance, such as climbing a very steep gradient and pulling many times its own weight. The switch is held in the hand and can be operated from many yards distance if desired, the two wires to the model from the switch can be any length. More detail can be put on the model when painting it.



SOUTHERN MIDGET RACING CLUB

IN view of the rapidly mounting enthusiasm for Go-Kart racing in this country, it has been decided to form a Club catering for the enthusiast in the south of England. The aim is to promote races under the R.A.C. Formula for the tiny machines, arrange social meetings, and circulate a monthly bulletin of interest to all Karting enthusiasts.

All those interested are invited to communicate with the Secretary, Southern Midget Racing Club, 197, Albany Street, London, N.W.1. for full details of membership.



A CLUTCH DRIVE FOR MACHINE TOOLS

John Waller Tells You How to Make it and How it Works

WHEN installing new machinery not every amateur can afford independent drives, which add considerably to the initial cost.

The use of clutches as an alternative form of control can mean that all the machines can take their motion from a single motor without having the unsightly array of belts which the normal countershaft form of drive can produce. Again, many readers may prefer a mechanical control rather than the switch for the electric motor. The use of flat belts moved from a loose to a fast pulley is yet another method that does not find favour because of the constant tapping noise created by the belt joint passing over the pulley.

Clutch Details

A clutch mechanism embodied in the drive means that a silent and efficient way of rotating the wheels is accomplished which gives instant stopping and starting with a negligible amount of noise especially when the vee type of belts are employed. The type of clutch in Fig. 1 has been utilised on numerous occasions by the writer in both the home workshop and for driving light machinery in industry, and used in conjunction with the tilting countershaft it provides a compact assembly which can stow away behind the machine or form part of a long drive arranged at the rear of a line of machine tools.

Both ideas—the movement of hardened balls on tapered seatings and the facing of circular details with brake material or leather are well known and both methods are utilised in this drive. The completed clutch is easily machined and constructed in the average workshop where a 4in. lathe is available. Some 20 clutches of various dimensions have been made, ranging from a baby member for connecting a sewing machine motor to that needed to drive a rather massive shaping machine where the intermittent motion made it essential to ensure there was no possible slippage. The design is offered as a practical solution to almost every form of workshop drive; it being merely necessary to enlarge or reduce the ball diameter and ball circle according to requirements.

Construction

A hardened steel stop collar "A" (Fig. 1), is secured by a cross pin to the shaft "T." The heat treatment process is essential because the pressure exerted by the balls on the taper can rapidly score the surface and ruin it. Most home mechanics obtain satisfactory results by observing the colour of a piece of steel when in the heated state. The removal of scale is not a formidable problem and is essential from the outside diameter, angle face and bore. If the part is held on the diameter through which the cross pin is driven, a quick spin in a three-jaw chuck will soon restore the polished surfaces. Initially bore the hole a tight fit in relation to the driving shaft as the removal of scale will then allow it to slide over without difficulty.

The outer sliding collar "B" is really a two-part detail, including the cover "C," which is to prevent dirt and chippings from entering the ball cone and clutch facing. The coned portion "B" is treated in the same manner as "A" and subsequently polished, but the cover is merely a piece of bright mild steel bored and threaded to fit tightly over the collar.

The cone or step pulley "G" is not a difficult pattern to construct if a casting is preferred, but as the latter takes a considerable time a steel pulley or one from an odd piece of cast iron, is machined almost as quickly as the pattern. Rough machine either of these details and then braze in the oil lubricator boss.

Two phosphor bronze bushes "H" and "J" are driven into the pulley. They are flanged to cover the complete facing of the pulley and are given a very rough face to receive the clutch material. Ferrodo and leather give almost equal results in this equipment though the latter wears a little faster, however, as scrap pieces are used—often short pieces rather than a full circle—they need cost nothing.

A cover is provided at the right-hand end in the form of two half plates "N." These sections are made as a turned circle and on cutting through with a saw they are easily assembled into the groove of the adjusting nut "M." To perform its duties efficiently a reasonable amount of movement is necessary; thus the plate must well clear the sides of the groove. Depending on the size of clutch under construction, a gap $\frac{1}{8}$in.

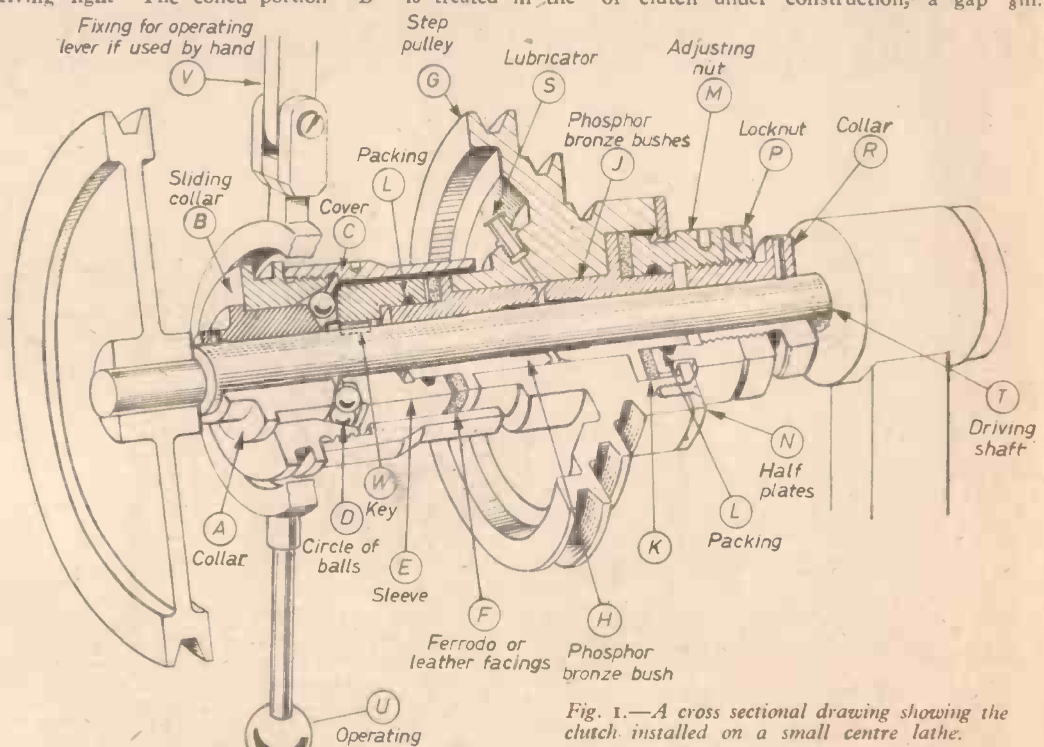


Fig. 1.—A cross sectional drawing showing the clutch installed on a small centre lathe.

larger than the plate thickness is required. To the bush "J" is attached another disc of clutch material which operates against the face of this adjusting nut. In order to ensure the latter "takes up" squarely—an impossible situation from a threaded location, one end fits snugly over the extended diameter of the phosphor bronze bush "J." Incidentally, oil seals are included on both these bushes at "L" to exclude oil from the clutch material.

At the extreme right-hand end of the assembly is the locknut "P" which carries out the obvious task of locking the adjusting

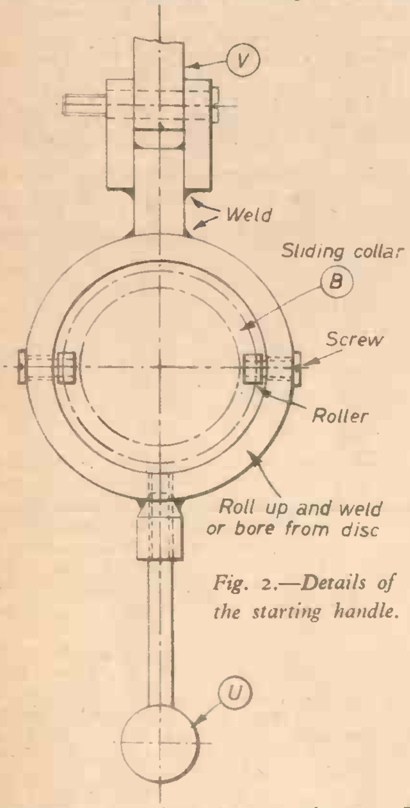


Fig. 2.—Details of the starting handle.

nut once this item is correctly set. The collar "R" performs a task similar to that of "A" at the opposite end, only on this occasion it has no sliding member locating on it. This collar is simply to increase the shaft diameter and provide the threaded diameter for the previously mentioned nuts.

The final item is the operating handle "U" which as the name implies, actuates the gear back and forth.

Action of the Clutch

The motion of moving this handle to the right—assuming, of course, the mechanism is in the disengaged position—causes the balls to move inwards under the influence of the taper in the collar "B." This causes them to move down the taper machined on the collar "A," thus moving them to the right and pushing with them the sleeve "E" against the leather facing, and so causing the stepped pulley to rotate.

The sleeve "E" is another hardened member, but this time it is keyed to the driving shaft. It rotates with the latter item but as no restriction is placed on it in a longitudinal direction, it can slide when a pressure is imparted to it. Releasing the operating handle will cause the balls to resume their former position as centrifugal force comes into operation and tends to make them fly outwards. This release of pressure means that the clutch would slip if any attempt were made to obtain a drive from it.

Operating Handle

Fig. 2 gives the design of an operating handle, fabricated from odd pieces of material and either welded at the local garage or brazed with Sif-Bronze in the home workshop.

A steel disc bored out to pass easily over the collar "B" is the basis of this design, and other items are welded to it as shown to make a hinge. The boss at the lower end provides a site for the handle, and is tapped for this purpose. The arrangement of the bar "Y," to which the handle is attached, depends solely on the way this item is fixed close to the lathe or other machine; a point which the reader must settle before embarking on the welding process. Two small rollers engage with a groove turned in the sleeve "B" and these are held in position in the conventional manner by means of two specially turned screws which have a plain diameter to create a bearing for the roller. As the groove in the sleeve is hardened, a similar treatment imparted to both rollers ensures these items last a considerable time before renewal becomes necessary. There is no need to treat the screws in this way.

Foot Operation

A foot-operated clutch is not difficult to make, but the type will largely depend on the work carried out, as there are occasions when stopping every few seconds is required, while for other machines the engagement of the clutch signifies a run of several minutes before the machine is brought to rest.

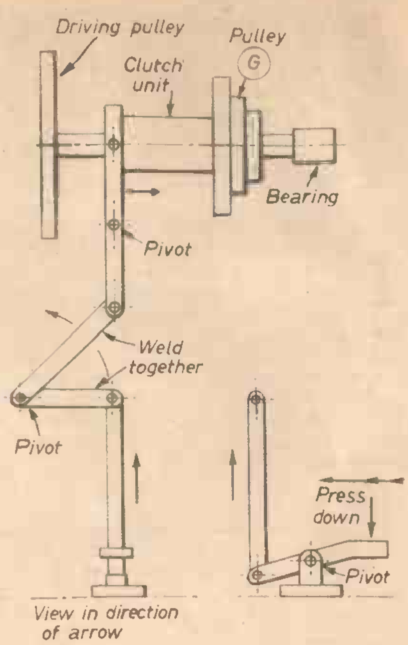


Fig. 3.—Method of providing a foot-operated arrangement.

Fig. 3 shows a foot treadle layout. Exact details will obviously depend on the usual factors of space, design of the machine and position of the drive in relation to the place of work. Generally speaking, most individuals will prefer to have the machine running all the time the foot is holding down the pedal. When it becomes necessary to stop the machine this is much better than spending time groping about to find the pedal. Somewhere in the "circuit" a rather heavy coiled spring is needed to help pull off the clutch as the foot is released and its location is a matter for experiment.

Avoid tight joints and pins as these naturally set up severe friction and make it difficult for the spring to release the drive. A difference between the diameters, giving gaps of about .003in. or .005in. is ample, especially if the parts are kept well oiled. There are all manner of different methods of connecting the clutch with a foot pedal control. A system of levers arranged at the rear of, say, a lathe, to reach from above is one idea.

Some initial care in adjusting the clutch is obviously essential, and a subsequent taking up of a slight degree of slack when the contact faces have bedded down is all that is usually needed over a long period.

GUIDED MISSILE FIRE FIGHTER

THE Solar Aircraft Company has recently designed a new guided missile fire fighter that is launched like a rocket and hovers like a helicopter. Known as the Firefly, it can zoom anywhere within five miles in 40 seconds.

When it reaches a crash scene, the unmanned craft turns into a helicopter and hovers over the area. Then a remote operator can flip a switch releasing more than a ton of extinguishing liquid over the crashed aircraft. The Firefly looks like a small aircraft with helicopter blades in its tail and a fire nozzle in its nose. A solid propellant rocket under the fuselage shoots the missile into cruise altitude.

The missile-helicopter reaches its goal in three flight stages: 1, a ballistic trajectory; 2, powered level flight and glide, and 3, deceleration and hovering. The missile picks up commands from a remote operator through an electronic "brain," and translates these into mechanical control of its devices.

Building the 'Luton Minor'

(*Continued from the October issue*)

3.—Commencing Construction of the Main Plane

THE wing of the Minor is made in two halves which are joined together at the centre by fittings attached to the fuselage wing pylons.

Each mainplane is 12ft. 6in. in length and has a chord (width from leading edge to trailing edge) of 63in. The wing section is R.A.F. 48 (modified). This section has been chosen for its good lift/drag co-efficient and gentle stall characteristics.

Jig for the Ribs

This is best made from a panel of blockboard about 5½ft. long and 1ft. wide. On to this, draw the full size layout of the rib, marking first the centre-line (rib datum), parallel to the lower edge. The bottom edge of the board must be quite straight.

Step off the ordinate stations, the first one (zero inches) being about 2in. from the left-hand edge of the board. Using a carpenter's square against the bottom edge of the board, draw in the station lines at right angles to the datum across the board.

With dividers, accurately step off the rib co-ordinates at each station, making doubly sure that the right dimension is set off at the correct station above and below the centre line.

Now mark in the position of the spars. The centre of the front spar is 9.45in. from the leading edge (station zero inches) and the rear spar is 34.65in. from the front spar centre.

Cut lengths of wood of the same section as the spar to represent the spars in the jig. The widths of these pieces should be equal to the spar thickness. Carefully glue and nail these into the jig at their correct positions.

From ½in. × 1in. strip wood cut a number of blocks about 1½in. long. These are required to hold the rib members in position while the rib is being assembled and they are glued and nailed to the jig at each side of every member. On the capstrips, they should be placed at frequent intervals—a spacing of 4in. is advised. The rib verticals and diagonals need only be located by a block either side at each end. Make sure that the rib member is a snug but not tight fit between the blocks. Since all the main ribs must be of the same profile, it is recommended that one jig only be used.

Having finished making the jig, paint it with two coats of very hot linseed oil, letting the oil sink well into the wood of the jig. The oil is to prevent surplus glue from the rib sticking to the jig and preventing its easy removal. Remember that the boiling point of oil is very high and hot oil can burn your brush (and your skin) long before it begins to look really hot. Do not let oil contaminate aircraft woods—keep your timber well clear of oil, grease, dirt and dust.

This rib jig will make all the main ribs (Rib A). Separate jigs will be required for Ribs B, C and D but, as only two of each rib are needed, the jigs can be made using headless brads to locate the rib members. Note that the ribs which form the aileron have a wider rear spar gap. Use the same jig, but pack out the gap to take the aileron spar. See Fig. 12.

A well made and accurate jig can save a lot of time and effort—especially when it comes to dressing the wing leading edge before ply covering.

The Rib Capstrips

These should not need pre-forming, although it is somewhat simpler to slip them in and out of the jig if they are so treated. To pre-form them, place a large shallow dish filled with water on a gas ring or stove so that about 12in. to 15in. of the end of the strip wood may be saturated. Boil the ends of all the strips for not more than five minutes.

Pre-form them to a slightly greater curve than is needed to allow for spring when they are dry. Clamp them up, as shown in Fig. 14, and leave at least overnight to dry out thoroughly. Do not try to accelerate drying aircraft wood by heating—this dries the timber quickly on the outside thereby making it brittle and can, in extreme cases, encourage rot. Air-drying is far better and much safer.

A lot of time can be saved at this stage

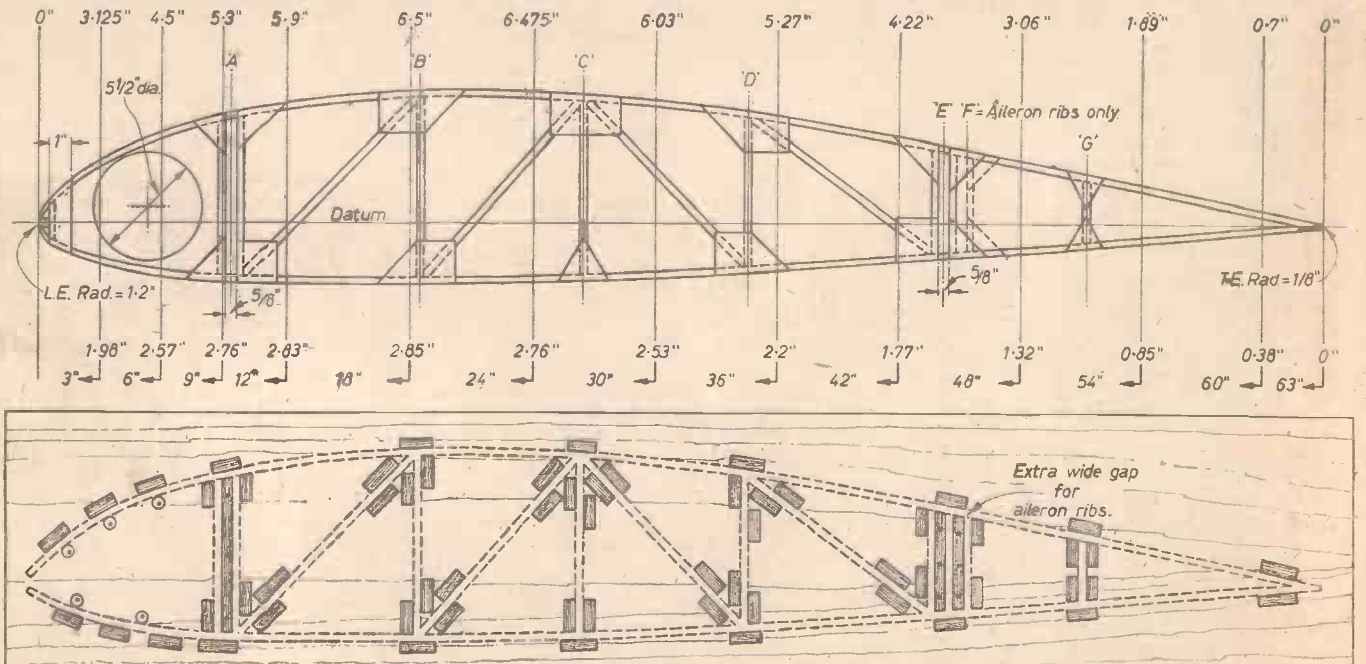


Fig. 12.—Rib construction and jig for assembling the ribs.

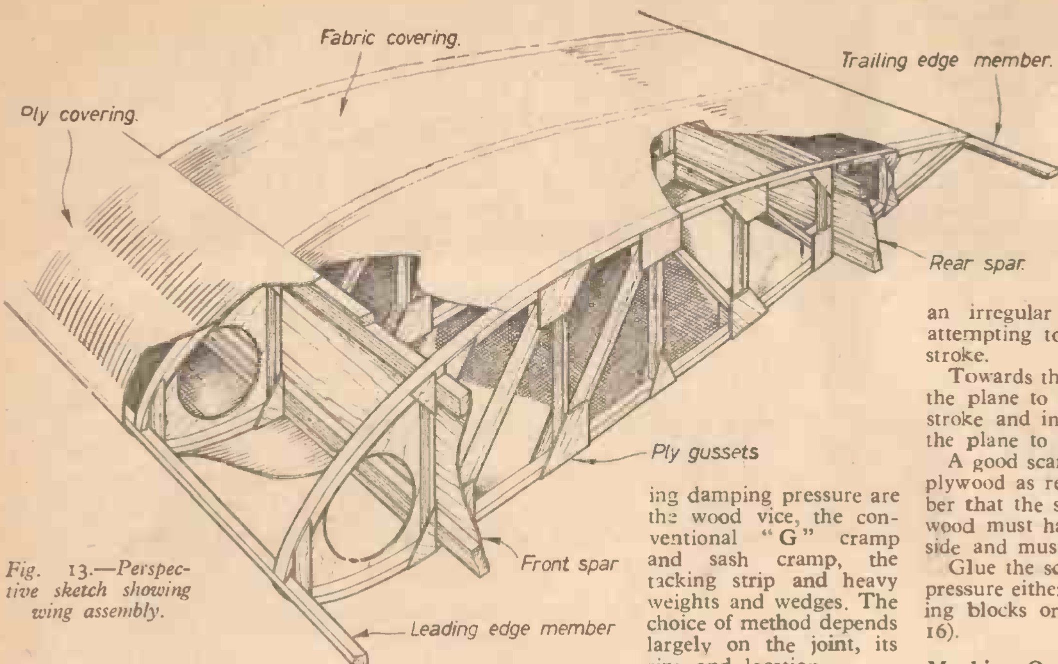


Fig. 13.—Perspective sketch showing wing assembly.

by cutting out all the plywood gussets for the wing ribs. They are of 1/16in. thick plywood and there are only three basic shapes. The direction of the grain is not important. Cut out the nose webs from 1/16in. plywood. Trepan out the lightening hole either with a fly-cutter or by using a sharp pair of carpenter's compasses.

Slip an upper and a lower capstrip into the jig and cut the diagonals and vertical members. Cut all these members for the set of ribs. You will find that, by selective marking out, you will have very little waste rib stock, offcuts coming in useful for shorter rib members.

Gluing the Rib

Mix the adhesive for the ribs and begin gluing all the verticals and diagonals, ensuring that the joints are well glued but avoiding excess glue. Glue also the nose web and all the ply gussets, stapling them into place.

The rib is now sufficiently solid to lift from the jig. Turn it over, lay it on a flat surface and glue and staple the gussets to the other side. Build all the ribs in this fashion. If the parts are cut ready beforehand as suggested, it should only take about 30 minutes to assemble each rib.

Some of the gussets will have overlapped the edge of the capstrips in order to place them accurately on the rib joint. This does not matter as any excess may be removed when the glue is set.

A useful device for cleaning such surplus off the rib profiles is a metal-backed sanding disc fixed in a saw table. This will ensure that the rib edge is quite square. The sanding disc can be stuck to the metal face plate in the saw bench with a good contact adhesive. This sanding disc may also be used for trimming the mitres on the rib diagonals and will have many similar applications on the Minor.

The Spars

Cut and scarf together the plywood for the spar shear webs, leaving the plywood about ½in. wider than will be required.

The scarf joint is one of the strongest joints in woodwork if it is properly made. It consists of feathering the edges of the pieces of timber or plywood to be joined, one on the top surface and one on the under surface so that they may be superimposed upon each other, glued and clamped until set. Among the various methods of applying damping pressure are the wood vice, the conventional "G" cramp and sash cramp, the tacking strip and heavy weights and wedges. The choice of method depends largely on the joint, its size and location.

The essence of a good scarf lies in the very accurate marking out so that the joint is the same length on both pieces of timber being joined.

To scarf plywood, first select a good

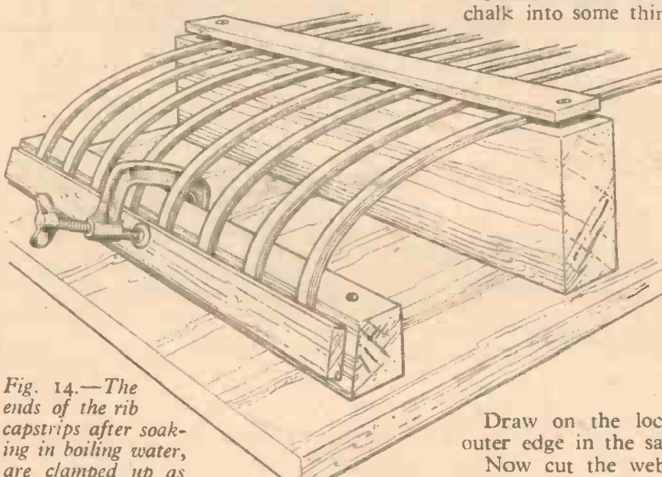


Fig. 14.—The ends of the rib capstrips after soaking in boiling water, are clamped up as shown.

planed wooden board about 1in. thick which is smooth, free from twist or wind and which has a straight edge.

Screw this to the end of the bench. Take one of the two pieces of plywood to be scarfed and lay it so that the edge is parallel and flush to the straight edge of the base board. Tack it into place at intervals with brads or staples, keeping the tacks at least 1½in. away from the edge (Fig. 15).

The width of the scarf for 1/16in. plywood should not be less than ¾in. and preferably ⅞in. Pencil a line this distance from the edge.

Check that the blade of the smoothing plane is sharp. A 1½in. or 2in. steel plane is best to use, although a small bullnosed plane will be needed later for certain scarfs cut when one piece of plywood is *in situ*.

Set the blade to remove only a thin shaving at a time and proceed to feather the edge of the plywood. If the plane is held at an angle of 15 to 20 deg. to the line of the scarf so that the wood is sheared off, a fine clean cut can be achieved. Since plywood is laminated, the various layers will show up as parallel bands as the edge is prepared. If the bands are not parallel, then the edge is not true; typical causes might be dirt between the ply and the base board, an irregular edge to the base board or attempting to plane off too much at each stroke.

Towards the completion of the edge, adjust the plane to remove even less wood at each stroke and increase the convergent angle of the plane to the edge.

A good scarf should show the layers of the plywood as regular parallel bands. Remember that the second, or mating piece of plywood must have its scarf cut on the reverse side and must be identical in width.

Glue the scarfed strips together and apply pressure either with "G" cramps and clamping blocks or by using tacking strips (Fig. 16).

Marking Out the Spars

Having prepared the four long strips of plywood—two for the mainspars and two for the rear spars—mark off a centre line corresponding to the rib datum along each one. Do this with a chalk line by well rubbing chalk into some thin string. Get two assistants to hold the line taut at each end and in contact with the plywood at the datum position. With forefinger and thumb, lift the string vertically at the middle about 3in. and then let go.

From this datum, mark off the position of the lower boom on one side and draw on the location of the bottom edge of the spar using a hard pencil and a straightedge.

Draw on the location of the top boom outer edge in the same way.

Now cut the web very accurately to the lines drawn and, laying it flat on the floor, tack blocks of wood about 6in. × 1½in. × 1in. at intervals of about 18in. along both sides. Lift out the plywood web.

Carefully select the wood for the booms from the best available spruce and diminish the thickness of the booms at the tip as shown in Fig. 17. Lay them in the jig and

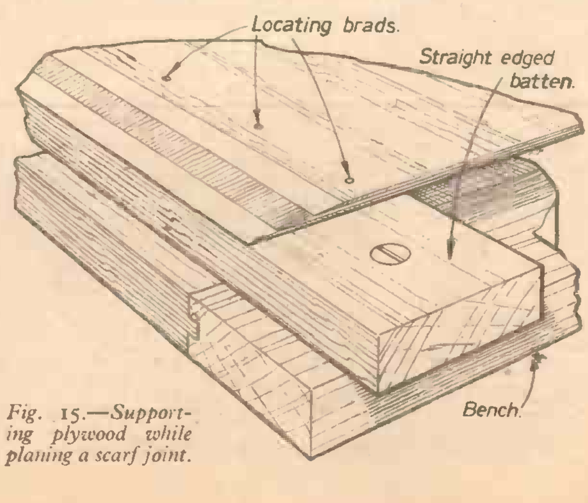


Fig. 15.—Supporting plywood while planing a scarf joint.

pack them out from the centre so that they are in close contact with the jig blocks. If necessary, the outer ends of the booms may be steamed to shape using boiling water. Let them dry thoroughly before gluing. Wherever the glue may come into contact with a wood jig block, insert a strip of polythene sheet or waxed paper.

Cut and fit all the vertical members and the root end block and lift strut angled block. The grain of all blocks in the spar is vertical with the exception of the angled lift strut block which has the grain parallel to its edges. The blocks should be a good snug fit in the booms.

Well glue the top surface of the booms and blocks and also the mating surfaces of the plywood web. Tack the web to the booms using ½in. × 20 s.w.g. brass gimp pins at intervals of about 1in., staggering the pitch as shown in Fig. 18.

Leave the spar to dry and then carefully remove it from the jig. Repeat this for the other spars, remembering to make each pair handed—that is with the plywood web on the other side—so that both port and both starboard spars have the plywood webs facing aft.

Check the spars against each other in pairs to see that they are identical as regards depth and length.

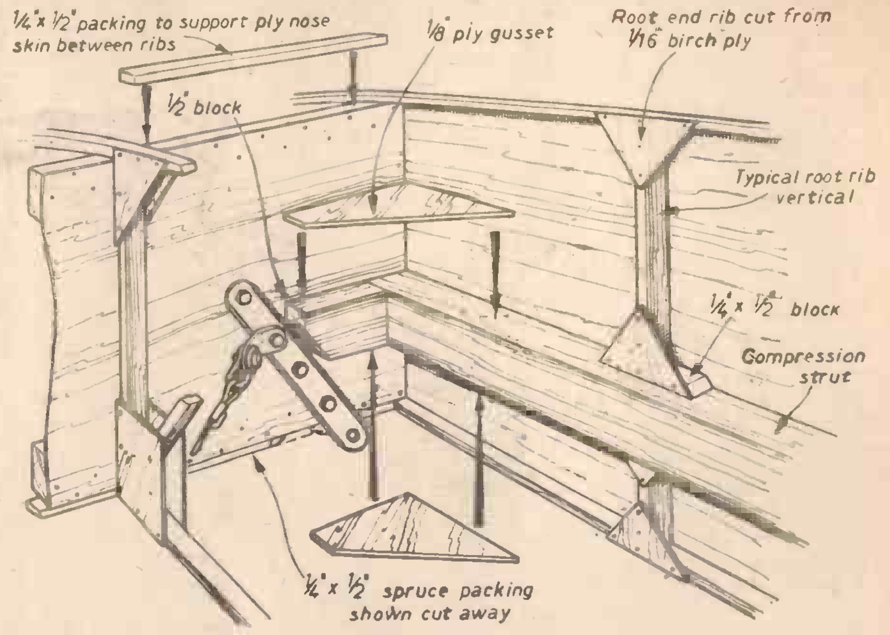


Fig. 19.—Attachment of compression strut at root end.

Compression Struts

Each wing has two bays of wire cross-bracing so there is a main compression strut at the centre, one at the root end and one at the tip. The centre one is of box construction; the tip one is a spruce strut glued to the inboard face of Rib D and the root end one is a spruce strut to which is built the root end rib.

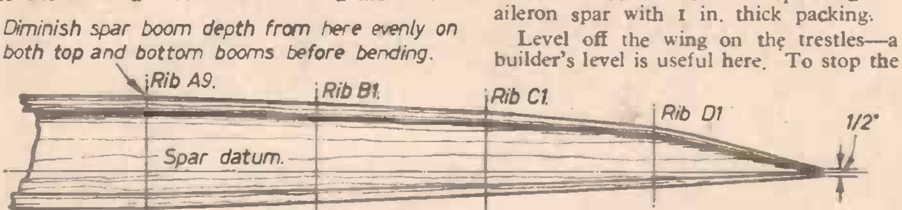


Fig. 17.—Reduction of thickness of spar boom tips.

Make up all the metal fittings for the wings and, having marked their positions on the spars, drill through and temporarily bolt them in place. It is far easier to drill the various bolt holes at this stage as, once the wing is assembled, it is hard to line up the drill.

Mark the correct positions of all the ribs on the spars.

Wing Assembly

Take two saw-horses or folding trestles which stand about 30in. high and set them about 8ft. apart. Lay the port wing front and rear spars upside down across the trestles with their plywood faces aft.

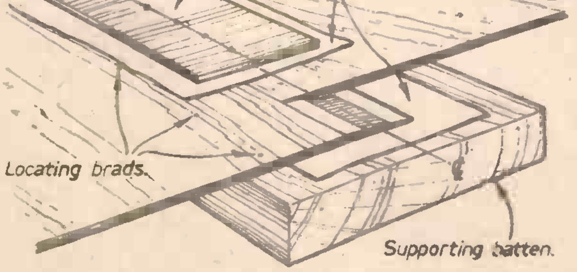


Fig. 16.—Gluing up a plywood scarf joint.

Thread all the ribs A to the spars, bottom surface up, and slide them approximately into their correct positions. Insert the aileron spar (which is made from ⅜in. solid spruce) and then slide on the tip ribs B, C and D. Pack between the rear spar and the aileron spar with 1 in. thick packing.

Level off the wing on the trestles—a builder's level is useful here. To stop the wing slipping off the trestles, tack small blocks either side of the spars.

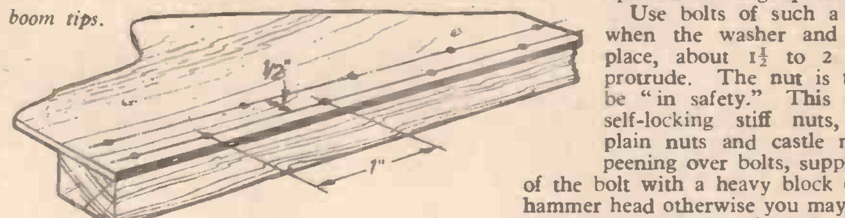


Fig. 18.—How the rows of gimp pins on spar flanges, etc., are staggered.

Glue all the ribs by sliding them to one side of the mark on the spar and thoroughly coating the spar and the rib vertical. Reposition the rib and, having seen that the rib capstrip is in firm contact with the bottom of the spar (uppermost), nail the rib to the spar through the verticals with ½in. × 20 s.w.g. gimp pins. A convenient way of doing this which cuts out much thumb-hitting and tack-bending is to use a spring pin pusher (available at tool shops for about 5s.), finally knocking them home with the tack hammer. For nailing in awkward places, a pair of long-nosed pliers can be used to press the brad in.

The ⅛in. thick plywood plates which cover the root end block and the lift strut fitting block may now be fitted, the latter one being trimmed to fit each side of the rib.

Fix the compression struts, blocking and gusseting them into place (Fig. 19).

Bolting on the Metal Fittings

This is done next. Avoid over-tightening aircraft blots as it is very easy to crush timber and distort fittings. Use a spanner of such a length that it is difficult to exert excessive torque. For a 2 B.A. nut, for example, a 2½in. long spanner is ample; a 3½in. spanner sufficiently tightens a ¼in. nut.

Do not hold the nut with one spanner and turn the bolt with the other. Always tighten up on the nut, using a fixed size spanner or ring spanner.

Use bolts of such a length that, when the washer and nut are in place, about 1½ to 2 full threads protrude. The nut is then said to be "in safety." This applies with self-locking stiff nuts, lock nuts, plain nuts and castle nuts. When peening over bolts, support the head of the bolt with a heavy block of steel or a hammer head otherwise you may damage the structure surrounding the bolt.

Details for completing the wing construction and commencing the fuselage will be given next month.

PUZZLE CORNER

1.—Elusive X, submitted by R. W. G.

FIND the value of x in the following progression.

9	8	7	6	5	4
x	46	94	63	52	61

2.—Long Division ?

DIVIDE 45 into four parts such that if one is multiplied by 2, one added to 2, one has 2 subtracted from it and the other is divided by 2 the results are all equal.

Answers

1.—The answer is 18. This is obtained by squaring 9 and reversing the order of the digits.

2.—Nos. are 5, 8, 12 and 20.

BUILD
PRINTI

THE chief advantages of this printing press, apart from the low cost of construction, are its simplicity in use and the ease with which it may be built. A unique feature is the three-point system of adjustment which enables the glass face of the platen to contact evenly the whole of a maximum or minimum paper or card area. Plate-glass is used both as a base on which to set up the type and for the platen, this being, in the author's opinion, ideal for the purpose.

As can be seen from Fig. 1, the press consists of two main parts: first, the baseboard and plate-glass type-bearer and, second the top with plate-glass platen and frame for associated padding material, compression adjustments and a movable pressure head.

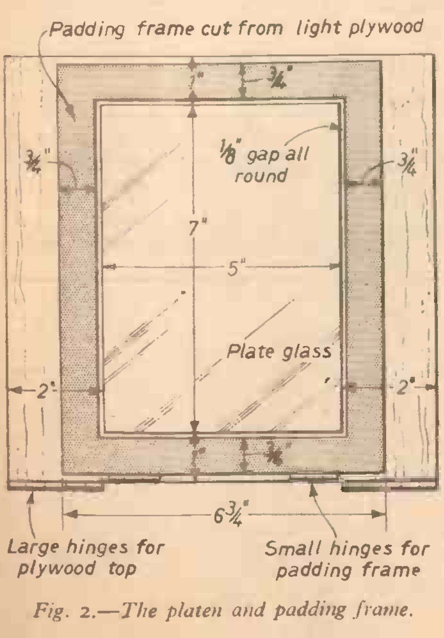


Fig. 2.—The platen and padding frame.

Construction

Start with the base, which, as can be seen from Fig. 1, is a 12in. × 9in. piece of 7/8in. plywood. Another piece of the same material is cut 9in. × 2 1/4in. and glued and screwed into position at one end. This is shown in the end view in Fig. 1 and it will be noted that one of the screws is positioned off centre so as not to foul the T-hinge fixing screw. On the flat part of the base is laid the plate-glass type-bearer, which measures 9in. × 7in. and is 1/4in. thick. To hold this in position it is flanked by two 7in. lengths of 1in. × 1/4in. plywood. These guides are glued into position.

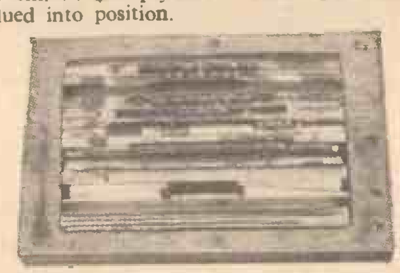


Fig. 3.—The forme, complete with type.

Hinged Top

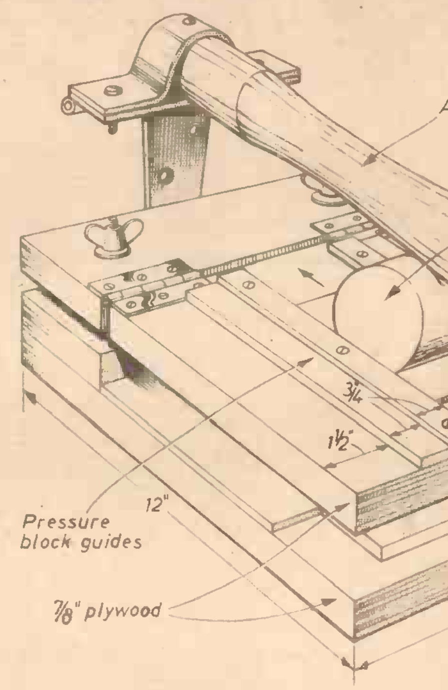
Two more pieces of 7/8in. thick plywood are used for this, measuring 9 1/4in. × 9in. and 9in. × 2 3/8in. respectively. They are hinged together along their 9in. edges by means of two 3in. × 2in. hinges, each secured with six c/sk woodscrews. The 7in. × 5in. piece of plate-glass, which forms the platen, is fixed in position on the underside of the top, as shown in Fig. 2, by means of a generous application of impact adhesive. A 3/4in. wide frame is cut from a single piece of 3/16in. plywood to fit round the platen, leaving a 1/8in. gap, as shown in Fig. 2. This is the padding frame and it is fitted to the top by means of two 1in. × 3/8in. brass hinges positioned between the large top hinges, as shown in Fig. 2.

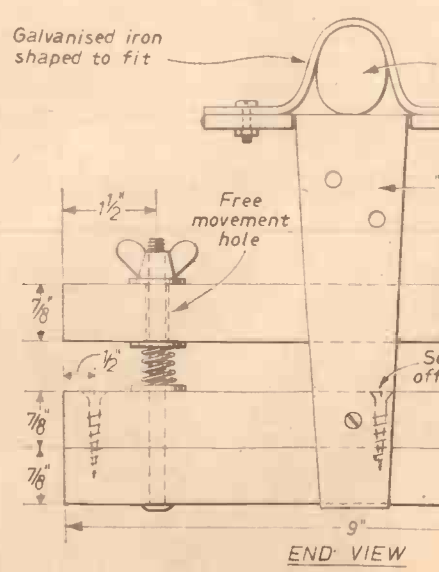
Two small bent-metal clips are made to fit round each side of the padding frame and each of these clips has a stiff copper-wire hook soldered to it. Between pairs of hooks on opposite sides of the padding frame, rubber bands are stretched, as can be seen in the perspective sketch in Fig. 1.

Two larger metal clips are made to secure the frame to the platen bearer.

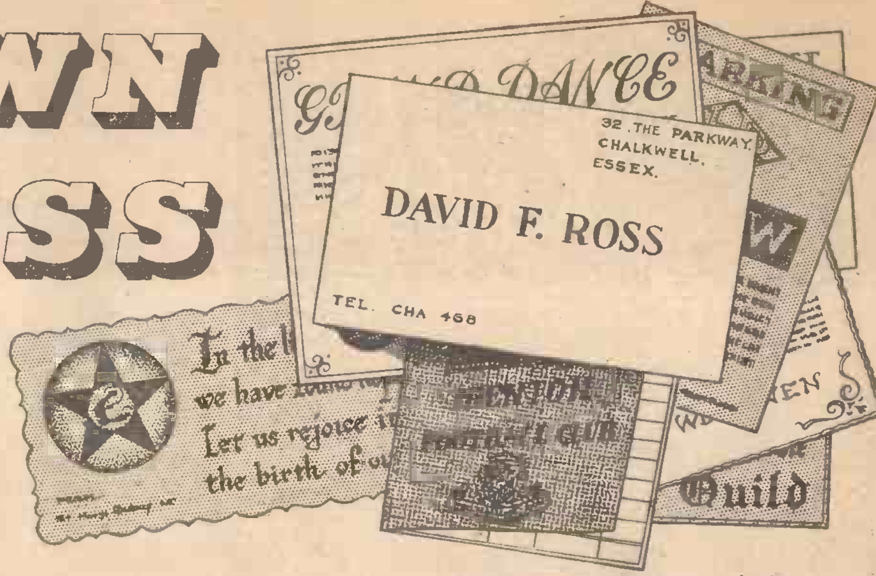
Movable Pressure Head

This is attached to the upper side of the platen bearer. It consists of a 2 1/2in. length of 2 1/2in. diameter dowel, fixed to a movable slide, positioned between guides, as shown in Fig. 1. A flat is cut on the dowel so that it can be screwed firmly to the 3/16in. plywood slide, measuring 2 5/8in. wide × 5in. long. The guides are made up from 3/8in. and 1in. strips of 3/16in. plywood, so that the slide is a free fit, and screwed to the hinged platen bearer with woodscrews. The





YOUR OWN
NG PRESS



By J. Rodger

It Can Be Made For Less Than £1

top of the dowel may be grooved to provide a snug fit for the pressure handle.

Assembly

The method of attaching the platen bearer to the baseboard can be seen in the end view in Fig. 1. Two 4in. × ¼in. bolts complete with three washers, one 1in. compression spring and one nut each are threaded through clearance holes drilled through the base and the short hinged part of the platen bearer. The bolt must be a free fit in the platen bearer so that pressure adjustments can be made by means of the wing nuts.

A 10in. metal T-hinge is bent to a right angle, giving arms 6in. and 4in. Positioned, as shown in the side view in Fig. 1, against the end of the baseboard and platen bearer the hinge is screwed to the underside of the baseboard and to the upper piece of plywood already glued and screwed to the baseboard, but *not* to the platen bearer.

An 18in. wooden axe handle is fixed at its head end to the short, wide part of the hinge by means of a galvanised iron strap, bent to shape, as shown, and secured by means of nuts and bolts. The top of the strap is drilled and a woodscrew passed through and into the wooden axe handle. The other end of the axe handle is fitted with a tennis racket grip of rubber and the press is complete.

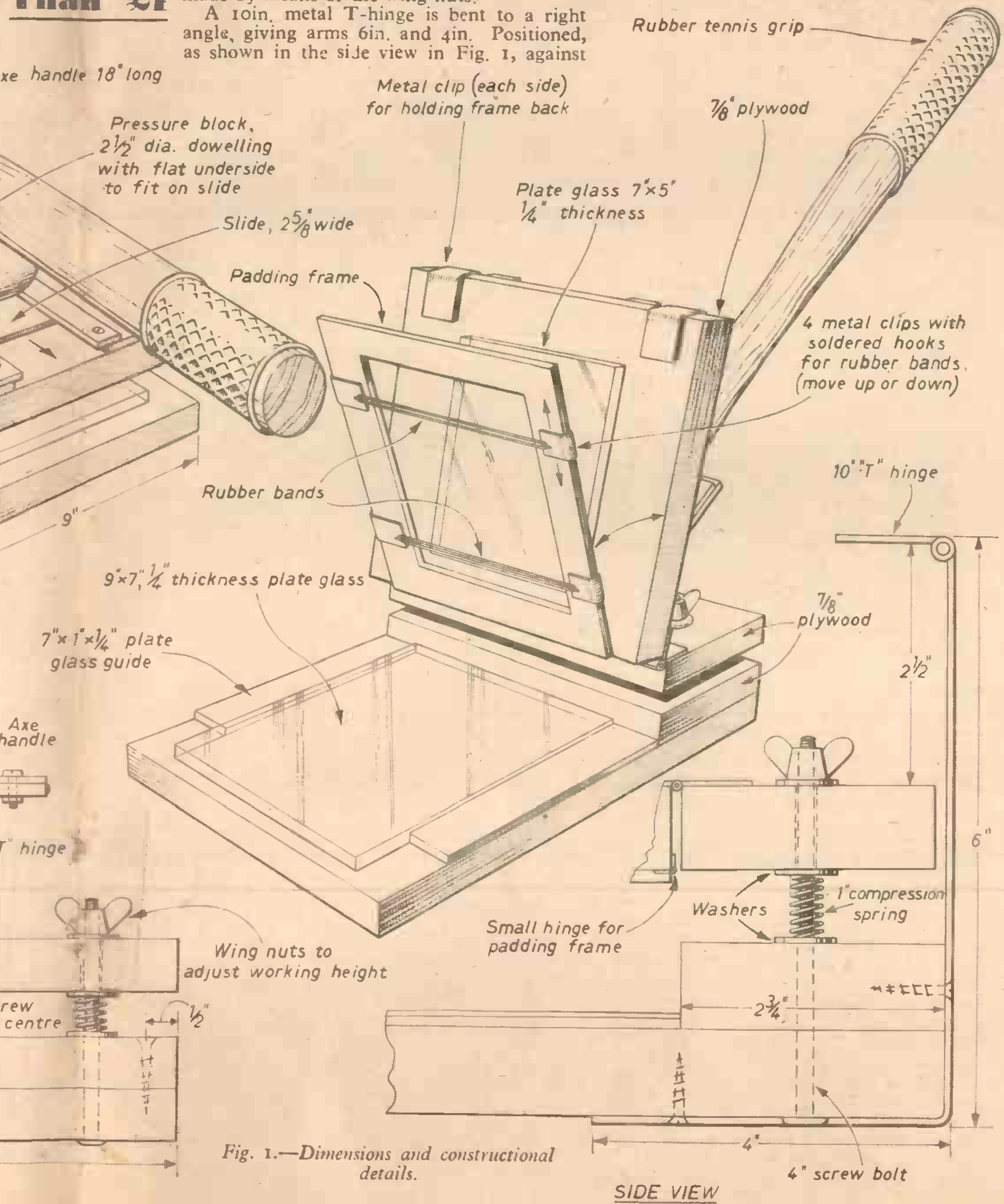


Fig. 1.—Dimensions and constructional details.

The Forme

The forme can be cut from a single piece of ⅞in. thick plywood or it can be built up from thinner pieces to the required thickness, as shown in Fig. 3. The inside measurements of the forme shown are 5in. × 3¼in. and the outside dimensions 6½in. × 4in.

For use with the forme some "furniture" will be required. This consists of wood packing pieces of standard size, reglets to use between the lines of type and side sticks and quoins. To make all this clear Fig. 4 shows how the type is set, using packing blocks, reglets, side pieces and quoins. Upper and lower side pieces are used when the forme is used vertically and left and right side pieces when it is used horizontally. Packing strips will be required in two lengths.

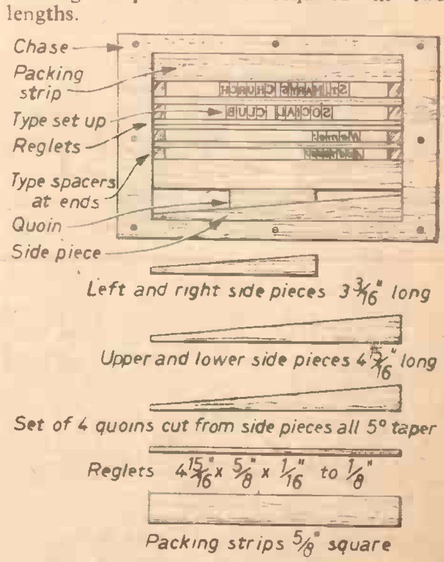
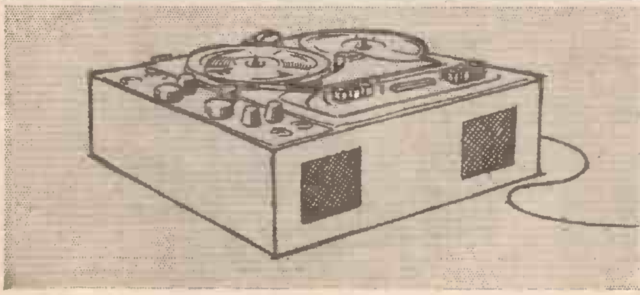


Fig. 4.—How the type is set and details of furniture.

Building a Tape Recorder



PART 2

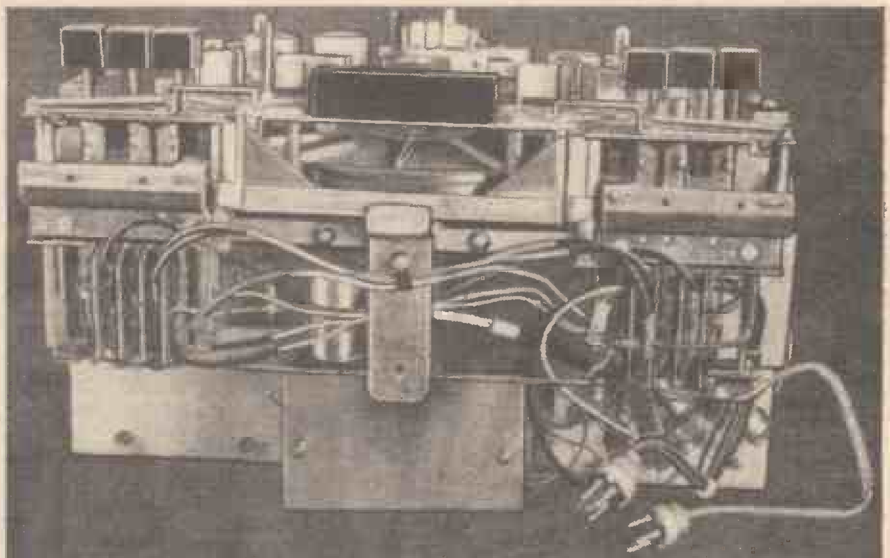
Continued from the October Issue

By S. A. KNIGHT

ON the side strips mentioned at the end of last month's article are bolted four rods of insulating material (such as bakelite), ½in. dia. and 4½in. long (three off), and 5⅞in. long (one off), to support the tape deck itself. The fixing holes for the latter should be set out on the side strips to coincide with the four deck fixing positions so that, when mounted, the deck is positioned as shown in the photograph, Fig. 7. It must be emphasised that these latter four rods are of insulating material because of the necessity of avoiding multiple earth returns from the deck chassis to eliminate hum trouble; the choice of material has nothing to do with the insulation of the deck from mains voltages such as is necessary with equipment not employing a mains transformer.

After the chassis has been shaped and drilled, it is as well to drop the deck in position to ensure that nothing fouls the mechanical parts of the latter. The condensers C38 and C39 are dropped through the chassis a little to help in this, and it will possibly be found that the deck mains input leads from the motors require shortening and tidying for the same reason. Also, flats may require to be filed in the two rear support rods to permit free operation of the deck speed-change levers. Once it has been ensured that the assembly is satisfactory, the deck may be removed and wiring begun.

The wiring is not critical; Fig. 2, in the October issue, shows that which is actually involved, with Fig. 9 (a) giving the wiring diagram of the power pack, and Figs. 9 (b) and 9 (c) the bias oscillator and output stages respectively. The mains transformer, smoothing condensers, R63 and C37, and the D.C. rectifier are mounted on or beneath the chassis centre section, with the rectifier V9 to one side. The push-pull output stage is mounted on one of the side strips, together with socket "D," while the bias oscillator is assembled on the rear wall of the main chassis. The recommended bias coil has to be screened, and for this a cut down I.F. can is suitable; the size must be at least 1½in. square, with a height of about 2½in.



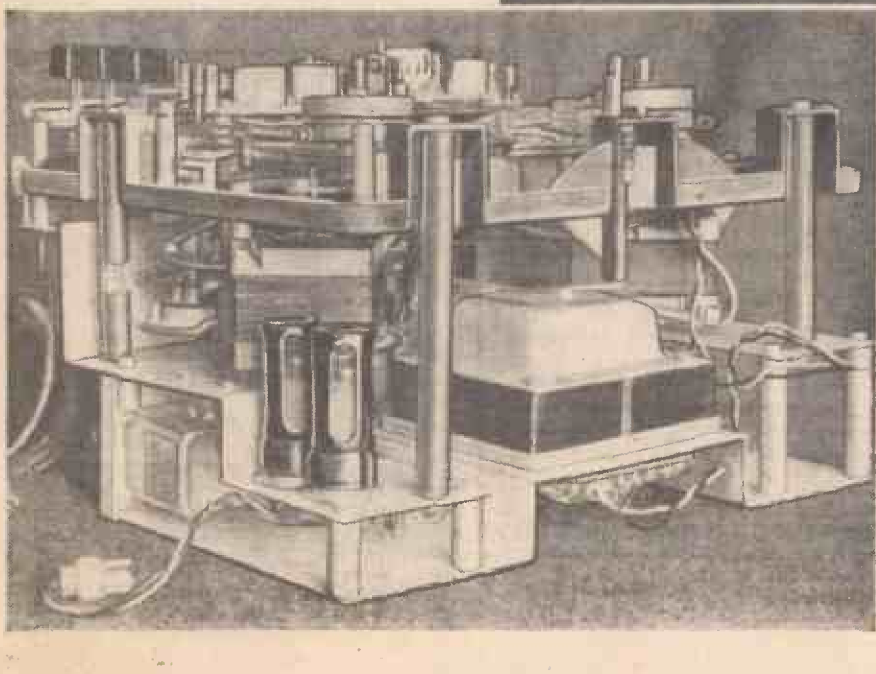
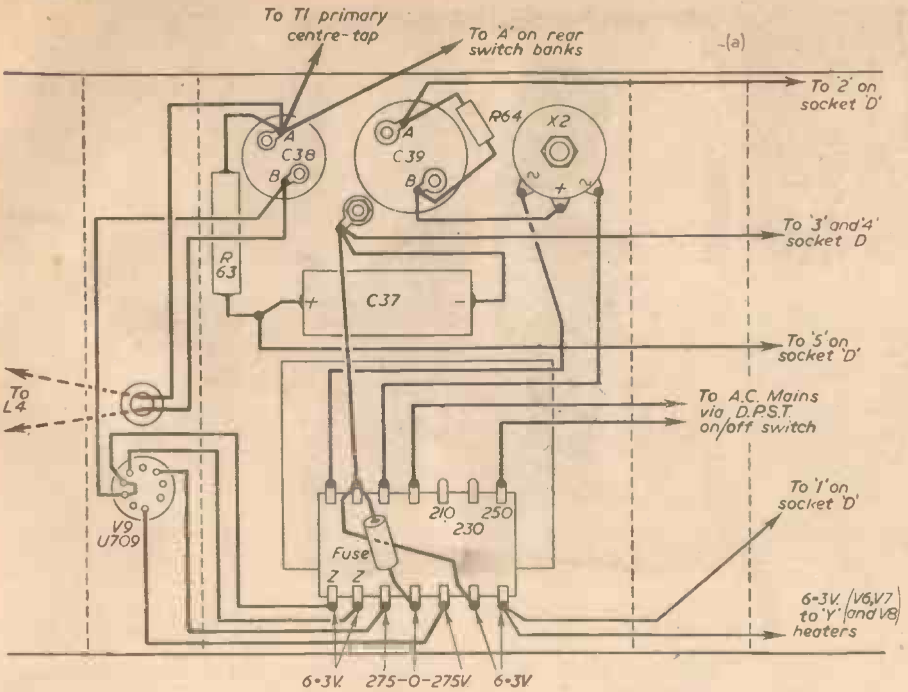


Fig. 7 (Left).—Position of the tape deck on the insulated rods.
Fig. 8 (Above).—The front switch bank of the deck after wiring.

The output transformer, being mounted close to the deck switching banks, has to be screened, and for this a simple tinplate box should be made up. No dimensions need be given, as the transformer should fit comfortably inside it, and apart from this requirement no special details are necessary. The lid should be made removable and a grommeted hole should be made in one side to permit the entry of the appropriate leads. R57 and C31 are mounted inside the shield.

Small tag strips are used where necessary



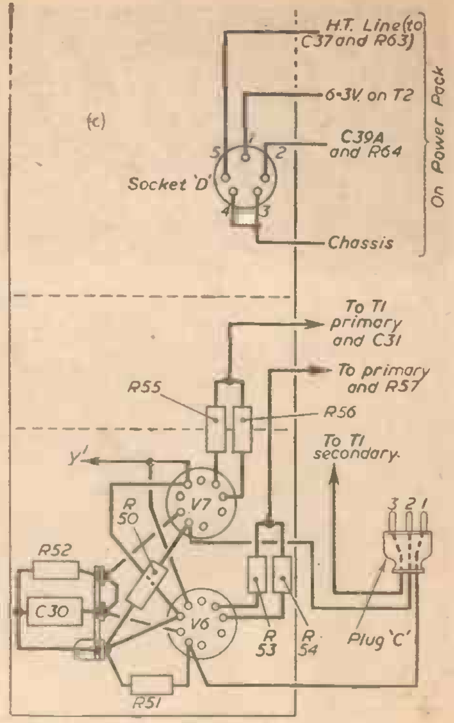
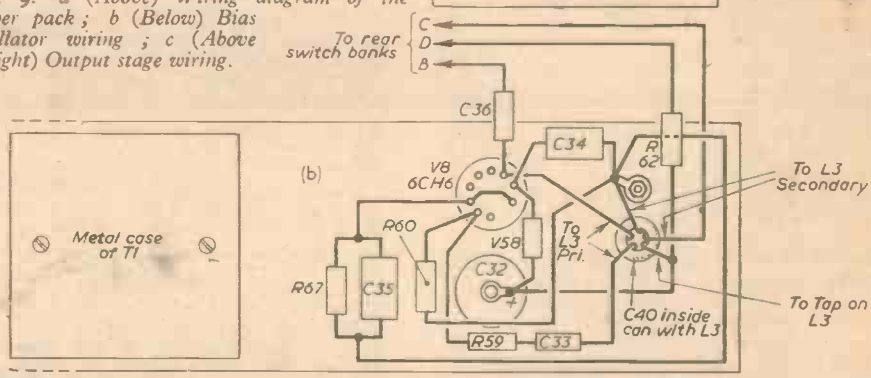


Fig. 9.—*a* (*Above*) *Wiring diagram of the power pack;* *b* (*Below*) *Bias oscillator wiring;* *c* (*Above right*) *Output stage wiring.*

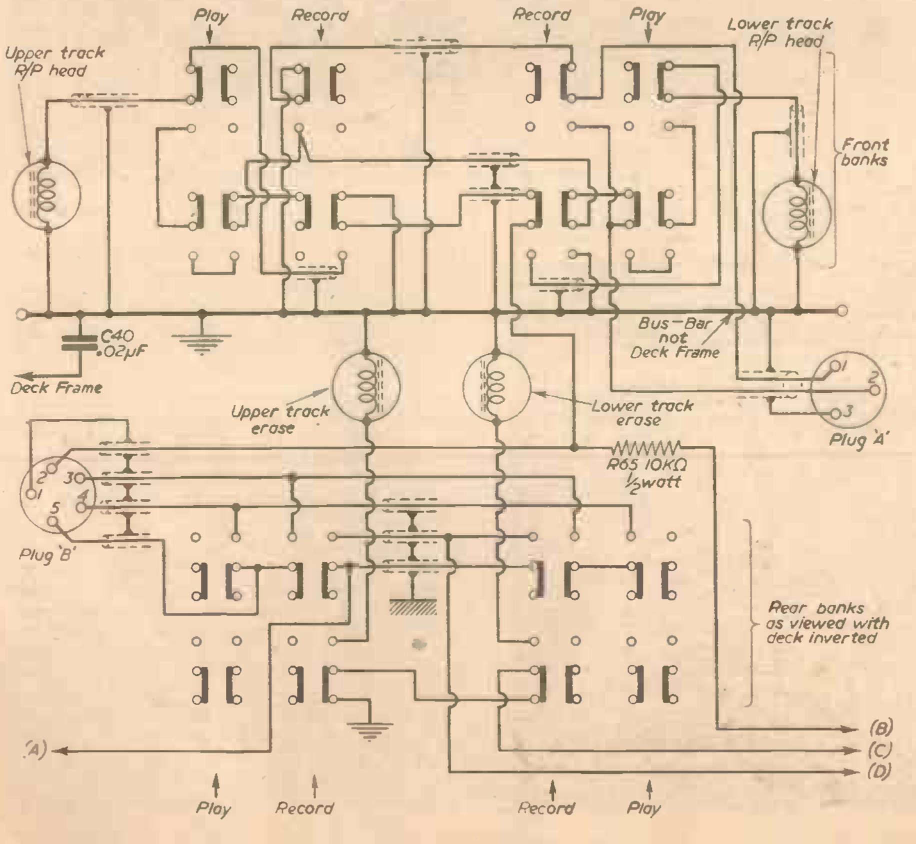


to permit the mounting of resistors, etc., and to provide anchor points. Two flying leads from the grids of the output valves, and one lead from the output transformer secondary, terminate in plug "C" as the photograph (Fig. 7), shows. About 4in. of lead is enough.

Working to the photograph, Fig. 3, and to Fig. 9, there should be no difficulty in making up this part of the complete design.

Deck Switching

Having now completed the wiring of the power unit and the associated output stage and bias oscillator, the deck switching itself must be completed before the recorder can be permanently fitted to the mounting rods. This wiring is not a difficult task, but great care is nevertheless required in the run and screening of the wires.



The photograph, Fig. 8, shows the front switch bank of the deck wired and connected to the necessary points on the unit beneath, and with the plug "A" and "B" output connectors on flying leads for later connection to the main amplifier chassis.

For the wiring of the switches, a quantity of screened lead is required; about 3yd. should be adequate. This screened lead must be of the thin variety; lead such as TV type cable is far too heavy. It should preferably have a stranded inner to avoid fractures, and an outer covering. The type of wire as used on the record heads of the deck gives an indication of the sort of screened lead to obtain, although a slightly heavier type may be used.

Wiring should now be carried out as shown in Fig. 10. This probably looks rather involved, but it is quite easy to follow and wire. The drawing is made in such a way that it is basically a pictorial representation of the layout. With the deck right way up, the front bank is wired point to point exactly as the upper part of the diagram shows; then with the deck *inverted*, the rear bank is wired as shown in the lower part of the sketch. Screened wiring is shown with the broken line surround at one end; the actual point at which the screening is brought out is also indicated.

Now the screening and various earth returns associated with the switching wiring are *not* returned to the deck frame itself which remains insulated on the four bakelite

Fig. 10 (*Left*).—*Deck switching wiring.*

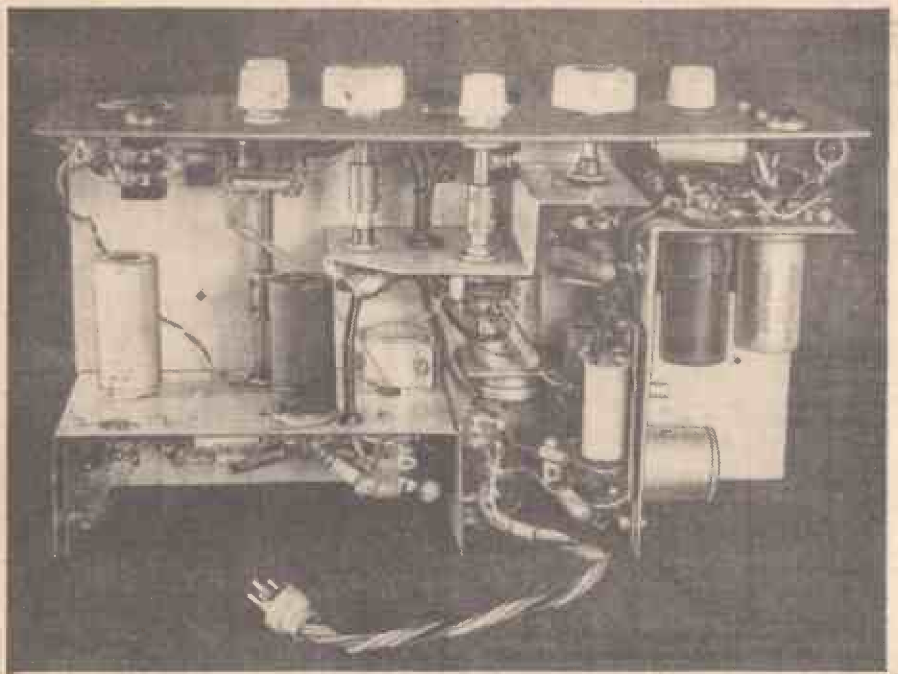


Fig. 11.—The five units of the completed chassis.

rods when mounted. Instead, a bus-bar made up from a stretched length of 16 s.w.g. copper wire is wired across between two insulated tags (cut from tag strips and mounted under a switch bolt at each end as seen in the photograph), and *all* earth returns go down to this. The actual recorder frame connects to this tag strip bus-bar through a condenser; the capacity is not critical, but 0.02 μF is suitable. Where the screened leads cross from one side to the other, care should be taken to ensure that the braiding does not contact the deck frame. The bus-bar finally connects to the main amplifier chassis *only* at the plug " A " pin 3 as shown in Fig. 10. Wires without the broken line surround are unscreened.

When the wiring is completed, the deck may be bolted down to the four rod mountings and connections made through leads A, B, C and D to the bias oscillator (refer back to Fig. 2 for this), and H.T. line. R65 is mounted close to the appropriate switch point, in series with lead B.

Main Amplifier

We now come to the construction of the main amplifier chassis, the circuit diagram of which was given last month, in Fig. 1. In this original design, the chassis is made to fit alongside the tape deck, and although it should be possible to make the necessary modifications to permit an alternative positioning, the present system will be found entirely satisfactory from the point of view of appearance in the finished article.

The completed chassis, which is shown in Fig. 11, consists basically of five units; the top panel, rear wall, and three sub-chassis. This layout has been carefully designed to give a compact assembly, together with ease of wiring, and freedom from hum or instability.

The three sub-chassis and the main drillings are shown in Fig. 12. These should be bent up, first of all, from 18 s.w.g. aluminium or brass sheet, and 6 B.A. hank nuts fitted as shown for later attachment to the rear wall section. This wall consists only of a plain sheet of the material, measuring 12in. × 6¾in., to which the sub-chassis are fitted as shown in Fig. 13. After the sub-chassis are bent up, the fixing points should be marked through on to the rear wall; these points can then be drilled through and the sub-chassis will be correctly located after wiring.

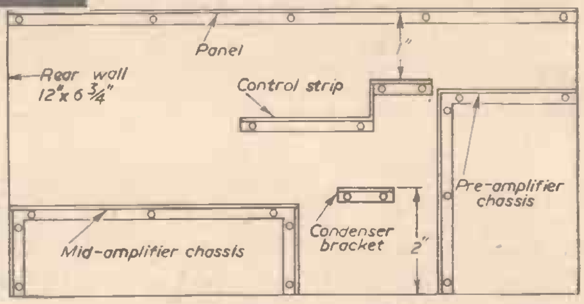


Fig. 13.—How the sub-chassis are positioned.

Next month panel details and wiring instructions will be given

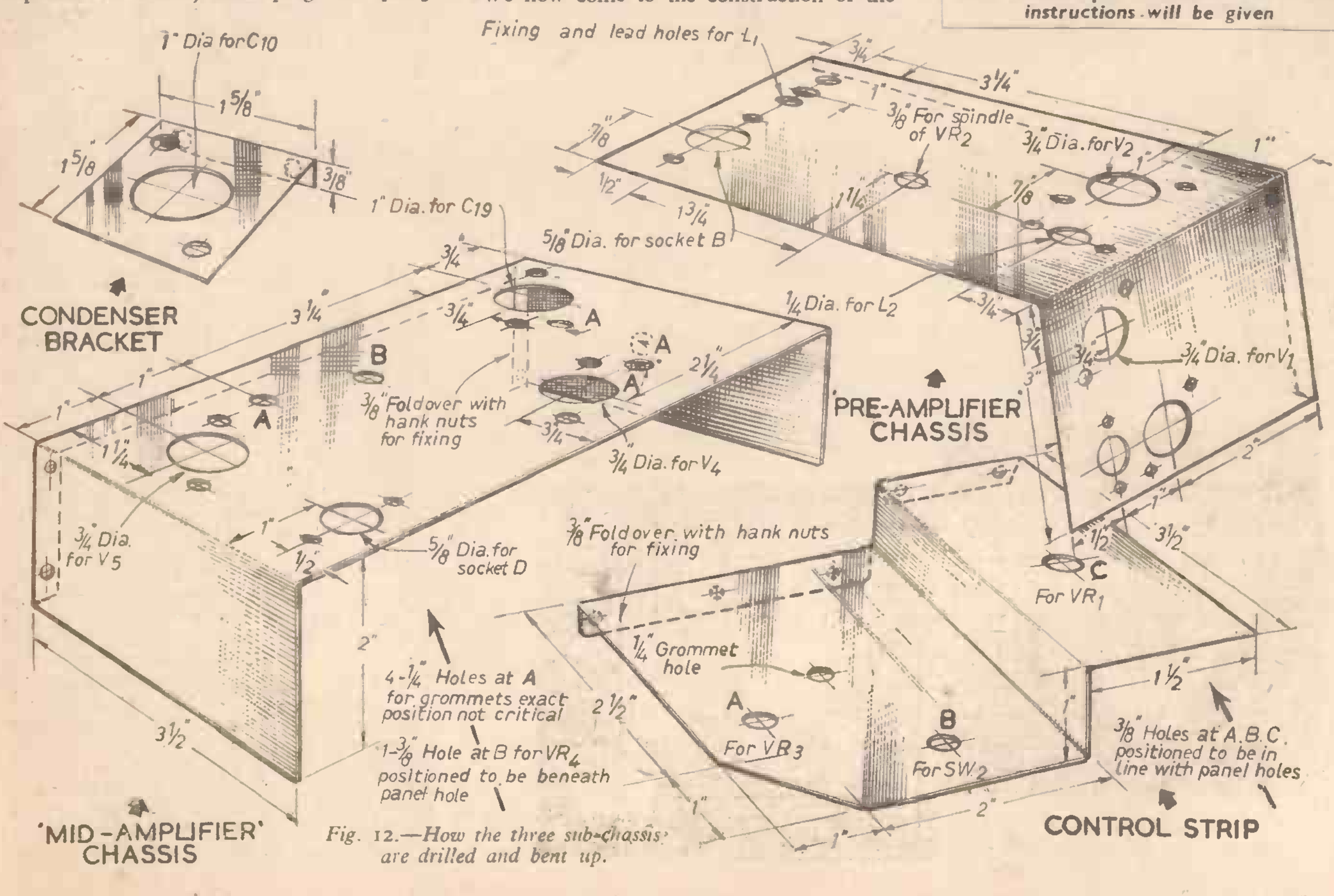


Fig. 12.—How the three sub-chassis are drilled and bent up.

Colour Filters in Astronomical Observation

How To Use Them and What Can Be Achieved

By V. A. FIRSOFF

ASTRONOMERS have many obstacles to overcome. Lenses can be improved, bigger instruments can be built (at a price), the clockwork and gearing which keep the tube following the apparent movement of the sky can be made more accurate, but the optics of any telescope will always include the uncontrollable element of our atmosphere, with its mists, fogs and clouds severely cutting down the time suitable for observation.

Yet even on a cloudless night stars twinkle and it is not the nature of stars to twinkle; their twinkling is due to air currents and gives a measure of the instability of the atmospheric optic. In telescopic vision this instability increases in proportion to magnification and also to the aperture. Thus the larger the telescope and the higher the power of the eyepiece, the fewer and farther between are the moments of clear seeing. This is why astronomers set up their observatories on mountain tops and lonely desert places where skies are clearer, but they can never escape the air altogether.

Colour is Lost

In addition to spoiling the clarity and steadiness of telescopic vision, the atmosphere also kills the colours. Look at the grey-blue of a distant landscape and its reddish haze. How dull and devoid of colour it is by comparison with your close surroundings.

If the whole of our atmosphere could be compressed to sea-level density it would make a layer some $5\frac{1}{2}$ miles thick. This, therefore, is the approximate amount of ground air we gaze through at a celestial body directly overhead. True, we may be above sea-level, but, on the other hand, few celestial bodies are anywhere near the zenith or stay there for long. If our object be a planet, it is most likely to be found somewhere halfway down to the horizon, where our line of sight includes at least 10 miles of air at sea-level density. In other words, our views of the moon and planets correspond to those of mountains 10 miles or more away. These will appear to us more often than not as featureless grey-blue silhouettes, with perhaps a little shading, but with very little variety of hue.

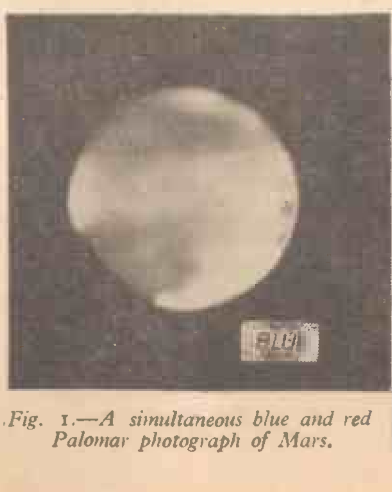


Fig. 1.—A simultaneous blue and red Palomar photograph of Mars.

Planetary Atmospheres

Most planets have atmospheres of their own, sometimes denser and vaster than ours, so that their surface colourings appear greatly subdued and distorted. The tendency is generally towards grey-blue i. the dark markings and red in the bright ones. But not all causes of colour distortion are atmospheric; some of them are in our own eye and brain. If there is a strong source of, say, red light close to a faint one of another colour, the latter colour is drowned in the after-image of the brighter source formed in our retina. This after-image is in the complementary colour—in the present case blue-green. Thus the fainter source of light will tend to take on a spurious colouring complementary to that of the strong source (or bright planetary marking).

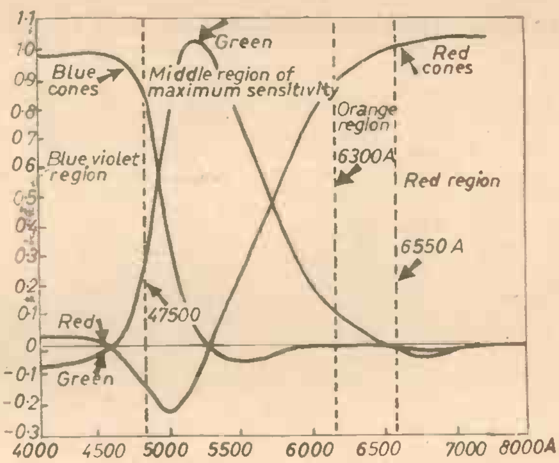


Fig. 2.—Graph of response of colour sensitive cones of the eye to different wavelengths of light (after Pirenne).

Use of Filters

It is, however, important for understanding the true nature of the feature which is observed to know its true colour. This is real where colour filters are used, either photographically or visually. The range of colour can be extended beyond the "optical window" accessible to the eye, into the region of infra-red and ultra-violet radiations; in photography by supplementing the filters with appropriately sensitised emulsions (the ordinary emulsion responds strongly to

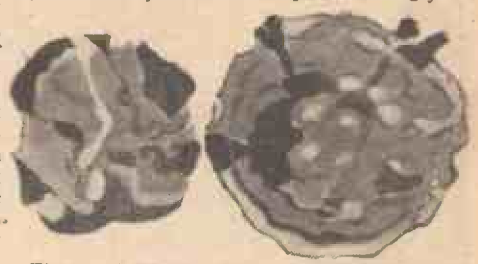


Fig. 3.—"Pseudo-shadows" appearing in the lunar craters Eratosthenes and Copernicus under vertical illumination.

the ultra-violet, but is insensitive to the infra-red), and in visual observation by means of an electronic image converter. At the present time electronic image converters can be obtained cheaply from dealers in surplus military equipment

Infra-red

Infra-red rays can pierce haze which is opaque to shorter wavelengths, as has been startlingly demonstrated in W. H. Wright's photographs of Mars taken at the Lick Observatory in the nineteen-twenties. As well as atmospheric, there exists also inter-stellar haze, which completely conceals to our sight the great concentration of stars at the core of our Galaxy beyond the star clouds of Sagittarius; but it presents no serious hindrance to infra-red photography. Conversely, the shorter the wavelength of a radiation the more it is scattered by gas, so that atmospheric features inaccessible to the unaided eye spring into prominence in the blue, violet and ultra-violet light. Shown in Fig. 1 is a pair of Palomar photographs of Mars in blue and red light respectively: the first displays little surface detail, but brings out the atmospheric veils, whilst the second is confined almost wholly to ground features. When Wright compared his infra-red and ultra-violet photographs of Mars, he found the diameter of the planet larger in the latter, owing to the inclusion of the atmosphere.

Filters for Visual Observation

However, the photographic possibilities of colour filters have been well known for some time, but their systematic use in visual observation is comparatively recent. This is also practicable for the amateur astronomer. His filters need not be mounted in high-quality optical glass, which is expensive. A plain gelatine filter can be cut out and inserted in the eyepiece or inside the tube (always out of focus of the ocular lenses) where it can do as well and better without any glass cover. Such gelatine filters do not usually cost more than about 2s. per sq. in.

Filters used in photography are not usually suitable for visual observation. There are two kinds of filters that can be used to advantage in visual work:—the so-called Tricolour sets, containing a red, a green and a blue filter, and narrow-band Monochromatic filters.

The object of the tricolour sets of different makes is to separate as nearly as possible the three fundamental colour reactions of the human eye, which contains three types of colour-sensitive elements called cones with a maximum response in the red, green and blue region of the spectrum respectively (see Fig. 2). This triple nature of colour vision makes three-colour printing and photographic processes possible, although these are not wholly adequate in the violet, which is reproduced imperfectly as purple, i.e., a mixture of red and blue.

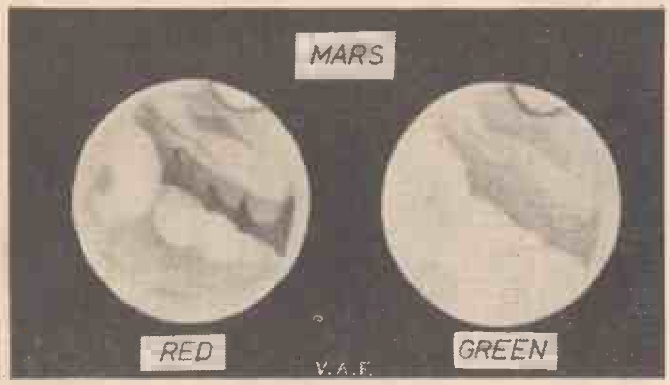


Fig. 4.—Two observational drawings of Mars in red and green.

Assessing True Colouring

The approximate separation of the three basic colour elements is very important in assessing the true colouring of, say, a planetary marking. Not only does it reveal such colours as could be detected directly in favourable conditions; it can also disclose a colour bias in what is seemingly a neutral white, grey or black (dark grey). Seen through a set of filters, a colour manifests itself as much by its presence—positively—as by its absence—negatively.

Let us take, for instance, a visually grey object which yet contains a little red in its make-up. When viewed through a red filter, it will appear relatively brighter than when a green filter is used. Snow has a green bias and the polar caps of Mars, as also those of Venus (the existence of the latter is not universally admitted), stand out with particular clearness through a green filter.

Thus, by comparing the relative brightness of various features through the filters of a tricolour set their true colouring can be established by a process of elimination. This reveals delicate hues in the seemingly colourless lunar scene in a way free from the confusion arising out of the spurious complementary colouring of the darker areas when scrutinised by an eye unaided by filters.

Haze Penetration

Apart from allowing us to get at the real colours of planetary, or other features, a red filter is useful also by virtue of its haze penetrating power and the lesser susceptibility of red light to atmospheric deflection, so that in poor seeing the clearness and steadiness of the image can be greatly improved by a red filter. Moreover, no lenses, however near perfection they may be, can focus the light of several colours as accurately at one point as they can the light of any one colour, so that a monochromatic filter, and to some extent a tricolour filter, of any colour may improve optical definition.

Monochromatic Filters

It has already been adumbrated that the filters of a tricolour set are not truly monochromatic; in other words, there is a considerable measure of marginal overlap, as there is in the natural responses of the cones in the retina (see Fig. 2). Thus a tricolour green filter transmits all of the yellow as well, even a little orange, and some of the blue light. A red filter also transmits yellow. Indeed, it is the combination of the green and red reactions in the eye that results in the sensation of yellow.

True separation of different colours requires monochromatic filters, which allow the light to pass only within a more or less narrow band of wavelengths falling wholly within, say, the green or violet region of the spectrum. The distinction, though, is only one of degree and the monochromation of light can always be pushed a step farther by narrowing down the band of wavelengths. Such monochromatic filters can be very useful both for colour determination and for improving optical definition, but by the same token they severely cut down the amount of light reaching the eyepiece and cannot be successfully employed for faint objects, or with high powers and small apertures.

Discovery by Filters

Filters can disclose much of interest in a planetary disc that could be neither seen nor even suspected without them, and, since the visual use of filters did not properly come into its own till after the last war, there is still a good deal that can be discovered or confirmed in this field with quite modest means.

Figs. 3 to 5 show a few observational drawings illustrating the results obtained with colour filters.

On the moon, some regions, including the interiors of many craters, show under vertical illumination, when real shadows are geometrically impossible, a number of variable "pseudo-shadows." Quite often these pseudo-shadows contain some colour, which can be brought out by filters. Thus the pseudo-shadows of Eratosthenes give a violet reaction. But the radial bands of Copernicus, which are almost invisible without filters, stand out clearly in red, whereas they are effaced in green, so that their true colouring must be green or at least greenish.

The next pair of drawings gives a red and a green view of the region of Mare Sirenum of Mars during the close approach of the planet in 1956 (Fig. 4). It will be seen at a glance that the red view is much clearer and stronger, but it also shows dark wedges in Mare Sirenum which do not appear in the green and must, therefore, be green themselves, as they indeed seemed to be without filters, which, though could have been due to mere contrast with the generally reddish disk.

The most striking example of the effect of colour filters, however, is probably provided by Venus. Three observational drawings of the planet are reproduced in Fig. 5, done consecutively in green, blue and red, with the additional use of a polarizing screen. In this case some areas which are dark in blue light appear bright in red, so that they have a true reddish colouring, or where they are also bright in green a strong yellow element must be present. Conversely, there is a large area at the south cusp which is bright in blue, medium in green and darkish in red; it must be bluish, accordingly. As a rule the blue and violet filters show the dark rotational belts, whilst the green filters accentuate the bright areas near the poles.

All these drawings were obtained with a comparatively small mirror, 6½in. in diameter, although of a very high optical quality, which effectively shows that such work is within reach of an average amateur astronomy enthusiast.

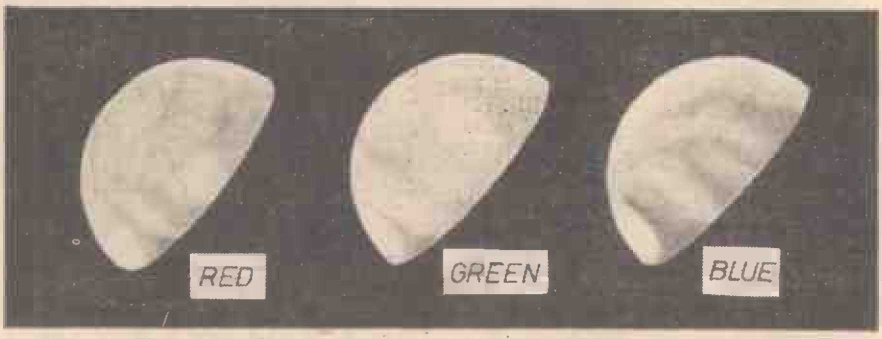


Fig. 5.—Three consecutive drawings of Venus (May, 1959), in red, green and blue.

A TRINKET BOX IN PLASTIC

Fig. 1.—The completed trinket box.

WORKING with Perspex is a most pleasurable occupation and the trinket box above in Fig. 1 provides an ideal "first job." You will require a sheet of $\frac{1}{4}$in. thick clear colourless Perspex measuring 12in × 12in. and a small bottle of Perspex cement from your local craft stores.

Base and Lid

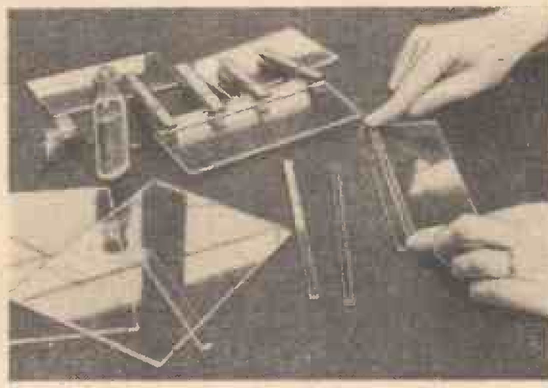
The Perspex will be covered by protective paper temporarily stuck to its surfaces. On this draw two accurate rectangles, each measuring 6in. × $4\frac{1}{2}$in. Use a very sharp pencil.

With a fine-tooth fretsaw saw out the pieces, keeping slightly to the outside of the pencil lines; then with a fine metal file smooth the edges to the pencil lines. Finish off with a fine sandpaper block and remove the covering paper. These comprise the base and the sliding lid.

Sides and Lid Rails

Mark two more pieces in a similar way each measuring $6\frac{1}{4}$in. × $2\frac{1}{2}$in., cut them out then file and sandpaper the edges true. These are the sides.

Fig. 2.—(Below) Cementing the strips, using Perspex cement and retaining their position with spring pegs.



To provide the lid rails mark out four strips each 3/16in. wide. Two of them must be 6in. long; the other two $6\frac{1}{8}$in. long. Cut them out and finish as before.

Cementing

Apply Perspex cement (this is a *must*—no other type of adhesive is satisfactory) to one side of one of the $6\frac{1}{8}$in. strips, using a matchstick shaved to a chisel edge, and press the strip in place flush with the edge of one of the box sides and level with one end. The other end of the strip will fall short by $\frac{1}{8}$in. Retain the strip in this position with spring pegs as shown in Fig. 2. Do the same with the second, similar strip and round off one corner of each side as shown. The other two 6in. long strips are cemented in a similar way $\frac{1}{8}$in. away from the top strips. Their ends will fall short of *each* end of the box sides by $\frac{1}{8}$in.

Cut the ends of the box next. One measures $4\frac{1}{2}$in. × $2\frac{1}{2}$in., the other $4\frac{1}{2}$in. × 2 3/16in. Cement the bigger end first against the end edge of the base and flush with its bottom surface. Check for absolute squareness with a set-square (Fig. 3).

When completely set, cement the sides in place with the rounded corners at the (at present) open end of the box. When dry, cement in place the remaining box end,

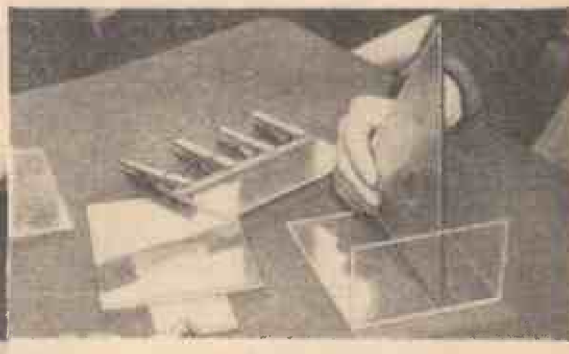


Fig. 3.—(Above) A set-square being used to ensure squareness.

flush with the base and sides.

Try the lid for fit and ease where necessary with sandpaper. The 4in. × $\frac{3}{8}$in. bar on the lid was a piece of 3/16in. thick Perspex but $\frac{1}{8}$in. material will do. Remove the corners and cement in place. Add four coloured Perspex feet in the corners of the base and line the bottom with baize.

An Inflatable Aircraft

A RECENT American invention is designed to assist the escape of air-force pilots shot down behind enemy lines. It is an inflatable aircraft which can be parcelled up and dropped by parachute. A total weight of 565lb. is made up of 225lb. plane, 180lb. fuel and the rest container and parachute. It can carry a payload of 240lb. The 42 h.p. engine is partly made of aluminium and the plane can cruise at 60 m.p.h. for six and a half hours with a full fuel tank. An air compressor running from the engine is used to inflate the aircraft and maintain pressure at any height up to 10,300ft. A take-off run of 250ft. is required.

Atomic Lamps

THESE lamps, which are being developed by Associated Electrical Industries, Leicester will work for about ten years without a power supply. In appearance the lamps resemble a large match and consist of a long thin glass stem with a small bulb at one end. The tube is filled with radioactive gas and the bulb is coated with phosphor. The gas emits radioactive rays which cause the phosphor to glow brilliantly. The lamps are at present purely experimental but may eventually be used as markers for buoys at sea, etc.

More Bauxite

A NEW deposit of bauxite, estimated at several million tons, has been discovered at a depth of 230ft. in the Myirád basin, western Hungary, by geologists of the Bauxite Research Establishment. Present annual output of Hungarian bauxite—raw material for the production of aluminium—is 1.2 million tons, about 9 per cent. of the world total.

First Gas Turbine Tanker

THE Shell tanker *Auris* of 12,000 tons deadweight, originally a motor ship, has now been fitted with gas turbine machinery and has successfully completed sea trials; she thus becomes the first tanker to be driven entirely by a gas turbine. The turbine of 5,500 horse-power was designed by the British Thomson-Houston Company and was built by them and by Cammell Laird and Company.

Brushless Alternator

ONE of the biggest steps forward in electrical generation, since the early 1940's, has been made by a Scottish engineering firm with the commercial development of a brushless alternator. The new machine, which has only recently come on to the market, is the end-product of three years' intensive research by the Macfarlane Engineering Company Limited. It has no brushes, no slip rings, no commutators and no external control gear.

Two New Machine Controlled Systems

AFTER eighteen months of intensive development and field research, Ferranti Limited have developed two new economically priced machine tool control systems acceptable to the small as well as the large engineering company.

It is claimed that these new systems represent a major break-through in automatic control equipment for machine tools. The systems are: (1) Transistor hydraulic continuous machine tool control equipment. (2) Numerical positional machine tool control equipment.

Our Leader in the September issue brought in a flood of letters from our readers, some of the most interesting of which are printed below.

Letters to the Editor

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

This reader says "Not Yet"

SIR,—I read with interest your editorial "Personal Transport of the Future?" in the September issue of PRACTICAL MECHANICS.

Already our roads are fast becoming saturated with private cars, motor cycles and other forms of private transport and it is only reasonable to suggest that new forms of transportation will be devised in order to ease the situation. The only practical medium for travel—if we are to dispense with the earth's surface—is its atmosphere. I say practical since it is in theory possible to travel underground, but such a mechanical mole, as it would be, would make travel very slow and expensive, adequate reasons for it not becoming popular!

In consequence of this we are left to consider flight as the alternative to surface travel.

I find it difficult to imagine a general exodus from the surface and to think in terms of vast arterial roads in the sky. The organisation of such a collection of roads would result in the necessity of providing some sort of super "traffic cop." His job would be a most unenviable one. The Highway Code which would be drawn up would have to be followed implicitly by every pilot. He would have to be medically fit and not likely to suffer from any blackouts. How many drivers on our roads can come up to this standard? Any legislation regarding mass flying, then, would apparently cut down to a great extent, the number of people piloting aircraft.

It has been suggested that the sky-roads would not be very crowded because there would be three-dimensional travel. Because of this accidents would lessen. But speeds would increase in proportion to this, and since human reactions will be the same, the accident rate would be just as high. Indeed, fatal accidents would, in all probability, increase, for a pilot cannot just stop his aircraft and have a look at the engine.

Also, it should be borne in mind that around large cities there would be a great pile-up of aircraft wanting to land. Only the crudest type of autogyro could land on a back lawn and it is difficult to imagine a middle-aged businessman using such a contraption strapped on his back to go to and from the office every day.

No, I think it unlikely that our roads will deserted for a long time to come. The answer to the transport problem must be met by building better roads and a more efficient railway system. Then the air may be left free for the commercial airlines.—R. STURMY (Middlesex).

A Reader Designs His Own SPACE CARRIAGE

SIR,—Looking at the problem from a practical standpoint, and considering oneself as the prospective flyer, the advantages are immediately apparent. The ease with which distance could be covered, making the proverbial "Bee line" to destination, is very appealing. The authorities could provide beam stations at strategic cities or towns, to which the flyer would be guided with effortless ease, and from which he would pilot himself to his local destination. Air roads between control stations would be sited to miss aerodromes by a safety margin. Their height would be above local air traffic, yet below the level flown by conventional aircraft. "Keep Left" lanes could operate between any two points, while overtaking (if permitted) would be a kind of leap-frog over the preceding carriage, or, having so much free air, speed lanes could be introduced. Guidance along airways might possibly be done by instrumentation along the existing electric grid system, with suitable receivers in each air carriage.

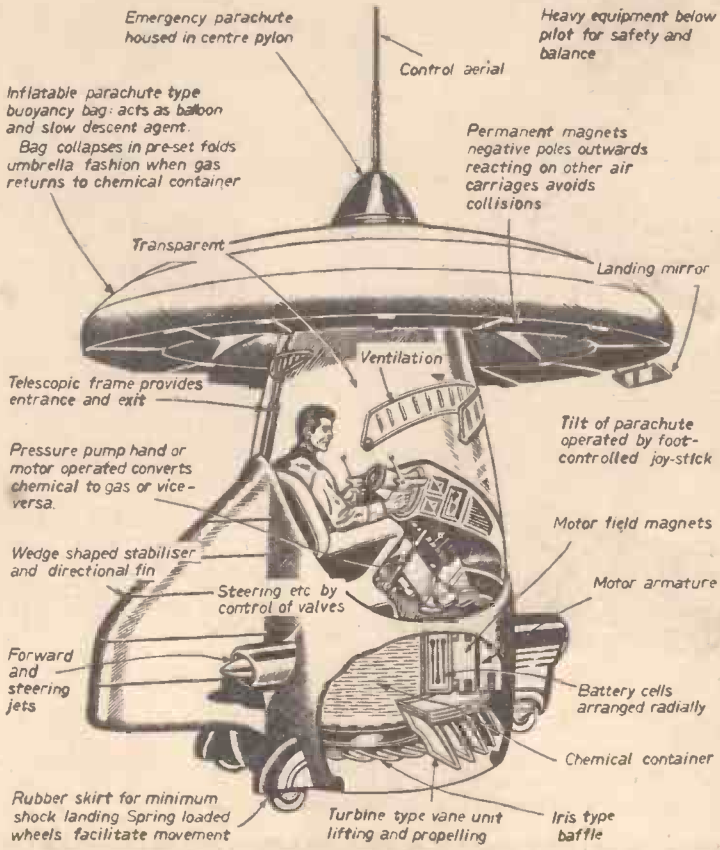
If requested to submit a design for an air carriage, the writer would visualise something similar to the sketch. Knowing that love of comfort is a fundamental human instinct, the design begins from this point. The pilot is seated as shown, and in the arrangements for control, etc., an attempt to ensure fast transition from car to air carriage has been made. The emergency parachute is added to give a sense of security, its purpose being to retard descent of the whole contrivance should mechanical power fail. The basic idea is similar to refrigeration processes. A liquid in a container is subjected to heat or pressure which converts it to a light gas, which in turn inflates the buoyancy bag and stabiliser fin.

Reverse operation deflates the bag which collapses against the pilot housing (for minimum space parking). No reduction of weight is achieved by this process, but its distribution over a greater area reduces the motor power needed for lifting and this power saving is used for horizontal propulsion.

It is visualised that at the commencement of a journey both the stabiliser and buoyancy bag would be neatly in parking position. The motor would be "revved up." At the same time a leak would be allowed on the correct side of the stabiliser fin to correct any torque tendency. Immediately after take off, buoyancy gas would be fed to the respective containers, and having become airborne, directional control made at a predetermined height. Adjustment of the iris-type shutter serves to vary the downward thrust from the turbine blades and simultaneously concentrates the power to the jets for horizontal travel. Steering would be achieved by varying the power of the jets on either side of the wedge-shaped fin, i.e., for straight flight they would have almost equal velocity. For the experienced pilot an explosive charge could be housed in a well in the base of the chemical container to give initial lift, which on detonation would rapidly soar him to the flight lane.

The purpose of the foot control is to alter the angle of inclination of the buoyancy bag to use, or combat the natural hazards of wind, etc. A following wind may mean that speed would need retarding with the opposite force of the engine, whereas, against the wind the clever manipulation and nicety of adjustment would indicate the skill of the pilot. Side winds pose different problems, and one could easily imagine that, for some, the excitement of yachting with additional fields to conquer would be appealing.—W. GREGSON (Cheshire).

(*Continued on page* 86)



Mr. W. Gregson's space carriage.

Air and Land Travel

SIR,—With regard to "Fair Comment" in the September issue, mentioning the possibility of overcrowding in the air, I would agree that this will be just temporary. People will choose the means of transport most suited for their own use and pleasure. In fact, I would suggest that the air will, to some degree, lessen the road traffic jams.—R. P. BAYLIE (Hants).

A Glider is the only Solution

SIR,—Any possibility of flying to the extent, say, of motor cycling, seems very improbable. The subject is hedged-in by the high power necessary and by the wing-loading factor, which prohibits anything of small size.

Thirty years ago, aircraft with 8 h.p. engines were built and flown successfully, but in general, such low powers meant flimsy air-frames and a low safety factor. Probably the 37 h.p. of the Luton Minor must be taken as the satisfactory minimum.

The American Military one-man helicopter must be around 30 h.p. at least. The engine must run "flat out," its life is undoubtedly very short, far too short for civilian economy; and the pleasure of dangling in a 100 m.p.h. slipstream, with a roaring engine on one's shoulders, seems questionable!

I believe that a huge multi-varied helicopter rotor, driven by two men pedalling hard, either rose or blew off the ground, at one time, for a few moments, but similar helicopter experiments have broken more hearts than bones, and the glider is the only low-powered success. I say low-powered, because it is in actual fact powered by gravity—in this way—say a glider and pilot weigh 400lb., its glide angle is 1 in 20, speed 45 m.p.h. It is then easy to work out the horsepower equivalent, which comes to roughly 2 h.p. in this case, and up to 3 or more for less efficient types.

If this power could be applied as thrust without added weight and mechanical stresses, it would maintain level flight and represents, in fact, the air-friction losses dissipated as heat. Additional power to climb is simply a matter of ft./lb. per minute above this figure.

The question of booster-rockets for initial glider take-off and climb is again a matter of cost, but one wonders that no use has been made of probably the cheapest thrust engine ever devised in low powers, namely the German V1 jet engine.

All we want to avoid a hill take-off is a rocket with a 10 h.p. thrust of three minute duration—for five bob!—F. O. BROWNSON (Beds).

Flying Armchair

SIR,—Your "Fair Comment" in the September issue voices a pet daydream of mine, of an armchair driven by an engine in which one could sit back and fly just a few feet above ground level.

Many advantages can be foreseen in personal flying machines with vertical landing and take-off, the need for the acres of roads at present necessary would be past, thus saving considerable expense. Transport dislocations caused by flooding, snow and fallen trees, etc., would no longer have to be suffered. Flying trucks and vans would be natural development of such a system.

Against all this telephone and electric cables would all have to be underground and it would very likely be found necessary to have the entire country lit at night in case of accidents or breakdowns.

The law relating to the sale of intoxicating liquor would no doubt be in need of revision, the possibility of finding a drunken driver with conventional motor-car on one's front lawn is one thing, but finding his counterpart of the future complete with flying machine in one's front bedroom is another.—FRANK COSGRAVE (Eire).

MINI HELICOPTERS AND GIANT HOVER CARS

SIR,—The possibilities and associated difficulties of individual flight presented in the Editorial of PRACTICAL MECHANICS (September issue), offer a fascinating challenge to the imagination and ingenuity of present and future generations.

The problems of minimum power flight, however, are formidable. The Man-powered Aircraft Committee (MAPAC) entertain the idea that a machine of refined design and lightness could be flown by the physical exertions of a crew of one or two. It would be propeller driven. This to my mind looks like extremely hard work, and there can be little doubt that after one or two precarious flights these aircraft/birdmen would settle for a tandem bicycle. Nevertheless, it must be admitted that the idea is a distinct advance on the "flapping wings" concepts, most of which appear to be highly original ways of committing suicide. Basically, human beings are unfitted for birdlike flight despite the aids which would certainly be brought to bear on the problem.

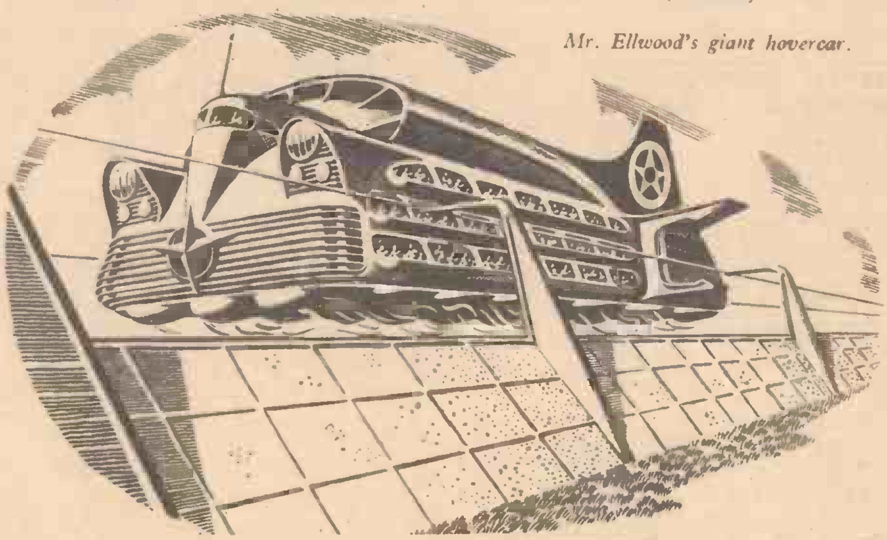
Motorised harness for individual flight which may be fitted on the human body is possible—but the stability factor is very worrying. In gusty air conditions it would be nearly impossible to retain equilibrium in flight, and even in calm weather, to land safely on one's feet would be a delicate operation.

Probably the answer to short-range individual flight lies in the small helicopter type of machine, where the aviator is ensconced in a bucket seat or capsule. Safe landings could be reasonably ensured by the use of compression struts fitted at their lower ends with castors to counter any yawing or pitching effect at touch-down.

With thousands of miniature helicopters whisking over the roof-tops, traffic control would be a sizeable headache. I feel assured, however, that this small aerial conveyance will be normal family property by 1980—a thing which if it does not shorten one's life will certainly add some spice to it.

There is still the question of large-scale future transport. The Saunders-Roe hovercraft or "flying saucer" which has recently been demonstrated in England and on the Channel, is an embryonic form of future medium-range land and sea transport. Leaving the long-range intercontinental hauls to the hypersonic rocket/jets, I foresee atomic powered hovercars superseding rail and road transports of today. The existing track sites of British Railways and many main roads could be economically converted for hovercar usage by spraying the present traffic ways with substances offering a hard and reasonably dust free surface.

Resting on an air cushion two or three feet in depth, the hovercar of the future (see sketch) carrying 500 passengers and 100 tons of freight will streak across land and sea with near-frictionless ease at speeds in excess of 400 m.p.h. Simple guide rails heavily lubricated will assist the pilot in orientating his hovercar in flight over land tracks. Tunnels will be enlarged or made obsolete by building fly-overs. The latter will be constructed at bridges and other major points of intersection along the route. These mighty transports will be capable of traversing Britain in little over one hour.—WILLIAM ELLWOOD (Hatfield).



Mr. Ellwood's giant hovercar.

ROOFTOP ROADS

SIR,—It is true that as the number of cars increases the roads become more and more congested, but this holds up only if the construction of our roads is not carried out at the same pace. To some extent every country is trying to cope with this problem in its own way.

It is also true that personal transport is becoming more common than a few years ago, but this means only that we should try to improve the road architecture, construct new wide roads and feed the people with more road etiquette.

There are other solutions, too. In densely populated areas, roads could be constructed on roof tops on both sides of the road and even crossing the roads when necessary. This idea serves a double purpose, too, for it solves the problem of "parking space." At certain distances roofstops could be constructed as parking spaces and escalators could be used to convey passengers and cars from and to the aerial roads. This only applies in congested areas for the aerial roads could slope down to ground level when out of town.

In my opinion three-dimensional roads will never take the place of the good old existing two-dimension ones. It is far easier to control land traffic than aerial traffic.

Personal transport will always keep to land routes, although aerial traffic will increase considerably.—JOSEPH P. SCERRI (Malta G.C.).

(*Continued on page 89*)

READERS' SALES AND WANTS

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

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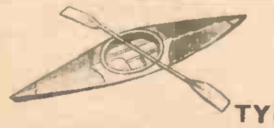

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Manual Flight

SIR,—Some years ago you were good enough to publish an article of mine on "Is Manual Flight Possible?" and now the subject has come up again, I should like to comment.

Mr. Shenstone will not, I think, be as successful as he hopes if he sticks to a propeller. I fitted one to a cycle, but could only get up to 6 m.p.h. but I could do 25 with normal transmission. This shows the large loss of power.

My ornithopters (I made three, 25ft., 32ft. and 38ft. span) did not require a tremendous amount of power to flap the wings. I used my weight as much as my strength. Although I did not fly I did get a lot of information about wing flapping. And if I had made one I drew plans for, I might really have been more successful. My 38ft. one was far too complicated. So I intended to use all the information I had gained to make strap-on wings and a tail design.

This was 50 years ago and I think if I had been able to develop my ideas today it would be normal for a person to go to his garage, take out his wings, strap them on and fly away. They would be folding like a bird's wings and the cost would not be more than £75, probably less.

Modern plastics would allow a very light-weight construction (about 25lb.). Probably a batwing design regarding ribbing, etc., of 45ft. span (three folds) would be employed.

Someone will hit upon the same method that I thought of to operate the wings, and with sufficient money to experiment will succeed. Gliding is knowledgable flying, and it has taken very many years to get that knowledge. Who can say what might have happened if someone with a little more money than I had, had gone on where I left off?—C. V. THOMPSON (Herts).

Boiler Setting Materials

SIR,—In "Your Queries Answered" in the May issue, G. Millar, of County Antrim, enquires re boiler-setting materials. The strange thing is that his own locality produces diatomite fireclays and boiler coverings, and he might enquire of the Diatomite Co., Ltd., Bellaghy, Co. Derry—just across the Bann river!—F. D. BROWNSON (Bedford).

Automatically-operated Garage Doors

SIR,—With reference to Mr. J. P. Serris' article on automatically-operated garage doors, September issue. Would not the police be likely to object to the feelers being mounted in a position where they would strike any person with whom the vehicle may collide? This rule applies to mascots fitted to vehicles registered on and after 1st October, 1937.— JOHN KERR (Morpeth).

[*They could be made retractable.*—ED.]

Minor Problems

SIR,—I wish your experts would forget about things like the shape of the world and the speed of light and UFOs, and explain some of the down to earth problems that puzzle a very minor brain:

Why does a reflector require *silver* polish? What is chrome? Something is continually happening between the poles of a magnet—what? Is there anything that will obstruct magnetism, and why not? Exactly what change takes place in, say, a piece of cast steel when it is, (a) hardened; (b) tempered; (c) magnetised.

These are the kind of things I like to cogitate over, the shape of the world leaves me very flat (sorry!).—W. R. BROOKS (Scarborough).

Testing Home-made Wines

SIR,—I disagree with the advice given on page 466 of the September issue. This enquirer could easily find himself in serious trouble with H.M. Customs and Excise. There is a very heavy duty on distilled spirits and in consequence there are very heavy penalties prescribed for persons who operate stills illegally.

As a schoolmaster teaching science can I assure you that it is illegal to distil alcohol using a still of any type without the knowledge and approval of H.M. Customs and Excise. Even the stills used in school laboratories for the preparation of distilled water are registered with H.M. Customs and Excise and are periodically examined; in industry the large kettles used in tar distillation are subject to similar control.

Home made wines usually contain about the same percentage of alcohol as ordinary beers and the use of a hydrometer similar to that used by H.M. Customs and Excise should be sufficient to give the gravity of the fluid. Any scientific instrument maker could supply a suitable instrument.—G. C. BELL (Colne).

"Bolo D'Armenia"

Electrified Door Knob Danger

SIR,—With reference to the query concerning "Bolo D'Armenia" on page 466 of the September issue of PRACTICAL MECHANICS.

This is a calcined iron oxide or a ferruginous earth similar to jewellers' rouge and other loosely designated substances such as red ochre, polishing crocus, tripoli, cholcothar, sienna, caput mortuum, crocus ferri, and other names.

Armenian Bole formerly was derived from the bole of a tree, produced in Armenia and is still occasionally called for in country recipes for horse powders, but the substance supplied nowadays is usually a crude iron oxide as mentioned above.

On page 431 of the same issue of PRACTICAL MECHANICS, in the first column, there is mention of electrifying door knobs, etc., likely to be touched by a burglar. May I suggest that a caution be given against using a source of supply such as the mains, capable of causing death or injury, as these would render the houseowner liable to a charge of manslaughter or of causing injury. —L. GUTHRIE (Grimsby).

★ ★ ★

SIR,—Re your reply to T. W. Harker (South Africa) re burnishing picture frames. Bolo d'Armenia sounds to me like Armenian Bole used to colour the whitening-glue base usually applied over the compo. or other ornament on the frame previous to the application of the parchment size. Armenian Bole used to be used in amateur theatricals to obtain a swarthy complexion.— R. GUY CLEASE (Dudley).

Puzzle Corner Error

SIR,—People who have studied calculus will not agree that $\log e^x = \int \frac{dx}{x}$ (page 456 September issue).

$\text{Log } e^x = x \log_e e = x.$

It should be $\log_e x = \int \frac{dx}{x} + C.$

—JOHN K. MARTIN (Hants).

[*We regret that the problem was wrongly printed and give the correct version below.*]

Simple Calculus

Most people who have done sufficient calculus will agree that $\log_e x = \int \frac{dx}{x}$ (1)

Now if we take the right-hand side and integrate by parts using the formula

$\int v\,du = uv - \int u\,dv$ we get

$$\text{RHS} = \int \frac{dx}{x} = \frac{1}{x} \times x + \int \frac{x\,dx}{x^2}$$

$$= 1 + \int \frac{dx}{x}$$

but from (1) $\log_e x = \int \frac{dx}{x} = 1 + \log_e x$

but LHS $= \log_e x$

but LHS $=$ RHS $\quad \therefore 1 = 0$??

Answer

The fault comes in first line:

$C + \log_e x = \int \frac{dx}{x}$ where C is a constant.

AVOIDING AIR COLLISIONS

SIR,—I have read several times with much interest the article on "High Speed Flight" by Wm. Ellwood, which appeared in the September issue of PRACTICAL MECHANICS, and I should like to comment on the author's proposed "Emergency Dial."

I thought that it was the best of the three ways he mentioned for avoiding collision in the air, but it falls short in its proposed usefulness if the collision courses steered by the two 'planes are other than "head-on," and are yet in the same sector of the "dial," for the definition of a collision course is that course steered by one 'plane relative to the other such that the bearing of one from the other remains constant.

It is highly improbable that two 'planes should still be flying on collision courses after both having dived or climbed, depending upon the sector in which their courses lay, but there is just the odd chance that it could happen.

"Probability" becomes "possibility," however, when the planes are flying with courses in the third sector, marked "level" on the emergency dial, so, to remove the possibility of a collision being caused in this manner, the present ruling, that each aircraft should turn to starboard, could be kept and used in conjunction with the emergency dial.

In the above case, the possibility of wing-scything would be very remote for the distances separating the 'planes should be much greater because the pilots would have more time in which to react as the resultant speed of the two 'planes would be less when approaching at an angle than from dead ahead.

Another way of overcoming this shortcoming would be to have a similar rule to that used at sea, namely, that the vessel with the other on her starboard bow should give way.

I think that one of the above modifications to the pure emergency dial would be a necessity, if no better ones were forthcoming, to make the idea more practical and safe.—M. D. LACEY (Cardiff).

★ ★ ★

SIR,—Re "High Speed Flight" in the September issue, I wish to congratulate you on a well thought out idea.

I am afraid, though, not quite practical enough, as three planes could travel on the three demarcation lines, converging to the centre (Fig. 9) with confusion to all three pilots.

At present all aircraft are given various heights to fly at, so the danger is of the pilots not respecting that rule. More particularly with jets, as they would not be troubled by cloud at, I think, above 30,000ft. So the danger of head-on collision should not occur, unless descending Even then, unless in heavy cloud, danger could be avoided under the existing rules.

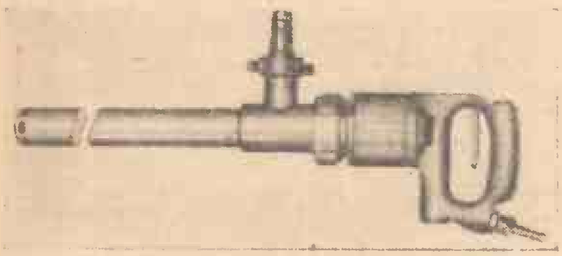
I would suggest that your times for reaction and evasion are probably intentionally overestimated.—R. P. BAYLIE (Aldershot).

TRADE NOTES

A REVIEW OF NEW TOOLS, EQUIPMENT, ETC.

Briticent Air-operated Portable Barrel Pump

BRITISH CENTRAL ELECTRICAL COMPANY LIMITED, 6, Rosebery Avenue, London, E.C.1, have just added to their portable barrel pump range an air-motor operated unit. Already used by companies in industries concerned with the removal of liquid from transit containers, this new addition will be of particular interest where the existing range is not acceptable due to hazardous conditions.



The new Briticent pump.

The air motor operates from a 30-120lb. per sq. inch air line, without a reducing valve. The rotary drive is transmitted through an inner tube, fitted with robust bearings and efficient seals, carrying the driving shaft which transmits the rotary motion to the impellor assembly. An outer suction tube fitted with hose attachment for 1¾in. bore hose allows the liquid to be raised into a standard hose line. The off load speed of motor and impellor assembly is 16,000 r.p.m.; on load, 12,000 r.p.m. The consumption of the air motor with such liquids as water is approximately 20 cu. ft./min. from an 80lb./in. air line. The unit will handle most liquids and deliver up to 2,000 gallons per hour dependent on viscosity and lifting head. The maximum head is approximately 25ft.; the maximum viscosity approximately 150 deg. Engler, or SAE 30. The 400-PMN, 2ft. 3in. alloy construction, costs £55 11s.

Silver Dee Retail Store

THE Silver Dee Company, of Staveley, Derbyshire, have recently opened a new retail store in Lowgates, Staveley, which supplies the various products they advertise in this journal. Their mail order service, of course, still continues.

Half-Round Blades for Stanley Shapers

THE half-round blades, which fit easily into both shaper-planes and shaper-files, are ideal for shaping, trimming, smoothing or filing concave surfaces. They have the same 500 shatter-proof teeth as the flat blades and can tackle anything from wood to mild steel in the same way. The half-round blades cost 3s. 6d. each and are available from all usual tool suppliers.

New Grid Produced by Dexion

A NEW multi-purpose grid that can be used to construct anything from industrial platforms and mobile stairs to car ramps and trolleys has been introduced by Dexion Limited, of Maygrove Road, Kilburn, London, N.W.6.

Available in two sizes and a standard width, it can be quickly bolted together with fixing plates and standard Dexion nuts and bolts to suit almost any purpose where a grid work or flooring is needed in any industry.

The grid will be available in 9in. widths, and in standard lengths of 4ft. 6in. and 6ft. only. Non-standard lengths in multiples of 1½in. wil lbe available in minimum quantities of 12.

Prices range from 18s. 9d. for 4ft. 6in. lengths up to one gross and over three gross 17s. 8d. 6ft. lengths, up to one gross 25s., to over three gross 23s. 6d. Non-standard lengths are available at proportionate prices per foot, plus 1s. per grid. Fixing plates are sold in separate packs at 12s. a hundred.

Wolf Cubmaster Drill

THIS ¼in. electric drill is a successor to the Wolf Cub—it has more power and a higher running speed, provided by a new motor. Equipped with a ¼in. geared precision chuck, the Cubmaster can be used with all existing attachments. A TV suppressor is built in. The price is £6 19s.

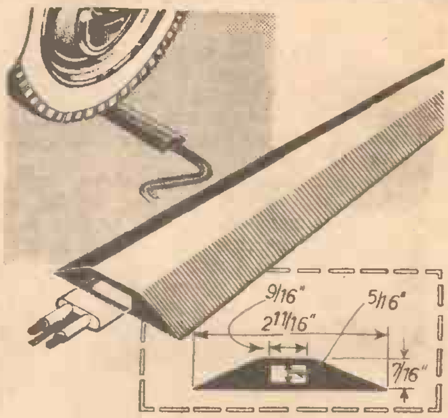
New Double Insulation Industrial Machines by Wolf

WOLF ELECTRIC TOOLS, LIMITED, have recently introduced the first British double insulated drills for industry.

In addition to the normal insulation incorporated in standard electric tools, these new machines have a second independent barrier of insulation between the current-carrying parts and the outer casing. The insulation of every unit leaving the works is finally tested at 4,000 volts. Standard machines are, of course, absolutely safe when properly connected and earthed, but through carelessness or neglect, accidents sometimes happen—Wolf double insulation is therefore the answer to such hazards.

Vulcascot Rubber Conduit Strip

A NEW type of conduit for temporary leads has recently been introduced by Vulcascot (Great Britain) Ltd., of 87, Abbey Road, London, N.W.8. It is designed to increase safety on industrial and business premises and in homes where pedestrians, trolleys and other light vehicles run over temporary leads. The tunnel in the strip is wide enough to take the widest flat cables. The retail price is 3s. 9d. per foot and it is obtainable from hardware stores, tool shops, etc.



Vulcastor rubber conduit strip.

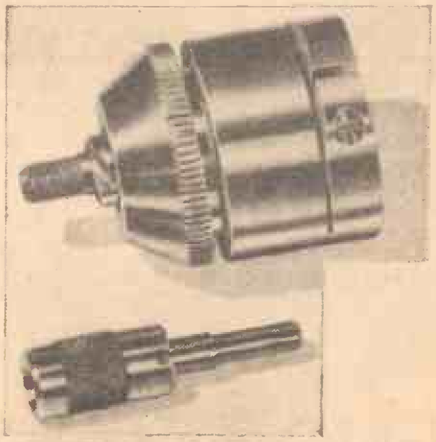
New Bridges Tools and Attachments

S. N. BRIDGES & CO. LTD., of York Road, London, S.W.11, announce the latest addition to their range of electric drills: the new DR58 Mark IV Neonic.

Incorporating all the features of the original Neonic Drill, the Mark IV offers greater power, increased capacity and a 5/16in. engineer's chuck. The drilling capacities are 5/16in. steel and ¼in. hardwood, and the spindle speeds 1,600 r.p.m. (full load) and 3,250 (running light). This new drill is designed to power all the equipment and attachments from the Bridges Home Workshop tools. The price is 8½ gns.

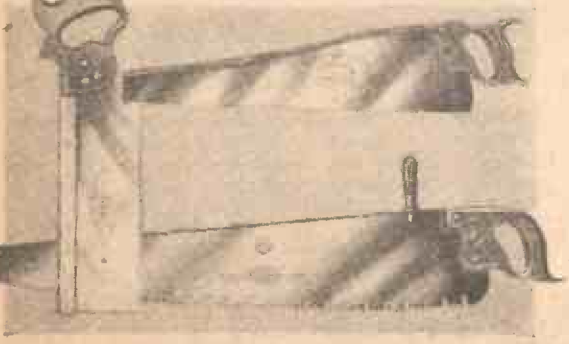
Bridges Nu-drive Speed-reducer Screwdriver Attachment is also a recent addition to their range. This attachment is a ball bearing drive reduction unit, giving a 3:1 speed reduction, and incorporates a clutch which can be locked for drilling in hard material such as masonry, ferrous metals, ceramic tiles, etc. Alternatively, the clutch can be left operative for use when screwdriving

The Nu-drive can be used with all Bridges drills up to ⅜in. capacity and the price is £2 7s. 6d.



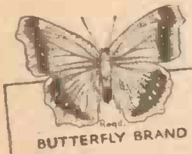
The Bridges Nu-drive speed reducer screwdriver attachment.

SANDERSON SAWS



A selection of Sanderson saws.

RECEIVED recently from Sanderson Brothers and Newbould Ltd., of Attercliffe Steel Works, Sheffield, 9, was a catalogue giving details of their large range of saws, which includes crosscut saws, hand saws, tenon saws, compass saws and pruning saws. Other products of this company are: band saws, circular saws, pitsaws, frame saws, segmental saws for cutting metal cold and hacksaw blades. Full details regarding prices, etc., are obtainable from the above address.



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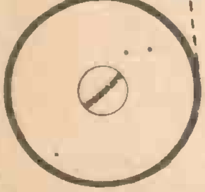

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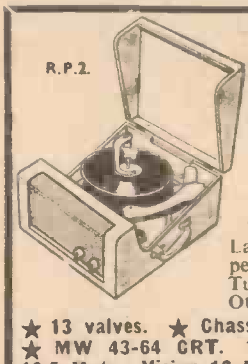

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★ 13 valves. ★ Chassis and valves guaranteed for three months. ★ MW 43-64 CRT. 12 months' full guarantee. ★ Sound I.F. 19.5 Mc/s. Vision 16 Mc/s. A.C. only.
Ready and working to fit into your own cabinet. Carr. & Ins. 25/-.

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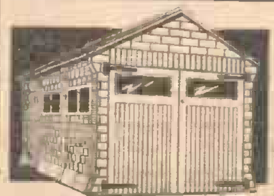

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(Complete with a pair of TONGS)

The ideal GIFT for the practical HOUSEHOLDER.
Suitable for Schools, Workshops.

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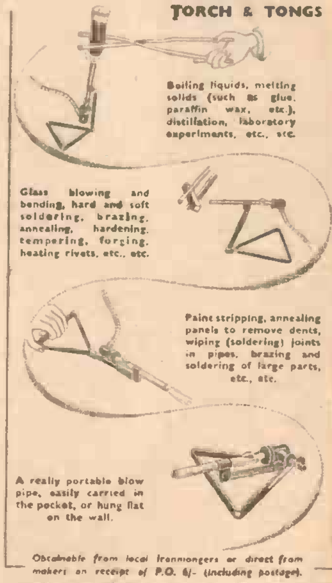

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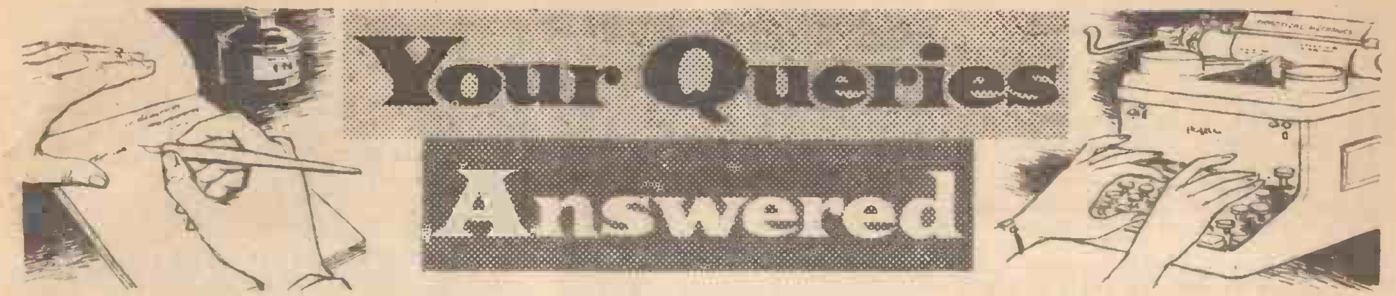


ROTARY DUPLICATOR PRINCIPLES

PLEASE could you tell me the basic principles of a rotary duplicator—the type which has a thin tissue stencil typed out and laid over a cloth drum soaked in a special ink? Also, how can this ink be made?—R. A. Philpott (Bristol, 6).

THE essential parts of a rotary duplicator consist of a tray "feed" which passes the paper and stencil to the drum, which is covered with an absorbent felt that has been treated with the appropriate ink. The mechanics of the apparatus are intricate and the "registering" of the paper and pad has to be very exact to avoid smudging. In other words, the pressure must be vertical to the paper.

Any alizarine dye with a small proportion of glycerine to keep in moisture will serve to prepare a felt pad for direct pressure by roller printing.

ELEMENT FOR U.V. SUNRAY LAMP

I WISH to construct an ultra violet ray sun lamp using a bowl fire element and the usual carbon rods. Would a 600-watt element be suitable?—W. Jones (Mon).

WE would advise you to use a 1,000-watt element in series with the arc in preference to a 600-watt element. No doubt you could obtain a suitable element locally.

SAW SIZE

I HAVE a ½ h.p. S.P. motor (1,400 r.p.m.) with which I wish to power an electric saw bench. What size circular saw could I fit?—P. J. Hagen (Clacton).

FOR a ½ h.p. motor we advise using a saw of about 7in. dia., maximum 8in. dia., driven at about 3,000 r.p.m. The saw may have about nine teeth per inch.

230V MOTOR ON 250V SUPPLY

I HAVE a Delco Remy 230V D.C. motor. Would it be advisable to connect it to 250V D.C. Mains?—H. Goodwin (Newcastle-on-Tyne).

WE do not anticipate that much difficulty would be experienced in running a 230 volt D.C. motor on a 250 volt D.C. supply. If it is a shunt or a compound motor, however, there may be some overheating of the shunt field coils on the higher voltage, which could be overcome by connecting a suitable resistor in series with the shunt field windings. A resistor of about 40 ohms, capable of carrying about 0.5 amps. would probably meet the case.

ILLUMINATED BURGEE

I WISH either to paint or otherwise define a burgee on a piece of glass or other translucent material and place an ordinary electric bulb behind it to illuminate it. Is it possible to paint on glass so that the design does not appear patchy and what sort of paint should I obtain?—F. C. Booty (Norfolk).

RULES

Our Panel of Experts will answer your Query only if the Rules given below are complied with.

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.

GLASS can be painted to give perfectly pure colours (with a light behind) by using transparent oil colours. These can be obtained—as distinct from the ordinary opaque pigments which only show up black —from an artist's colourman.

Transparent colours are also made up conveniently by The Halford Cycle Co., Ltd., and sold as lamp lacquers, costing approximately 9d. a jar. There is a fair selection of colours from which to choose.

CUTTING WOODEN THREADS

PLEASE give me details of the procedure for turning male and female threads on timber on a wood turning lathe.—A. L. Ellis (Birkenhead).

AS far as we can ascertain there is no attachment for a wood turning lathe available which will allow you to cut all manner of different pitches—no doubt the reason for this is the fact the makers have little call for such equipment.

The alteration to an existing machine would be rather a formidable proposition, and we would suggest that instead of altering the design, you will perhaps find it easier to buy a second-hand metal turning lathe and overhaul it for this purpose; keeping your wood lathe for the present type of work.

If, however, you only wish to cut one or two threads, then you can provide a lead-screw of those pitches and attach it to a slide; the latter being arranged to traverse along the bed in exactly the same way as the above mentioned metal turning lathe. You must change the screw for different threads—the pitch, of course, being equal to the thread you wish to machine. Use chasers as a means of cutting the threads, and these are obtainable from Messrs. Alfred Herbert Ltd., of Coventry, in a range of pitches for both internal and external tools.

CASTING MATERIAL

WHERE can I obtain suitable materials in powder form for use with rubber moulds, etc., for making small articles with a finish resembling imitation marble or alabaster?—V. D. Howells (Cheltenham).

THE most suitable material for your purpose will probably be plaster of paris to which has been added about 10 per cent. by weight of powdered glue. The glue should be dissolved in the water with which the plaster is mixed, not added to the dry plaster.

Marbled effects can be obtained by stirring in small amounts of powder poster colours (obtainable from any art and craft shop) immediately before filling the moulds. To obtain a gloss finish, paint the models with hot paraffin wax and polish with a soft cloth.

SOUNDPROOFING A WALL

I WISH to build an insulated partition to avoid the nuisance caused by a neighbour's radio. What do you suggest?—R. Yelland (Lancs).

THE length of wall to be insulated against sound can first be covered with sheets of 2in. "Stramit", stuck to the surface with Synthaprufe. On this, nail ½in. soft insulating board and then cover with plasterboard and decorate.

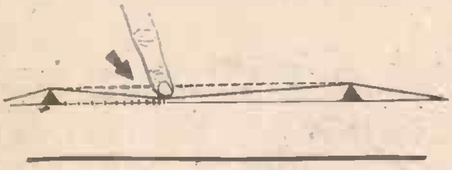
It is necessary to carry the work from the floor to the ceiling to have the desired effect, so remove the skirting board before you commence and refix on completion.

FRET POSITION FORMULA

IN your November 1958 issue, you gave a formula for working out fret positions on a guitar. This was based on the open string length. I notice that on most guitars the bridge is either at an angle or each individual string has a different open string length (as on Hofner guitars) why is this? Also can you give me the formula for working this out?

Some tailpieces have different string lengths. Why is this compensation needed and is there a formula for obtaining same?—J. D. Overton (London, S.W.4).

THE formula for fret intervals might be termed "theoretical" in as much as



The formula does not include this increased tension.

when the string is pressed down to the fret the formula does not take into account the slightly increased tension on the string—in other words the string is now stretched along two sides of the triangle, the fret being at the apex, the base being the open string.

This increased stretching not being taken into account by the formula will tend to make the frets all sharp and will be most noticeable by playing the open string and then the octave note at the twelfth fret.

Most usual practice among players is to make this test of octaves on all strings and adjust the bridge to give the most compromise on all six strings.

Due to the slow vibration of the lower strings, tension, etc., the change in pitch requires a greater length of extra string to rectify matters and this is why the bridge slopes away more towards the base side.

I suggest you make the guitar as per instructions and then when tuning the strings proceed as explained above, testing the octaves of the open strings. The ear is the final judge and not a formula.

These remarks, of course, apply to the Spanish guitar style of playing. For Hawaiian style where the strings are not depressed to the frets the matter would not be of importance.

PATENT QUERIES

I HAVE designed a new type of lamp for use by police forces, fire brigades, naval personnel, etc. This lamp is not strictly an invention but an adaptation of existing material. I have taken out a provisional patent. Does this cover me against an imitation of the design? Do you advise me to register the design and trade name? If so, please inform me of the body with whom I register and the address.

If this article is put on the market, it will be in conjunction with myself and one other person. Could you please inform me of our position in regard to Company Law? I understand that we should be classed as a private company.—T. J. Barrett (Warwick).

THE provisional specification that you have made secures priority for you when you take out your patent; but it does not give you protection against infringements.

If the design and the suggested trade name are original, it would be well to have them registered. Write to the Registrar, Patent Office, 25, Southampton Buildings, Chancery Lane, London, W.C.2, for the Official Pamphlet giving particulars. (This is sent free of charge.) You and your cooperator would not be a company but a partnership. If you carried on the business under a name other than your own names, you would need to register under the Registration of Business Names Act, 1916. Obtain particulars from the Registrar of Business Names (address already given).

The lamp will probably be subject to purchase tax. Whether or not it is you can confirm by asking your local Excise Officer.

ULTRASONIC VIBRATIONS

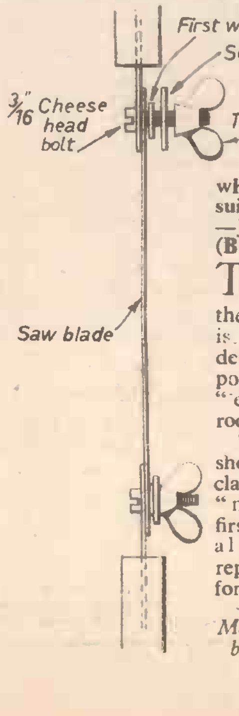
COULD you please inform me how to produce ultrasonic vibrations for cutting into metals which would need a frequency of 20,000 vibrations per second? What is it that controls the frequency? How it is increased to, say, 300,000 vibrations per second?—D. Morgan (Cardiff).

ULTRASONIC power for supplying the tool may be obtained from an oscillatory valve circuit with amplification stages. There are various types of oscillators in which the frequency of the oscillations is controlled by varying the constants, inductance and/or capacitance of the tuned circuit of the valve.

Messrs. Mullard Ltd., supply a 2 kW. oscillator having a frequency of 10 to 30 kc/s; this employs a variable R.F. oscillator followed by amplification stages. The H.T. for the push-pull output stage is obtained from a bridge rectifier circuit employing rare gas valves, vacuum-type rectifiers being used for the other H.T. supplies. A variable low-voltage polarising supply is obtained from bridge-connected metal rectifiers.

JIG SAW ATTACHMENT

I HAVE constructed the Jig Saw Attachment as described by J. Rodgers in the September, 1959, issue and have adapted it to my 4in. centre lathe. I should, however, like the following information: Advisable stroke or vertical movement of saw. Sketch of blade holder. The type of saw to use. I have been unable to get these and have used some band-saw material with holes at each end. Could you also let me know where I can purchase suitable saw blades?—J. Hargreaves (Bury).



Method of clamping the blade in a fret saw.

THE stroke or vertical movement of the original saw blade is ⅞in. It can vary depending on the positioning of the "eccentric" driving rod.

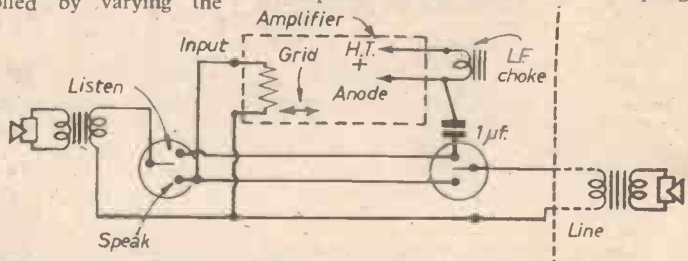
The illustration shows the blade clamped between brass "moving arm" and first washer. This is almost an exact replica of the system for clamping the blade in a simple fret-saw. The bottom blade-holder is an exact copy of the upper.

The type of saw used and Hobbies fret-saws in different gauges from "fine" to "coarse" can be purchased at handicraft shops. You can also use Junior Eclipse saw-blades and small jig-saw blades. Where the blade happens to be slightly too long, break it down to a workable length.

INTERCOM CIRCUIT

PLEASE suggest a simple design for an Inter-communication system, by which one can speak to one or four persons.—H. M. Berry (India).

THE simplest circuit for 2-way intercommunication is as shown below, an existing amplifier being used, to suit the mains or other supplies available. In this circuit small moving-coil speakers, with matching transformers of the usual type, are employed for reproduction, and as microphones, a double-pole 2-way switch being used to transfer connections from the amplifier input to amplifier output. Volume is adjusted with the amplifier volume control. The coupling



Circuit for a 2-way intercom.

circuit shown above allows a twin conductor line to be used, and avoids H.T. voltages in this.

For speaking to more than one point, the switch should be duplicated, or a multi-way switch should be used, so that the amplifier input and output can be switched to any required distant speaker.

MODEL CONTROL TRANSMITTER

(*Concluded from page 66*)

be used. For output tests or adjustments, the key must be closed, or the key tags or sockets shorted.

The output from the transmitter can be used to calibrate a frequency meter, which is then used in turn to tune the simple type of battery transmitter. The frequency meter can consist of a coil with variable condenser, crystal diode, and 1mA or similar meter, as shown in Fig. 5. Alternatively, the diode and 1mA meter can be replaced by a .04A. bulb soldered to a two turn coupling winding, as also shown in Fig. 5.

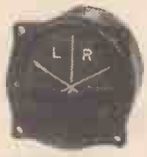
The coil and condenser can be of any suitable type tunable to 27Mc/s. For permanency of calibration, the coil should be so wound that turns cannot move, and a ribbed and notched former can be used. A condenser of about 15pF to 30pF maximum capacity is most satisfactory. With the bulb indicator, the bulb should not be changed after calibrating.

To calibrate the frequency meter, the transmitter is switched on, and the key sockets shorted. If a bulb is used, hold the frequency meter with its coil 1in. or so from the transmitter coil, and locate and mark the tuning position on the freqency meter scale. If a 1mA meter serves as the indicating device, place the frequency meter at such a distance from the transmitter as will give a convenient deflection at the optimum tuning point, and mark this reading. Tunable transmitters are then set on frequency by leaving the frequency meter at its correct setting, and adjusting the transmitter tuning for maximum indication.

Wilkinsons EST. 1921

TELEPHONES
EASY TO FIX
WIRING DIAGRAM FREE

Telephone Set Type "A" ringing and speaking both ways on a 4-core cable. Very loud and clear over any distance. The handsets are as illus. and the set is complete except wire. 4-core at **8d.** per yard or 2-core at **3d.** per yard extra. Price **75/-** set, post 3/6. **Set B.** Two headphones connected to breast microphones, with leads, plugs and fitted carrying cases. Join instruments together with two wires and 1½ volt battery for a super Intercom. **25/-**, post 3/6. **Set "C."** Similar to set "A". Instead of P.O. Type handsets, two P.O. Desk Type Instruments are supplied; with usual drawer in base. Complete and ready for use. Price **150/-**, post 7/-.



METERS GUARANTEED

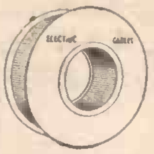
F.S.D.	Size	Type	Price
50 Microamps	2½in.	Mc/FR	70/-
100 ,,	3½in.	MC/FR	70/-
250 ,,	3½in.	MC/FR	55/-
500 ,,	2½in.	MC/FR	25/-
1 Milliamp	2½in.	MC/FR	35/-
5-0-5 ,,	2½in.	MC/FR	20/-
30 ,,	2½in.	MC FR	12/6
100 ,,	2½in.	MC/FR	12/6
200 ,,	2½in.	MC/FR	12/6
5 Amperes	2in.	MC/FS	27 6
15 ,,	2in.	MC/FR	10 6
25 ,, D.C.	2½in.	MI/FR	7/6
30-0-30 ,,	2in.	MC/FR	15/6
50-0-50 ,,	2in.	MC/FS	12/6
20 Volts	2in.	MC/FS	10/6
40 ,,	2in.	MC/FS	10/6
300 ,, A.C.	2½in.	MI/FR	25/-

CROSSPOINTER METER with 2 separate 100 microamp movements, 22/6. Post 2/-. **ROTARY CONVERTERS.** Input 12 D.C. Output 230 A.C., 50 cy. 135 w. In fitted case with variable resistance. 0/300 voltmeter. The ideal job for television where A.C. mains are not available. **£10** carr. 15/-. Special connectors one fitted with 6ft. heavy duty flex and clips for D.C. side. **10/-** set, post 1/-. **CONVERTER ONLY** 12 volt or 24 volt. **£8/10/-**. Carr. 7/6.
BATTERIES. Portable Lead Acid type, 6 volts 125 ampere hours. In metal case 16in. x 8in. x 11in. (Two will make an ideal power supply for our 12-volt Rotary Converters.) Uncharged **£6/10/-**, carr. 15/-. 24 volt 85 ampere, **£15/-/-**, carriage 30/-.
10 AMP. BATTERY CHARGER. Here is your chance to purchase a brand new unit worth £40! For our special price, **£17.10.0**, carr. 20/-. **Specification:** Input 200/250 volts A.C., 50 cycles. Output 10 amps, 22 volts D.C. Controlled by two 4-position switches for fine and coarse control which enables 6 to 24 volt batts. to be charged. Brand new with 0/12 ammeter. Fused A.C. and D.C.

VACUUM PUMP. Brand New. 7 cu. ft. per min. 10 lbs. per sq. in. at 1,200 r.p.m. Rotary Vane type **35/-**, post 3/-.
SOLENOIDS. 12 volts D.C. with a 3½in. lever, very powerful. **5/-** each, post 1/6.
SYNCHRONOUS MOTOR. 200/250 volts A.C. 60 r.p.m., suitable for electric clocks, etc. **25/-**, post 2/6.
SYNCHRONOUS MOTOR. 200/250 volts A.C. 50 cycles with gear train driving 5 dials 1/10th hr.—10,000 hrs., **35/-**, post 2 6.
MAINS MOTORS. Capacitor 230 volts A.C. 1/40th h.p. 1,400 r.p.m., **55/-**, post 3/6.
SMALL MOTORS. 12 volts D.C. 3,000 r.p.m. with speed governor in end cap. 2in. x 1½in., **12/6**, post 2/-.
GEARED MOTORS for the model maker, small but powerful 12/24 volts A.C./D.C. 4/8 r.p.m., **35/-**, post 2/6.
GEARED MOTORS. 220-240 volts A.C. 175 r.p.m. Torque, 15lb. in Klaxon, **£10**, carriage 15/-.
MOTORISED FUEL PUMPS. 24 volts D.C. 400 g.p.h. Pulsometer type with flange for fitting on side of tank. Plessey type also available for use with pipe system. Either type **55/-**, carriage 3/6.
VARIAC TRANSFORMER. Input 230 volts. Output infinitely variable 0-230 volts and 0-270 volts. 9 amp. Bench or panel mounting. **£15**, carriage 12/6.
TERMINAL BLOCKS 4/- doz., or box of 50 for 15/-. 3-way, 6/- doz., 50 for 22/6, post 1/6.
NIFE BATTERIES. Nickel cadmium. 6 volts 75 amps., crated and connected. Alkaline filled. Brand new. **£7.10.0**, cge. 15/-.
VEEDER-ROOT MAGNETIC COUNTER. General purpose type with zero re-set. 800 counts per minute up to 999,999. 48 volt D.C., **55/-**, post 2/6.
MAP READING LAMPS. Ex-R.A.F. NAVIGATOR'S CHART MAGNIFIERS. 3in. lens complete with batteries, bulb and dimming switch. 12in. long. **37/6**, post 2/6.
SWITCHES. 1 hole fixing, 3 amp. 250 volts, **1/6** each, **12/-** doz.

L. WILKINSON (CROYDON) LTD.
19 LANSDOWNE RD. CROYDON SURREY
Phone: CRO 0839 Grams: WILCO CROYDON

Versatile Wire



Single-strand 18-gauge with P.V.C. covering which makes it rustproof. Extra strong, will stand tremendous strain. Ideal for gardening, clothes lines, indoor aerials, etc. etc. Also being steel alloy and having a resistance of approximately 1 ohm per yard this can be used for electrical work, soil heating, wrapping round water pipes, etc. New on drum containing 3,000ft. Price **8/6**, plus 3/6 carr.

"Dim and Full" Switch

Particularly useful for controlling photo-flood lamps which have only a short life at full brilliance. This toggle switch has three positions, the first position puts two lamps in series at half brilliance for setting up, the second position is off and the third position full brilliance for the operational shots. Also useful for controlling night lights, heaters, etc., etc. Price **2/6** each. S. post 9d. Circuit diagram included.

Hi-Fi Snip Infinite Wall Baffle

Gives really superb results with only a low-priced 8in. speaker out-out for tweeter, nicely veneered with fabric speaker enclosure. Corner fitting, can be attached to Picture rail. Only **45/-**, carriage and insurance 3/6.

Speaker Bargain

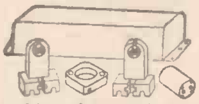
12in. Hi-fidelity loud-speaker. High flux. Permanent magnet type with standard 3 ohm speech coil. Will handle up to 12 watts. Brand new by famous maker. Price **32/6**, plus 3/6 post and insurance. Ditto 8in. Hi-Flux, **27 6**.

This Month's Snip

Car Starter Battery Charger

Due to a fortunate purchase we are able to offer you a fine ready-made high output battery charger in stove enamelled sheet steel louvred case. New, complete and ready to work, this charger is rated at 12 v. 4 amps and has a variable rate selector for trickle charging, also a meter to show charging rate. Suitable for 230/250 A.C. mains. Made to sell at 85/-, but offered this month at special snip price of **55/-**, plus 3/6 post and insurance.

Fluorescent Kits

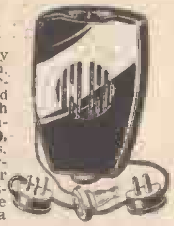


Complete kits of parts less tube for fluorescent lighting. Comprise five items as follows: best quality impregnated choke ballast unit, canister starter, starter holder, two lampholders.
40 watt ... 19 6, plus 2/6 post.
80 watt ... 24/6, plus 2/6 post.
These kits are for strip tubes, but if you wish to use circular tubes then the prices are:
Circular 40 watt ... 21/-, plus 2/6 post.
Circular 80 watt ... 25/-, plus 2/6 post.
Complete ready to work fluorescent fittings, beautifully made, stove enamelled white; all have polyester filled chokes and fitted interference suppressors.

5ft. 125 watt	59/6
5ft. 80 watt	39/6
4ft. 40 watt	32/6
Circular 40 watt	49/6
Circular 80 watt	59 6
2ft. 20 watt	29/6
3ft. 40 watt	31/6
21in. 13 watt ... (miniature tube)	37/6

Note these prices do not include tubes and represent only a selection of our complete range of which a list is available on request. (Special Snip Offer: 40 watt, complete with tube, 39/6.) If ordering by post add carriage and insurance; up to 150 miles 5/6, up to 250 miles 7 6.

Medresco Hearing Aid



As supplied by National Health, completely overhauled and in good working order with six months' guarantee. Only **£3/15/0**, plus 2/6 post and ins. Complete with earphone and *new* ear plug but not batteries, these can be supplied as an extra for 5/- per set.
Superior model—new—higher gain—and self-contained batteries **£7/10 0**, or 10/- deposit and 15 fortnightly payments of 10/-.

Stereo Outfit

Stereo Amplifier outfit comprising 7 watt twin channel amplifier for A.C. mains working and two 8in. P.M. Speakers on veneered and polished corner baffles. Whole outfit giving really terrific reproduction and amazing 3D effects. **£14** complete, plus carriage and insurance. Or **£1** down and 28 weekly payments of **10/-**.

Gyro by Sperry

Made for use in Aircraft. This is an air-operated Gyro, it really is a Superb instrument, made to the closest limits of precision.
Brand new in original air sealed packing, probable cost around £50 each. Our price only **15/-**, plus 2/6 post.

A.C./D.C. Multimeter Kit

Ranges: D.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. A.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. D.C. milliamps 0-5, 0-100, 0-500. Ohms 0-50,000 with internal batteries. 0-500,000 with external batteries. Measures A.C./D.C. volts D.C. current and ohms. All the essential parts including metal case, 2in. moving coil meter, selected resistors, wire for shunts, range selector, switches, calibrated scale and full instructions, price **19 6**, plus 2/6 post and insurance.

For Portable Radio or Player

This fine cabinet as illustrated but less control knobs is available this month at a special snip price of **12/6**, plus 3/6 post and insurance. Size is 13½in. x 9in. x 4in. and it is nicely covered in two-tone I.C.I. fabric.

Miniature Microphone

American made. Dynamic type real bargain at **2/6**, plus 6d. post.

Band III Converter Kit

Suitable Wales, London, Midlands, North, Scotland, etc. All the parts including 2 EF80 valves, coils, fine tuner, contrast control, condensers and resistors. (Metal case available as an extra.) Price only **19/6**, plus 2/6 post and insurance. Data free with parts or available separately 1/6.
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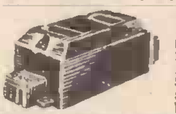

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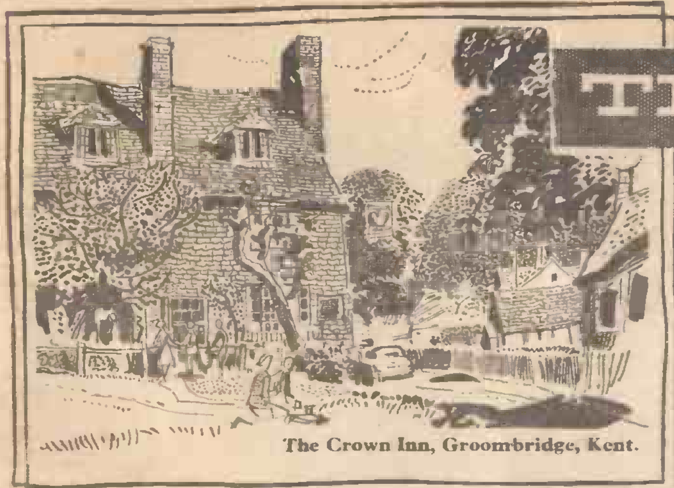

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Vol. XXVIII No. 446

COMMENTS OF THE MONTH

Dazzling Headlights

AT midnight on Saturday, October, 3rd, the clocks all over the country were put back one hour and British Summer Time came to end. The immediate and most apparent effect on all cyclists was that they found themselves doing part of their ride home from work in the dark. This is not an inconvenience to most cyclists —rather the new experience invests the old too-familiar ride with a new glamour, giving the rider a new interest in his surroundings, which, while it does not last long, provides at least a temporary change.

At the same time, however, as old experiences are renewed with the coming of the winter dark, so are the old annoyances and the worst of these is the dazzle of undimmed headlamps from approaching motor traffic. Not all motorists are offenders in this respect of course but there are many who are inconsiderate enough or discourteous enough never to dip their blazing headlamps to avoid annoying oncoming traffic. It is a common sight to-day to see a car rushing along the road with headlamps full on and another approaching in the other direction flashing his own lights at the other driver to indicate that he is being dazzled and requesting he dip his lights.

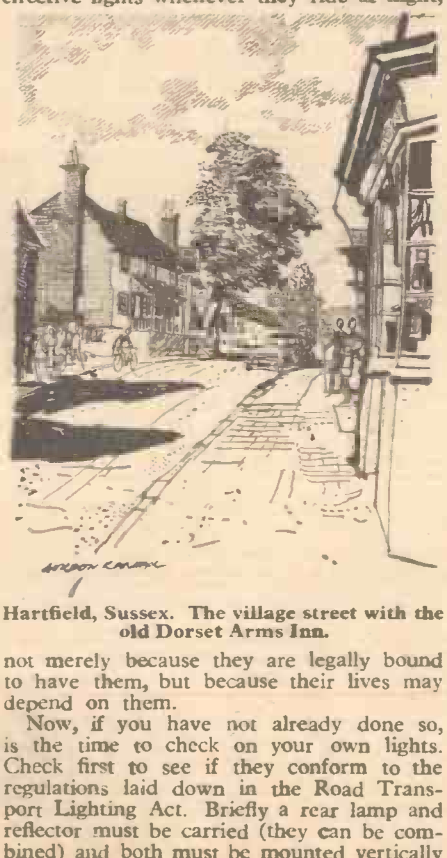
The cyclist is unfortunate in that he cannot even display his annoyance to a driver offending in this way and for the cyclist, of course, the effect of dazzling headlamps on a dark road is even more severe. While the lamps are approaching he can see very little and is quite likely to run into a ditch or up the kerb, but immediately the car has passed the effect is even worse. The sudden transition from blinding light to inpenetrable darkness leaves the cyclist unable to see anything at all and often he has to stop completely and wait till his eyes become accustomed to the dark again. The motorist, of course, is faced with the same problem but to a lesser degree. When the car with the dazzling headlamps has passed by, he still has his own lamps to light his path. The meagre light afforded by most cycle lamps is usually completely ineffective in such a situation.

Sometimes this annoyance is carried to even further extremes and in well-lit city and suburban areas one sees cars with full headlamps blazing. The sudden darkness after dazzle does not occur here, although the effect of dazzle is as bad—but the offence is greater, because it is so completely unnecessary. If a driver cannot see to drive on his sidelights only when aided by the modern sodium street lighting, he has no business to be driving at all!

How About Your Own Lights?

As already mentioned, a motorist who has been dazzled by the lights of oncoming traffic finds it difficult to see in the sudden darkness which follows. It is at a time like this that it is imperative that a cyclist has an effective rear lamp. How often do we read in the newspapers after an accident, some such phrase as, "I was dazzled by the lights of oncoming traffic and he had no rear light"?

It is vitally necessary for cyclists to have effective lights whenever they ride at night,



Hartfield, Sussex. The village street with the old Dorset Arms Inn.

not merely because they are legally bound to have them, but because their lives may depend on them.

Now, if you have not already done so, is the time to check on your own lights. Check first to see if they conform to the regulations laid down in the Road Transport Lighting Act. Briefly a rear lamp and reflector must be carried (they can be combined) and both must be mounted vertically and square to the rear. They must be at least 1½in. in diameter and if not circular in shape must be of at least equal area and capable of having a 1in. circle described on them. The reflecting surface must also be capable of being contained within a 6in. circle. Both must be positioned on the centre line of the machine or on the off side and not more than 1ft. 8in. from the rearmost point of the machine. Their height must be between 15in. and 42in. B.S. standards are laid down to which lamps and reflectors must conform.

A single white light must be carried on the front of the machine. Position is not exactly defined. When riding a tricycle the lamp should be on the off side and if a sidecar is fitted two lamps should be carried.

Those are the rules, but conforming to them does not end the matter. It is no good carrying the requisite lamps if they are obscured in any way, either by dirt on the lamp itself or, for instance, by a jersey hanging from the saddlebag. Battery lamps have an unfortunate habit of going on and off as the machine jolts over bumps in the road. Make sure they are alight permanently while riding. It is a definite advantage if the rear lamp is visible from the riding position and when choosing a rear lamp pick one with thick collared glass or with a window in the body of the lamp so that it is possible to tell whether it is alight or not while riding.

Bulbs and batteries always fail at the most awkward times. Be prepared for this by carrying a spare. Spare bulbs are particularly necessary when using a dynamo. Finally, always fit correctly rated bulbs. With dynamo lighting sets, the makers do not always specify the same rating, so make sure the bulbs you fit conform to the recommendations of the maker of your own particular lighting set.

New C.T.C. Appointments

The new secretary is Mr. Leslie C. Warner. He succeeds Mr. Reg. C. Shaw, M.B.E., who held the post for many years. Mr. Shaw is also president of the Cycling Commission of the Alliance Internationale de Tourisme. Mr. Warner was previously assistant secretary and now at 32 is the youngest secretary since the founder, Stanley Cotterell. He is an enthusiastic cyclist, clubman and rough stuff rider and as the new secretary will represent the C.T.C. on the Royal Society for the Prevention of Accidents. He will also be secretary of the Standing Joint Committee on Cycling.

Mr. William F. Stiles has been appointed manager of the C.T.C.s London headquarters. He is well-known at the C.T.C. for his organised tours and rail excursions known as "Cyclists Specials."

The C.T.C. Gazette, previously edited by Mr. Shaw, now comes under the aegis of the previous assistant editor Mr. H. John Way who is author of the "Good Companion" travel guides to the Continent.

The Cyclist's Workshop

EVERY cyclist who does his own repair work needs a place to work and to keep his tools and spare parts. A wooden shed is suitable or a corner of the garage can be used, but wherever is chosen it is an advantage if it is large enough to accommodate a bench fitted with a vice. It is not important what type of bench is used. Ideal, of course, is a proper engineer's bench, but a carpenter's bench, an old table, or merely a couple of boards fixed on supports across the width of the shed will be suitable. The bench is best sited under a window or at least where there is plenty of light, either daylight or artificial. If artificial light is employed some means of adjusting the position of the lamp is very useful.

The type of vice used will, of course, depend largely on what is available or easily obtainable, but ideally a 4in. or 6in. machine vice should be used and it is an advantage if this is equipped with soft jaws.

Storage of Tools and Spares

Instead of hanging tools individually on the wall, the best method is to fix up a large sheet of pegboard and mount the tools on this.

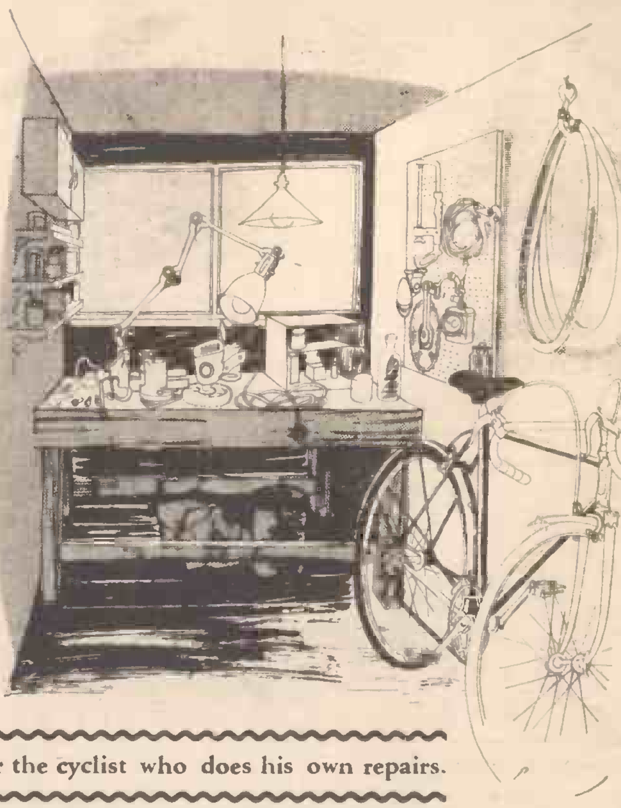
Some of the smaller accessories could be hung up in the same way, but many will need individual fixing. Spare tyres are best suspended from hooks by means of leather straps; brake cables, mudguards, etc., will want hanging individually. Saddles, handlebars, chainsets and similar items will require the same treatment, but things like pedals, lamps, hubs, sprockets, etc., could be hung on the pegboard.

If a large range of sprockets is kept—and a time-trialing enthusiast would need a large range—the best method of storage is to stack them over an old straight wooden hat peg. Do not hang inner tubes over nails, but dust them with French chalk, squeeze out the air, coil them and keep in a box. Almost all cycle parts and cycle tools will keep better if covered with a thin layer of grease. That is, of course, all the metal items will, but keep the grease and oil away from tyres and inner tubes. Finally, a large selection of tins is always useful for storing small items like screws, bolts, ball bearings, washers, etc.

Selection of Tools

Most cyclists carry a tool kit around with them for emergency repairs while travelling, but this should be entirely separate from the workshop tools which should be sufficient to dismantle a cycle completely, without "bodging" or "forcing" any parts. Obviously, many tools which are too heavy or cumbersome to carry in the saddlebag will be necessities in the workshop.

The most obvious need is for spanners. Most of the nuts on a British bicycle will be British Standard Cycle sizes and a set of good quality open-ended spanners ranging in size from ¼in. to ⅝in. is almost a necessity. Many of these sizes will need to be duplicated. For instance, you will need two spanners the same size when holding the cone locking nut and removing the wheel spindle locking nut. It is a good idea to duplicate these B.S.C. sizes by means of a set of ring spanners—often so useful in awkward places. Useful in a similar way is the well-known box spanner and a couple of these will do some jobs better than the open ender or the spanners or alternatively socket spanners.

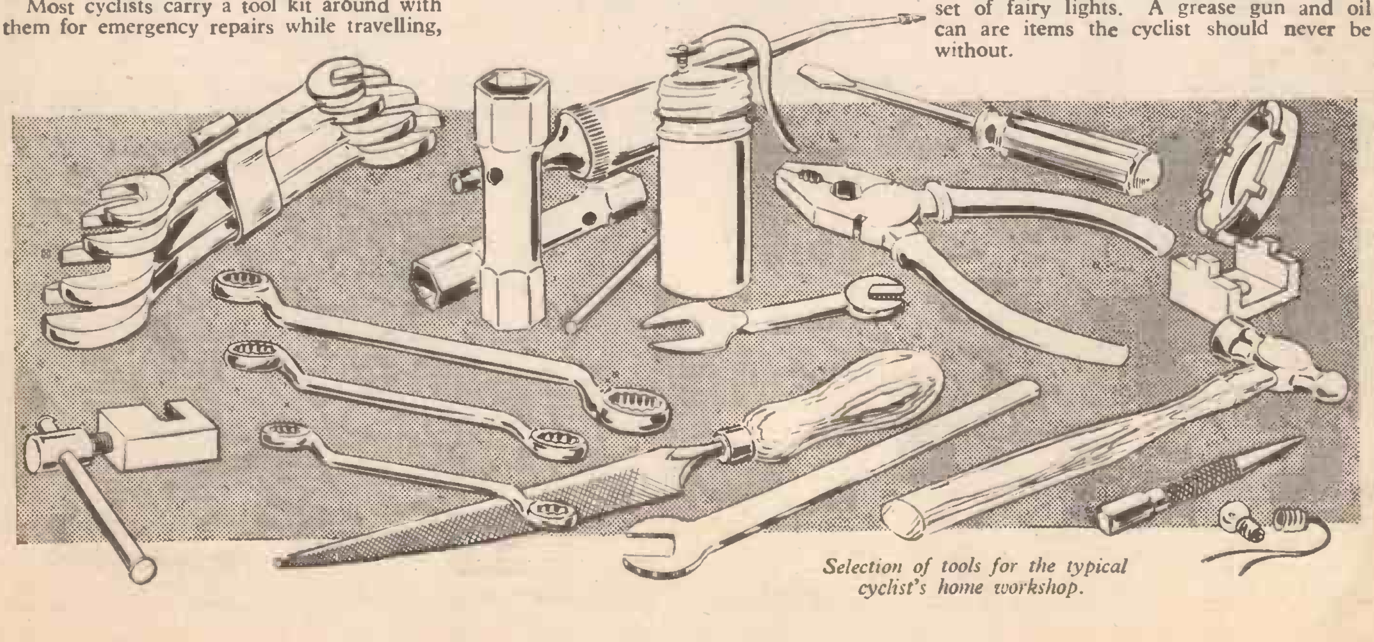


This is a necessity for the cyclist who does his own repairs.

If you have a Continental machine and all the nuts are metric sizes, you will, of course, require a set of metric spanners. Probably a set of sizes between 10 and 24mm. will do all the jobs required. Duplicate sizes will again be found useful and a set each of open-ended spanners and ring spanners will be found the best combination, with perhaps a couple of additional box spanners or, alternatively, socket spanners.

A good screwdriver with a ¼in. blade will be necessary and a pair of large pliers with insulated handles and wire cutters. For filing down spoke ends and cotter pins at least one file will be needed and for removing cotter pins a hammer and punch is necessary. For innumerable jobs of adjustment and dismantling a set of good quality cone spanners will be required, including one with a long shank for removing pedals. Cone spanners with thin blades are best.

A number of special purpose tools will be useful including specially shaped spanners for dismantling the head and bottom bracket, a spoke key, a chain rivet extractor, a fixed sprocket remover and a dog for removing freewheels. A spare set of tyre levers kept in the workshop is always useful and for cleaning chains and other small components a dish and some paraffin will be required. Another useful adjunct, whether dynamo or battery lamps are used, is a bulb tester, consisting of a bulb holder and two short pieces of flex. This can often be removed from a set of fairy lights. A grease gun and oil can are items the cyclist should never be without.



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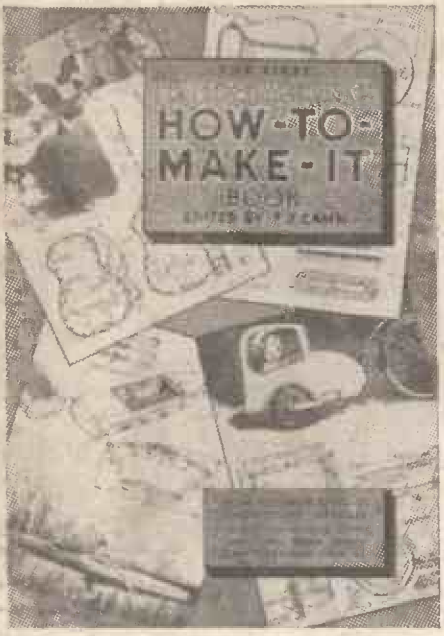

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