BUILDING A TAPE RECORDER

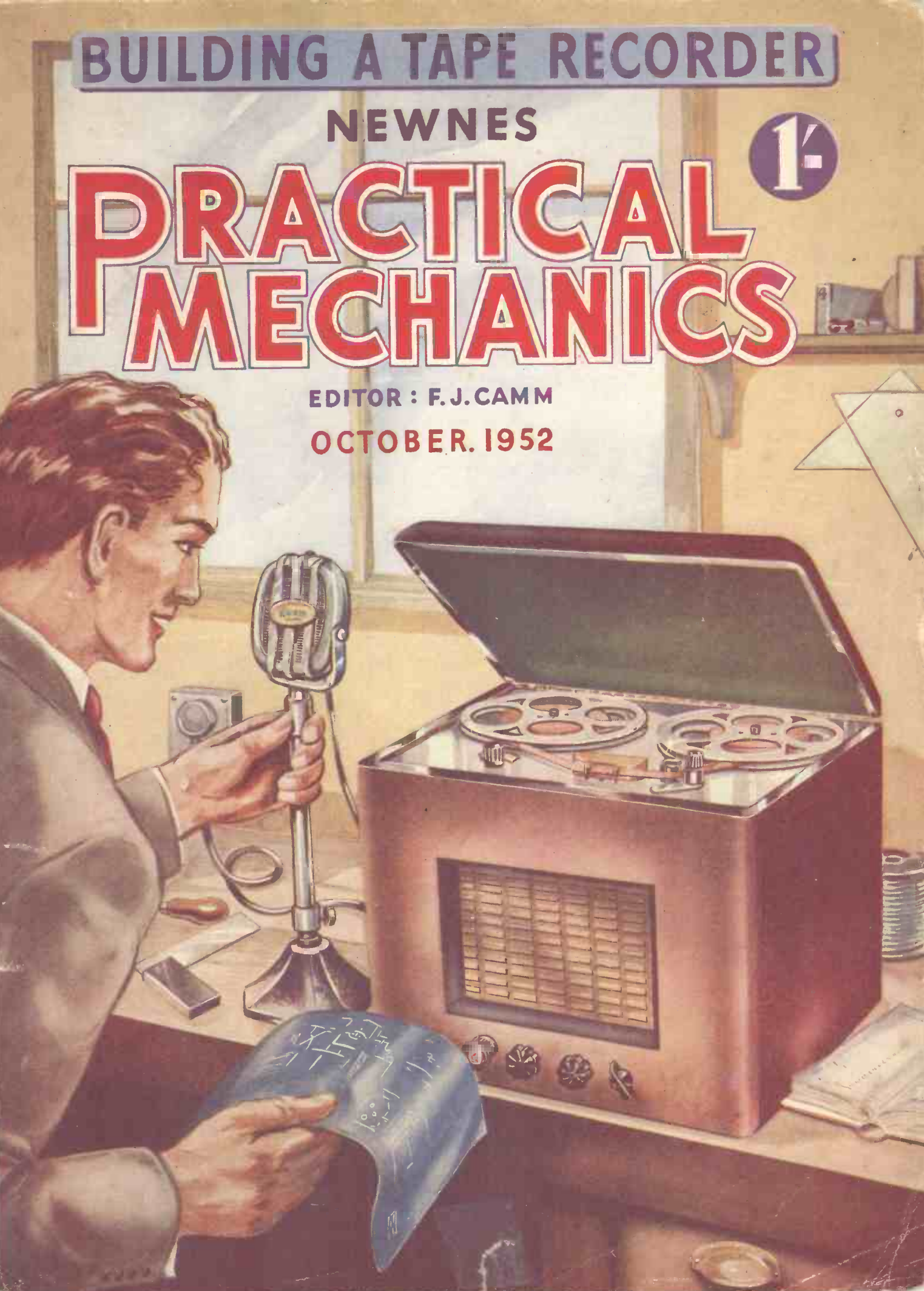
NEWNES

PRACTICAL MECHANICS

1/-

EDITOR : F. J. CAMM

OCTOBER. 1952



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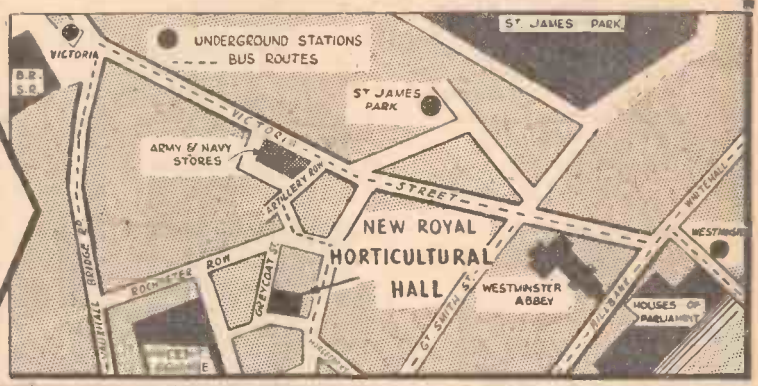

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OCTOBER, 1952
VOL. XX
No. 226

PRACTICAL MECHANICS

EDITOR
F. J. CAMM

Owing to the paper shortage "The Cyclist," "Practical Motorist," and "Home Movies" are temporarily incorporated.

FAIR COMMENT By The Editor

Sonic and Supersonic Speeds

THE aircraft display at Farnborough demonstrated beyond all doubt the superiority of British aircraft and the considerable lead we have over many other nations. The fact that tragedy supervened is a reminder that a price must be paid for all the scientific advancements. However carefully designs are prepared and stresses calculated it is only by practical tests that the theories can be proved. Mechanical flight has suffered most in this respect from its earliest days.

The early pioneers had no data on which to work and they had to find out by placing their own lives in peril and risking death. The fact that to-day that peril is much less as a result of their work is but a poor consolation for the loss of highly specialised scientists.

Not so many years ago it was thought that the limit of speed was that of sound and that it would never be possible to break through the sound barrier. It is now being done by many different makes of aircraft both in this country and others. Those who have never heard the sonic boom as a plane breaks through that barrier have a thrilling experience before them. Speeds of 800 m.p.h. and more are now common and the experience and data gained is paving the way for that time probably during the present century when interplanetary travel will be possible. There is, in fact, only practical limits to speed and certainly speeds will have to be of the order of thousands of miles an hour if journeys to the moon are to be undertaken.

The shape of the modern 'plane takes us back to the darts of our schoolboy days and the man who first conceived the idea of shaping a dart was ahead of his time and discovered something of tremendous import. The piston engine is passing although it will remain with us for many more years. The turbo-jet car is still only a remote possibility of the future. As far as aircraft is concerned many other problems remain to be solved.

Special runways, for example, are necessary for them, because the tremendous heat burns up the tarmac. Jet helicopters must sometime follow present developments.

A STEERABLE RADIO TELESCOPE

IN another direction this country is regaining the lead it formerly had. The Government, through the Department of Scientific and Industrial Research and the Nuffield Foundation have decided to provide a steerable radio telescope for the Manchester University at a cost of £336,000.

The very first large telescopes was built in Great Britain by Herschell and Rosse in the 18th and 19th centuries, but we were unable to maintain our lead because such telescopes require clear skies and good atmospheric conditions. It was for this reason that the large telescopes of the 20th century have been built in America on Mount Wilson and Mount Paloma.

In Great Britain climatic conditions severely handicap visual astronomy. Since the war the techniques of radio and radar as applied to astronomy have yielded a series of discoveries about the universe, and in this field the pioneering work of research astronomers at Manchester and Cambridge Universities have given this country a pre-eminent and prominent position.

At Cambridge, for example, important results have been attained using interferometric methods, and at Manchester a fixed radio telescope has been used to pick up radio waves reaching the earth from sources as far distant as the great spiral nebula of Andromeda, which is no less than 750,000 light years away, and at both Universities radio waves have been recorded from light sources in space which do not coincide with known visible stars.

In 1920 the telescope on Mount Wilson showed that the Milky Way was a system of stars far more extensive than hitherto imagined and that it would take 100,000 years travelling at the speed of light to traverse it. One of the remarkable features of these discoveries is the fact that man's eyesight is able to penetrate the atmosphere of the earth. It was in 1931 that the discovery was made that radio waves were reaching the earth from outer space. From the number of queries we have received regarding the construction of telescopes it is evident that many of our readers are interested in this absorbing subject, and we shall from time to time publish further articles on telescope construction.

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Inland	14s. per annum.
Abroad	14s. per annum.
Canada	13s. per annum.

Editorial and Advertisement Office: "Practical Mechanics," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2
'Phone: Temple Bar 4363
Telegrams: Newnes, Rand, London.
Registered at the G.P.O. for transmission by Canadian Magazine Post.

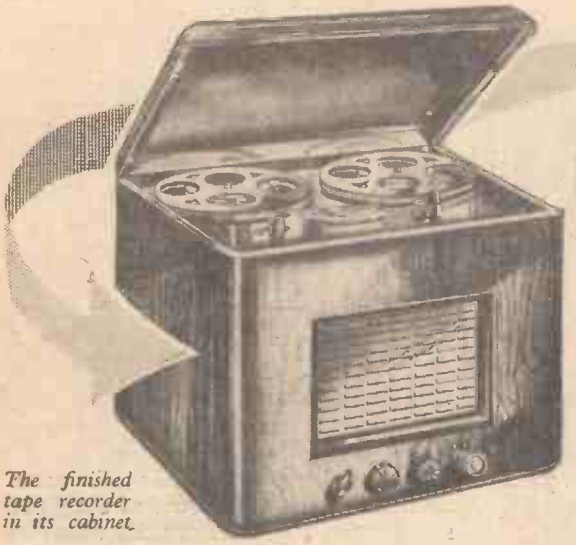
OUR COVER

HERE we are in our new dress and with more pages. This is a sign, if a small one, that the rigid economy of the past ten years is passing; whilst costs of production and paper are still very high when compared with pre-war, they are none the less showing a decline. This journal is one of the first to pass along to its readers the benefit of those reductions.

From now on our front cover will feature one of the main articles in each issue, and we shall welcome suggestions from readers as to the style of article which lends itself to cover illustrations.

We already have under construction a number of devices, models, and other apparatus which readers have requested during the past year but which space restrictions have prevented us from developing. The ample space we now have has released the shackles and we shall welcome your suggestions.

F. J. C.



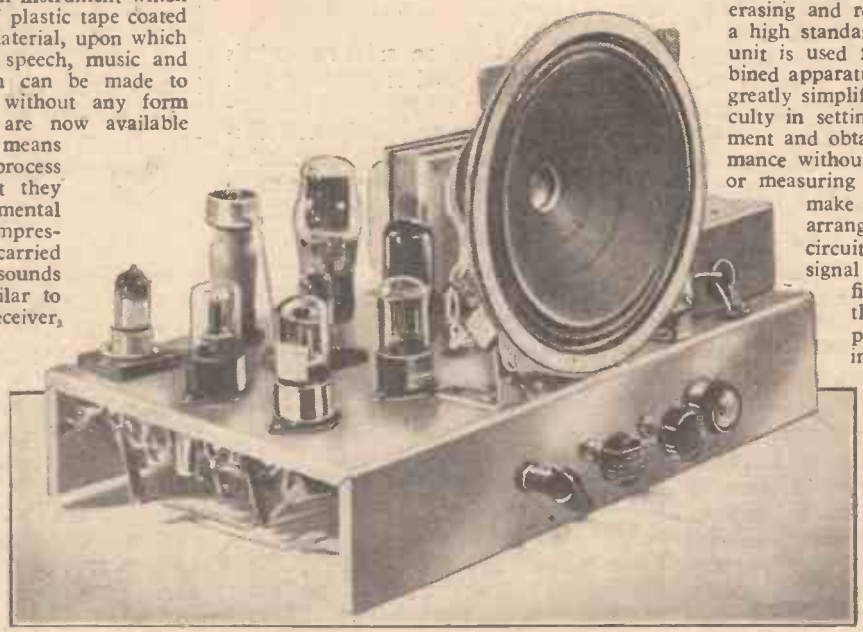
The finished tape recorder in its cabinet.

Building a TAPE RECORDER

Designed and Built in the "P.M" Laboratory

Full Constructional Details of a Recording and Reproducing Unit Utilising a Commercial Tape Deck

A TAPE recorder is an instrument which utilises a length of plastic tape coated with a magnetic material, upon which it is possible to impress speech, music and other sounds, and which can be made to reproduce those sounds without any form of processing. There are now available various arrangements by means of which the complete process may be carried out, but they all involve certain fundamental principles. First, the impressions on the tape are carried out by amplifying the sounds through an amplifier similar to that used in a radio receiver, and then feeding them to a small magnetic unit known as a Recording Head. This bears some resemblance to a telephone earpiece, and the variation across a magnetic gap is passed across the magnetic surface of the tape which is drawn across the gap by a motor at a certain speed. For very high quality recordings the speed is fast (15in. per second), and for speech it is slow (3¾in. per second). The tape is carried on a metal spool similar to those used in the amateur home cinematograph, and when a suitable record has been made the tape is wound back on to its original spool and then passed forward again, either across a different head or across the Recording Head, but this time the head is connected to the input side of an amplifier and the fluctuations introduced in the winding of the head are amplified and fed to a loudspeaker. If the recorded tape is passed across a strong magnetic field the recorded impressions will be "erased." This, briefly, is the complete process, but it is rendered very complicated by the fact that in order to obtain a suitable impression on the tape the recording head must carry alternating current impulses, upon which the recording may be superimposed, and the erasure must be carried out also with a suitable magnetic field to avoid making a noisy background to the record. The motors must, of course, pull the tape past the head very steadily and without any jerkiness or unevenness, and the recording amplifier must have certain forms of tone correction introduced to maintain a suitable quality standard. Similarly, when playing back the recorded music, further forms of tone correction are required, and thus the complete recorder would appear to be a complicated piece of equipment.



The amplifier unit of the tape recorder

The Circuit

In the Recorder which is described here, the complete process has been greatly simplified by using separate amplifiers for the recording and reproducing, and a commercial tape-deck which incorporates the motors for driving the tape, and the Erase and combined Recording and Playback Head. In addition, as the waveform produced by the special oscillator unit which is used for erasing and recording must conform to a high standard, a commercial oscillator unit is used for this part of the combined apparatus. The work is, therefore, greatly simplified and there is little difficulty in setting up the complete equipment and obtaining a high-class performance without the need for special test or measuring instruments. In order to make the recorder of greater use, arrangements are made in the circuit for coupling the recorded signal into any standard amplifier or broadcast receiver so that a high level of output may be obtained, instead of playing back via the loudspeaker which is built into the instrument. This speaker acts as a monitor when making a recording, and when switched to playback it will deliver sufficient volume for normal domestic purposes. The circuit is also arranged to permit of the plugging-in of a meter, whilst it is also possible to include a small neon to indicate the recording level, instead of using the loudspeaker. (Figs. 1 and 2.)

Controls

There are three controls, one adjusting

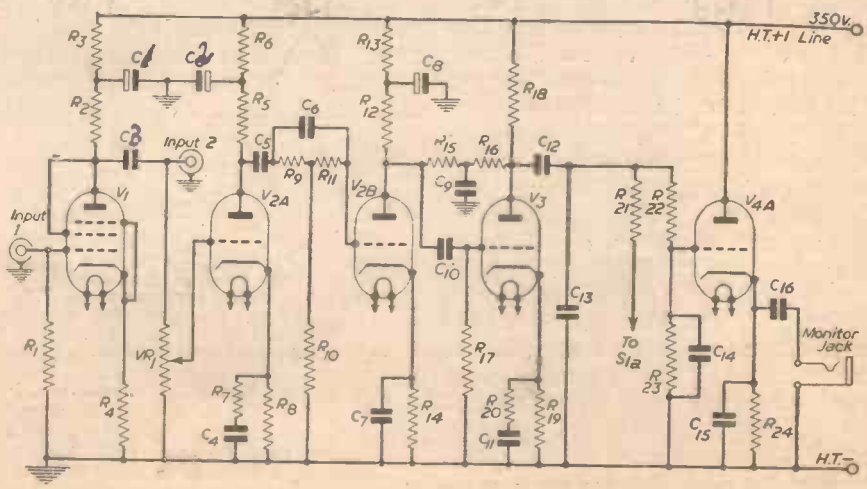


Fig. 1.—Theoretical circuit of the recording section of the equipment.

the level when recording, one adjusting the playing-back volume (with which is combined the on/off switch), and a rotary two-position switch. This changes over the connections to the head and connects it to the recording amplifier or the playback amplifier, and to enable the user to know which part of the circuit is in use a section of the switch is connected to a special signal lamp which changes colour and should be wired as shown in the sketch, wiring to show "red" when recording, and "green" when playing back. The switch also disconnects the H.T. supply from the oscillator unit when playing back—an essential point, as the erase head must be "dead" when the tape passes it or the recording will be erased.

On the actual tape deck there is a further switch which provides for the tape to travel past the heads at a speed of 7½in. per second, and, in addition, it may be rewound at a very high speed after recording. This high-speed feature is also available for winding-on the tape when it is desired to pick out a portion of recording in the centre of the tape, or for "dubbing" purposes. The high speed permits the normal 1,200ft. spools which are used on the machine to be fully rewound in approximately 1 minute, whilst the playing time of the spool is about 30 minutes. As the head which is fitted records on only half the width of the tape, the spool is turned over and reversed when full and the recording thus continued on the other half of the tape, thereby providing approximately 1 hour's playing. The tape may be used over and over again almost indefinitely, and the only deterioration which is likely to be noticed is a noisy background which will arise after many recordings have been made and wiped out.

This illustration shows the chassis and tape deck out of the cabinet, and also the microphone.

LIST OF COMPONENTS

RESISTORS
(Erie Resistor Company)

R1—1M Ω ¼W.
R2—39K Ω ¼W.
R3—150K Ω ¼W.
R4—1.2K Ω ½W.
R5—120K Ω 1W.
R6—15K Ω 1W.
R7—2.2K Ω ¼W.
R8—3.6K Ω ¼W.
R9—100K Ω ¼W.
R10—22K Ω ½W.
R11—240K Ω ½W.
R12—120K Ω 1W.
R13—15K Ω 1W.
R14—2.2K Ω ¼W.
R15—240K Ω ½W.
R16—82K Ω ½W.
R17—500K Ω ¼W.
R18—50K Ω 1W.
R19—1.5K Ω 1W.
R20—200 Ω ½W.
R21—56K Ω ¼W.
R22—620K Ω ½W.
R23—470K Ω ½W.
R24—5.6K Ω 1W.
R25—820 Ω ¼W.
R26—1.5M Ω ¼W.
R27—2.2K Ω ½W.
R28—270 Ω ½W.
R29—220K Ω ¼W.
R30—22K Ω ½W.
R31—1.2M Ω ¼W.
R32—125K Ω ¼W.
R33—1M Ω ¼W.
R34—1.5K Ω ½W.
R35—100K Ω ½W.
R36—150K Ω ¼W.
R37—50K Ω 1W.
R38—470K Ω ¼W.
R39—47K Ω ½W.
R40—1.5K Ω 1W.
R41—10K Ω ½W.
R42—100K Ω 1W.
R43—500K Ω ½W.
R44—560 Ω 1W.
R45—4.7K Ω ¼W.
R46—2,500 Ω 5W.
R47—2,500 Ω 10W.

CONDENSERS (T.C.C.)

C1—16 μF. elect. cond. 450V. wkg.
C2—16 μF. elect. cond. 450V. wkg.
C3—0.1 μF. paper cond. 250V. wkg.
C4—0.01 μF. paper cond. 250V. wkg.
C5—0.1 μF. paper cond. 350V. wkg.
C6—50pF. mica cond. 250V. wkg.
C7—0.01 μF. paper cond. 250V. wkg.
C8—8 μF. elect. cond. 450V. wkg.
C9—500pF. mica cond. 350V wkg.
C10—0.1 μF. paper cond. 350V. wkg.
C11—0.01 μF. paper cond. 250V. wkg.
C12—0.5 μF. paper cond. 350V. wkg.
C13—200pF. mica cond. 250V. wkg.
C14—0.001 μF. mica cond. 250V. wkg.
C15—0.01 μF. paper cond. 250V. wkg.
C16—0.1 μF. paper cond. 250V. wkg.
C17—16 μF. elect. cond. 350V. wkg.
C18—16 μF. elect. cond. 350V. wkg.
C19—0.25 μF. paper cond. 250V. wkg.
C20—0.01 μF. paper cond. 250V. wkg.
C21—0.25 μF. paper cond. 350V. wkg.
C22—0.002 μF. paper cond. 250V. wkg.
C23—0.001 μF. mica cond. 250V. wkg.
C24—0.25 μF. paper cond. 350V. wkg.
C25—300pF. mica cond. 250V. wkg.
C26—0.1 μF. paper cond. 350V. wkg.
C27—8.0 μF. elect. cond. 350V. wkg.
C28—50.0 μF. elect. cond. 25V. wkg.
C29—0.25 μF. (type 543).
C30—16 μF. (CE29P).
C31—16 μF. (CE29P).
C32—16 μF. (CE29P).
C33—16 μF. (CE29P).
C34—8 μF.

VR1—0.5M. Potentiometer without switch Type SG/1. (Reliance Mfg.)
VR2— 0.5m with S.P.S.T. switch (Reliance Mfg.)
6 International Octal Valveholders. (Clix.)
2 B8A Valveholders (Clix.)
2 Knobs—K365.
1 Knob—K357.
1 Plug—P38.
1 Socket—J11.
1 Plug and Socket—P73.
1 Signal Lamp—D670.
(Bulgin.)
1 High Impedance Microphone with Table Stand—Model C51Z. (Lustraphone.)
1 Mains Transformer (350/0/350 at 100mA.; 6.3V. at 4A.; 5V. at 3A.) (Radio Supply Co.)
2 L.F. Chokes (100mA., 200Ω.) (Radio Supply Co.)
1 8in. Loudspeaker with Transformer. S810T. (Whiteley Electrical Co.)
4 Coaxial Plugs and Sockets, L734/P and L604/S. (Belling and Lee.)
1 4-pole two-way Rotary Switch with 2¼in. spindle. (Telcradio.)
8 Valves :—
2 at EF40. 1 at EF37A. Mullard.
1 at 6SL7. 1 at 6J5.
1 at 6SN7. 1 at 5Z4G. Brimar.
1 at 6V6.
1 Lane Tape Deck MK2. (Verdik Electronic Co.)
1 Lane Oscillator Unit type OC/1 with Valve. (Verdik Electronic Co.)
1 Metal Chassis, 16in. by 12in. by 3in. (Precision Equipment Co.)
1 yard of single-screened Flex.
1 yard of 80-Ohm Coaxial Cable.
Tinned Copper Wire and Sleeving, Nuts, Bolts, etc.
1 Screened Top Cap Connector.
1 Reel H.C. Emitape and 1 empty Spool.
3 Rubber Grommets.
10 Soldering Tags.
1 Cabinet. (J. Tallon and Sons.)

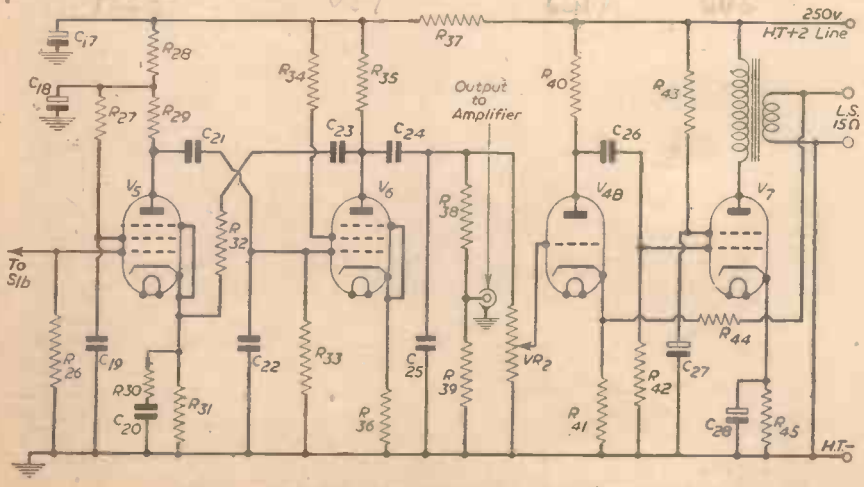


Fig. 2.—This is the play-back section of the instrument.

Construction

As may be seen from the illustrations and the picture on our cover this month, the complete equipment is housed in a neat table cabinet the overall size of which is governed by the dimensions of the tape deck. This is approximately 11 9/16in. by 16 5/16in., and the amplifier chassis measures 16in. by 12in. by 3in. deep, and is drilled as shown in Fig. 3. The holes for the valve-holders are all drilled the same size, but

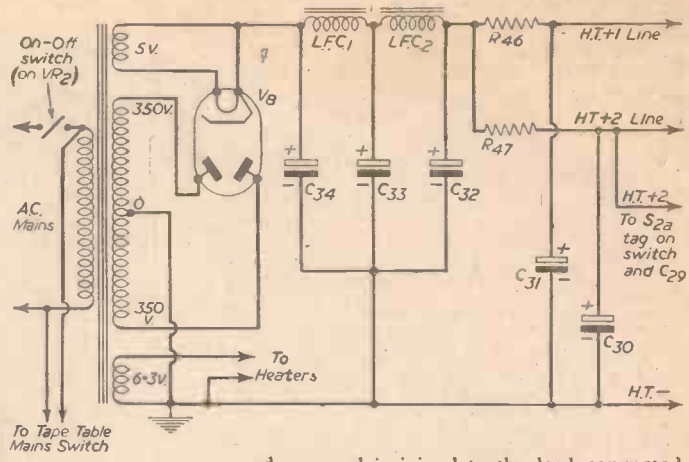
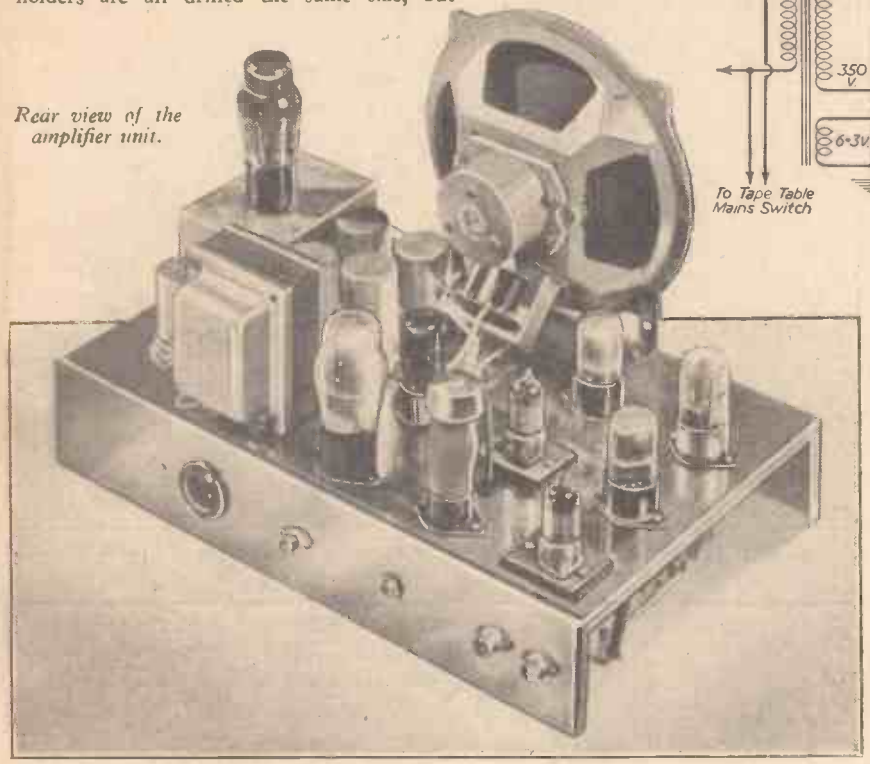


Fig. 4. — Theoretical circuit of the mains portion of the recorder.



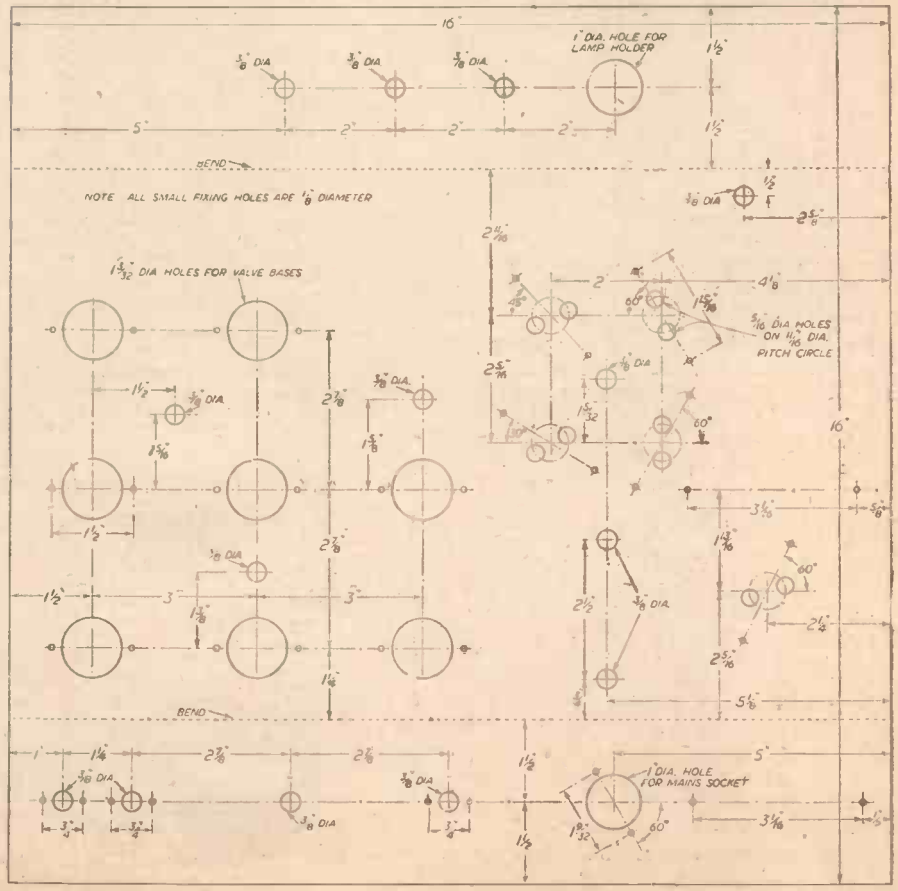
Rear view of the amplifier unit.

two of the valves are mounted on strips of rubber to avoid any microphonic troubles, and as these valves are of the miniature type this leaves ample clearance round the normal type of valve hole. The rubber actually used in the prototype was ¼in. thick strip as supplied for car floor mats and was cut 2½ in. by 1½in., with a hole to clear the B9A valveholder. The bolts holding these strips to the chassis must be provided with lock-nuts so that the rubber is not clamped too tightly and the "floating" effect on the valves thus lost. As there are chassis earth-return soldering tags attached to these bolts it is essential to see that the tag is locked solidly to the chassis but the rubber is not pulled tight.

When the chassis is drilled mount the components as shown, noting that an earthing tag is fitted to each of the valve-holders (with the exception of V8), as well as to two of the coaxial sockets on the rear chassis runner. The earth side of the components in each stage of both amplifiers is taken to a common point, which is the earthing tag referred to, and it is important to see that this is done. The draughtsman, in the wiring diagram, Fig. 8, has had to show them connected together, but separated from the earthing tag, in order that the drawing may be clear, but in the case of V2, for instance, the metal braiding of the lead from S1b and S1, and the ends of C9, R8, C4 are all taken to the tag to which R10 is shown connected. Other points in the diagram must be similarly treated, and this greatly assists in keeping the amplifiers stable. Note that R33, the small ¼ watt, 1 megohm resistor is mounted inside the screening cap which is fitted to the top of V6. It should have its end wires cut short and one end is joined to the lead connected to the centre contact and the other lead should be passed through the eyelet in the cap and soldered to the metal cap. The screening round the lead should also be soldered cleanly round the cap where it enters so that the grid connection is completely screened.

To assist in wiring up the switch a separate sketch is given in Fig. 5, and the leads to the signal lamp should be carefully chosen after looking inside the lamp and noting the position of the coloured filters. There are actually three colours and three contacts, and it is a simple matter to select the correct contacts for the colours which are used. A separate diagram of the valve pin connections of the different types of valve is also given in Fig. 7, whilst the colour code and connections of the special Bias and Erase Unit are shown in Fig. 6. There are two screened flexible leads on this component, and as will be seen from the wiring diagram one is joined to S1 whilst the

Fig. 3.—Drilling details of the chassis.



other is taken from the unit on top of the chassis up to the erase head. A grommet is fitted to a hole in the centre of the four electrolytic condensers and through this hole is passed a short length of twin flex, and a single lead which is connected to the common H.T. — point.

All details of the wiring are clearly shown in Fig. 8 and the usual precautions of using insulated sleeving over certain wires should be taken, and the maker's instructions concerning the colour code used on the mains transformer should be followed. A three-point mains connector is fitted so that a lead may be taken to earth to assist in keeping the unit quite hum-free and also as a safety measure. If, however, the power point to which the recorder is connected is of the two-point type, simply ignore the third

(*Continued on page 38*)

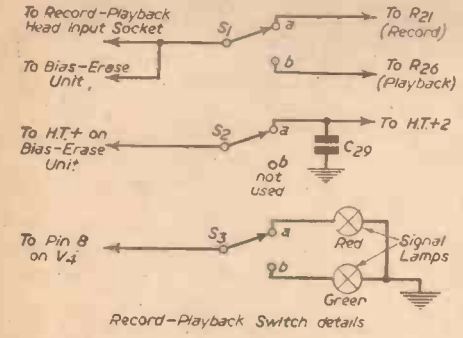


Fig. 5.—Details of wiring of the change-over switch.

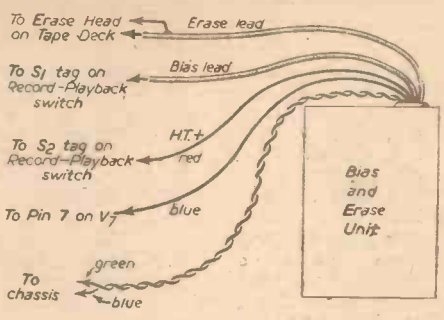


Fig. 6.—The Bias and Erase unit with details of the connections.

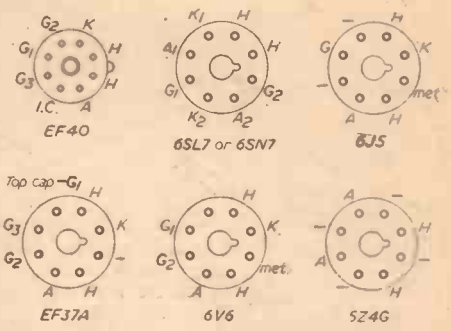


Fig. 7.—Valve-pin details of the various valves used in the Recorder.

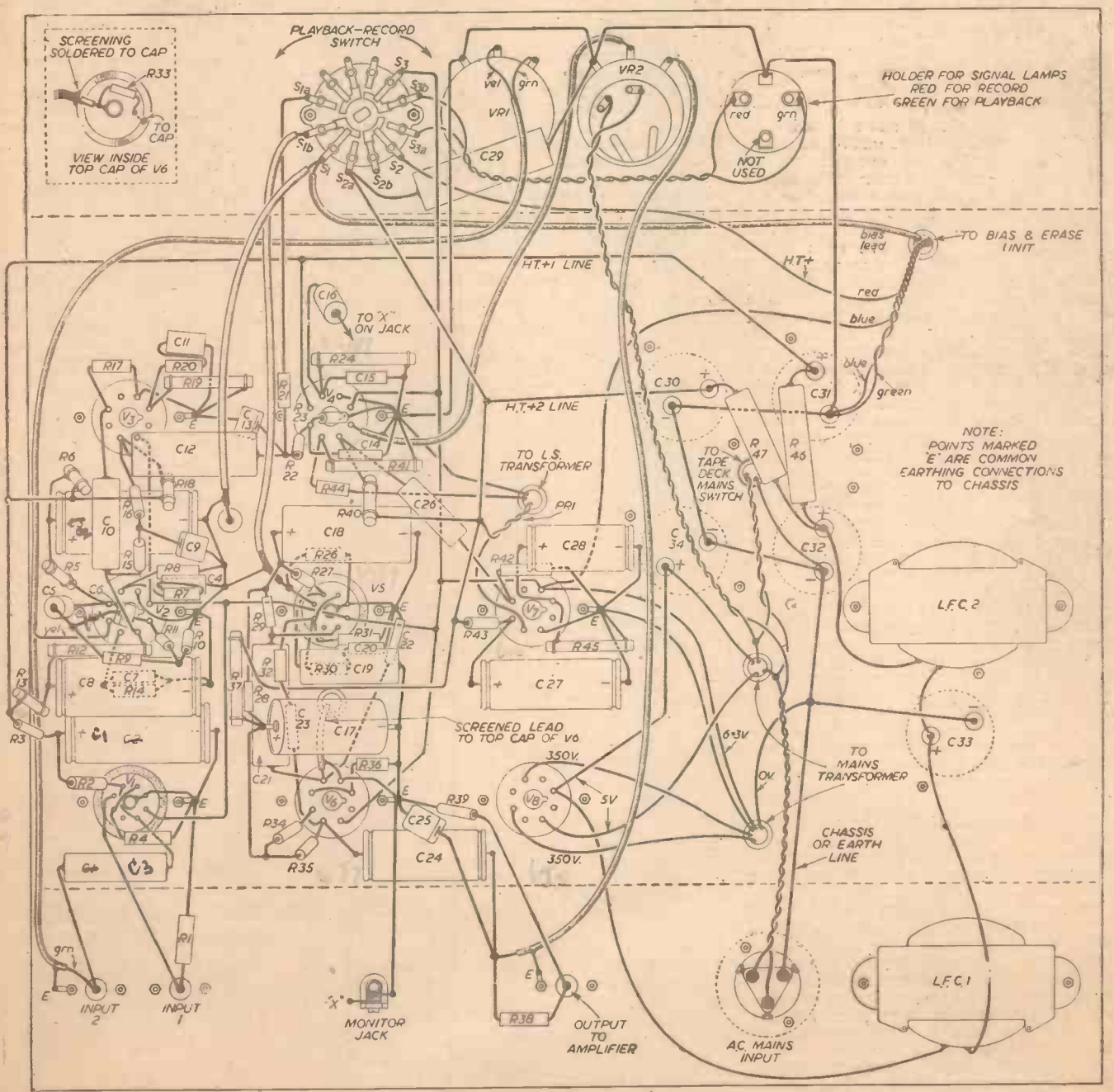


Fig. 8.—Detailed illustration of the wiring of the chassis. See text regarding the connections made to the various tags marked "E."

MAKING SMALL BOATS

A Novel Method of Making Miniature Lifeboats for Model Liners

By R. K. BATTSON

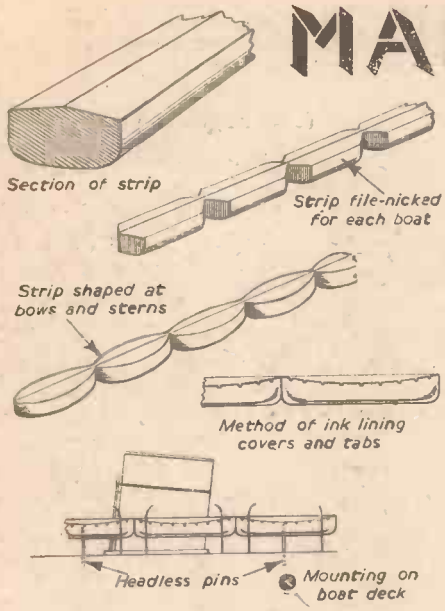


Fig. 1.—Boats for model liners.

ONE of the more tricky (and in some cases, tedious) jobs in ship modelling is the making of the small boats which every ship carries for one purpose or another. But really good boats are as important to the appearance of a model as any other part, and the following notes may be helpful.

The long rows of lifeboats on a miniature liner (there may be as many as sixty) can be easily, quickly, and really well represented in the following way. Prepare a stick of wood the width and depth of the boats, its length being that of the whole line. With a small plane, round the bottom edges of the strip, and form the top surface to a flat V, as in Fig 1. Next, mark off the length of each boat and, with a three-cornered file, cut nicks on each side at the marks, going nearly, but not quite through the strip at each point. Then, with sandpaper, shape the file-cuts into smoothly-rounded contours (do this delicately, because the nicked strip is now rather weak) so that there are no flats or angles anywhere.

Now paint the strip with at least three coats of white and, when dry, draw with a fine pen and Indian ink, the outline of the canvas covers with their securing tabs, preserving the sheerline of the gunwale, and showing the top strake as solid black between the tabs.

To mount the boats on the model insert three beheaded pins point upwards in the boat deck, and gently press the line of boats down on the pinpoints, fitting dummy davits of wire when the strip is in position. The sketches should make the job quite clear, and the result is extremely convincing.

Interior Detail

For larger models, where the desired boat may be two or three inches long, with proper interior detail, the following method is most effective; the essential tool is a fretsaw or machine with a tilting cutting table.

Take two pieces of wood, the length and breadth and, respectively, one-third and two-thirds the full depth of the boat (measured at the ends) and, on the thicker piece, draw first the plan of the boat, and another line 1/16in. inside and parallel to it. Setting the cutting table on a slight bevel, cut out the middle of the piece along this inner line, so that the sides are left thicker at the bottom than at the top (Fig. 2). Keep this cut-out piece for a moment.

Now sandpaper the inside of the cut dead smooth, and glue this piece to the other, or bottom, section. Place it under pressure in a vice, and leave till absolutely set.

Next, lay the whole thing on its side, and cut, first the sheerline, and then, with it flat, the plan, going as close to the inner edge as you can.

Temporarily replace the cut-out piece you have saved (without it the now thin sides would break-up) and, with plane and gouge, shape the outside of the boat in the ordinary way then smooth with sandpaper.

Next, the ribs, in stripwood or thin card, can be cut and glued in place, keeping them fairly closely-spaced, and when these are dry, two stringers, or longitudinal strips, each side, at gunwale and thwart level. Glue these with Durofix or "balsa cement," as they have to be held to the inner curve, and need to set quickly. Then cut and fit the thwarts, or seats, gluing them to the lower stringer each side; add knees, or brackets, of thin wood, and finish off the gunwale with a capping strip of card. You can get the right curve for this by using the cut-out piece as a pattern for the inner edge. Then, on the outside, cut and glue stripwood to represent stem and sternposts, and keel, making sure they all fit the curvature properly.

Painting

The now-finished boat can be painted or varnished as desired, and a neatly-coiled painter of thin cord (first passed through a little glue to make the coils stick) laid on the bow thwart. Rowlocks should *not* be in place, though the holes for them should be indicated, and as many oars as are required shaped up and laid inside.

This method of boat-making gives a much cleaner effect than any attempt at hollowing from solid (or even the well-known method of hollowing each half and gluing to a central keelpiece) and is much less risky to the hands, which can be severely gashed if, as often happens, the gouge should slip; it is also much easier. It applies equally well to either a double-ended boat or one with a flat transom, though in the latter case, the stern must be cut on a bevel, and delicately handled when rubbing down, as the end grain will be rather weak.

Clinker-built Boats

All the foregoing applies to carvel-built boats, *i.e.*, where the planking is laid edge to edge. If the plan you are using calls for clinker-built boats, with the planks overlapping, this is quite easily represented by proceeding as described, but before painting, covering the outside with narrow, shaped strips of stout cartridge paper. You will have to get the shape of each strip by trial and error (most of them look roughly like a banana) but start, of course, from the bottom, seeing that the first strip each side (called the garboard strake) butts nicely against the keel; and when you have got one strip to fit, use it as a pattern for cutting its opposite number. If you work this way, laying on one "plank" each side, you will keep the lines of the "planking" level when viewed from the ends. Stout cartridge paper is just about the scale thickness for a small boat, but keep the strips as narrow as possible, both from the point of view of scale appearance, and also because wide strips will not lie to the curve of the bilges. Use Durofix, which is colourless and clean-working, and the paper will then take any desired finish.

Carry out all the processes carefully, taking plenty of time (after all, modelmaking is *fun*, and the longer you take, the longer the fun lasts), and you will end up with model boats to be proud of.

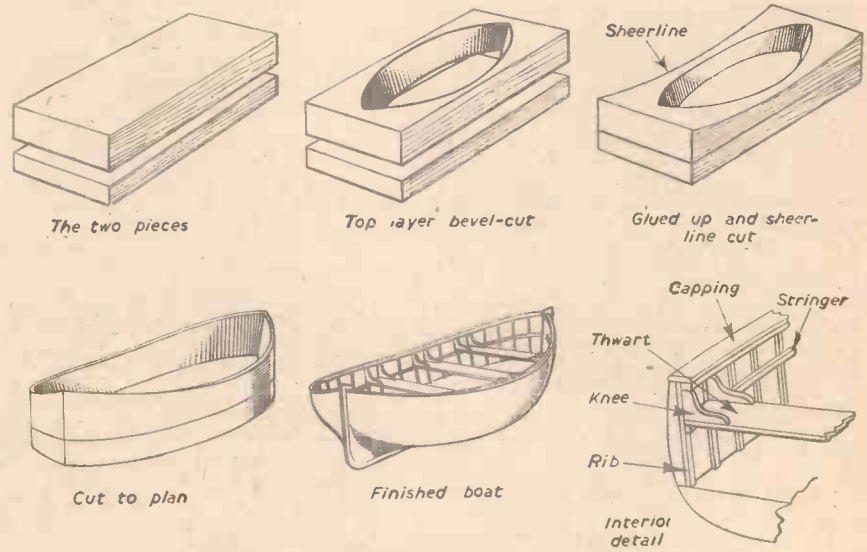


Fig. 2.—Various stages in the construction of fully-detailed boats.

CLOSE-UP PHOTOGRAPHY

How Enlarged Photographs of Various Subjects Can be Taken With Simple Apparatus

By F. G. RAYER

CLOSE-UP photos may be taken with any kind of camera, including the simplest box type, and open up a new field of interest. Coins, stamps, and other small objects can be photographed indoors, by natural or artificial light, while during the summer, flowers, insects, and many other subjects of interest will be found. No permanent changes of any kind need be made to the camera and the total cost, in most cases, will be extremely low. In view of this, it was thought that readers would be interested in some examples of how such photographs can be taken with simple and inexpensive apparatus.

Clip-on Additional Lens

The usual type of camera with focusing adjustment cannot be used with objects nearer than about three feet. The simplest way to get nearer objects into focus is to use an additional lens, which may be clipped in position in front of the existing lens. Such an arrangement is that illustrated in Fig. 1. Here a narrow strip of metal has been cut out and bent into a ring which will clip on to the front of the camera lens-mount. A few small projections, turned inwards, serve to prevent the additional lens slipping out at the front. This arrangement can be brought into use with the minimum of trouble, and is readily removed when ordinary photographs are to be taken.

Ranges from 9in. to 3ft.

The extra lens may be of almost any type, provided it is a positive (e.g.—magnifying) lens. The more powerful the lens the nearer to the camera must the object being photographed be. Photographic dealers can supply such lenses in many diameters, or old spectacle lenses or magnifying lenses of any kind can be used. Assuming that the camera ordinarily focuses from 3ft. to infinity, as is usual, a weak lens would change this from about 2ft. to 3ft. With a more powerful lens, a range of about 1ft. 3in. to 2ft. may be obtained, while an even more powerful lens would focus from about 9in. to 1ft. 3in. If a lens of about the same diameter as the lens-mount of the camera is obtained, fitting will be easier. Larger lenses may be ground down fairly easily with an emery wheel, as optical glass is soft. (Only the edges should be ground, of course.)

Determining Exact Focus

If some unknown lenses are to hand, or have been obtained, it will be necessary to see at exactly what distance the objects to be photographed must be. This can easily be done by removing the film from the camera and inserting in its place a strip of *thin* paper. With the usual camera taking 120 films, this strip will need to be about 2¼in. wide. The length is immaterial. The extra lens is then placed in position and the camera shutter set open as for a "Time" exposure. Objects may then be viewed on the paper, and the distance for sharp focus measured. A certain amount of focusing can also be done with the usual adjustment on the camera, but the distances marked here will not now apply. Having determined the correct distance from camera to object with the lens or lenses to be used, this can be measured off, when photographing, and the test would not need to be carried out again.

With reflex cameras, or cameras with a back focusing screen, the effect of the extra lens will be immediately seen. But with a roll-film camera with no such arrangement the foregoing test will be necessary. Ground glass, or a "fixed" plate, can be used instead of the paper.

(*Above*) *Minute blooms of the elder-flower. (Actual photo roughly* 100 *times natural size.)*

(*Left*) *Common house-fly that had impaled itself on cactus spine. (Actual photo roughly* 100 *times natural size.)*

With Box Cameras

This simple type of camera usually has no lens-mount to which a ring may be clipped, and no focusing arrangement (except in the better-class models). A simple method of securing the close-up lens in position is shown in Fig. 2. Three pieces of card are cut to the size of the front of the camera. One piece has a hole which will accommodate the lens; the other pieces have a somewhat smaller hole. A "sandwich" is formed, with the lens held between the pieces, and this can be held in front of the camera by passing elastic bands completly round the camera and assembly.

The distance at which objects should be is determined as already explained, and this simple method has been used with perfect success.

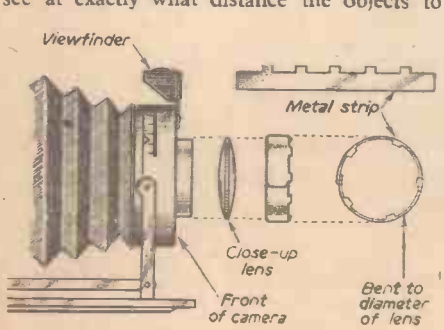


Fig. 1.—A push-on holder for close-up lens made from metal strip.

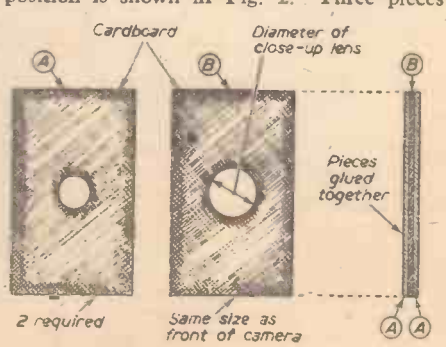


Fig. 2.—A simple fitment for box cameras shaped from cardboard.

With Increased Extension

Another method of photographing close-up objects is to increase the distance between the camera lens and film, no extra lens being used. This cannot be done with some types of camera; with others the lens may be unscrewed and an extension tube used, as shown in Fig. 3. For ordinary close-up shots this tube only needs to be very short—a tube about an inch long will enable objects up to within 1ft. or so to be photographed. (The exact result of adding such a tube will depend upon the focal length of the lens.) The distance may be determined as already explained, or, with the type of camera shown, the object itself will be seen on the reflex screen, so that the result of adding the tube is immediately apparent.

Using Cardboard Tube

Such tubes can be made without much difficulty, and are also stocked in various sizes by some dealers. A stout cardboard tube can be used, provided it is reasonably

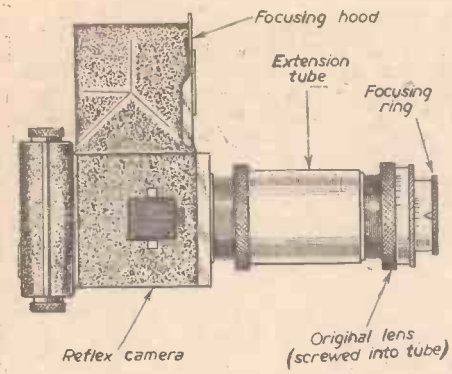


Fig. 3.—Using extension tubes for close-up shots.

well-made so that the lens is kept parallel to the front of the camera.

A close-up lens may be added in addition to the tube, thereby bringing the distance down to a few inches. When this is done, the photograph can be larger than natural size. The longer the tube, and the more powerful the additional lens, the larger will the image on the film become.

Exposure to Use

When using a close-up lens alone no increase in exposure is necessary. During bright summer weather, shots out-of-doors would require about 1/100th second at F8 aperture, with a 30° Sch. film. ("Selochrome" films are of such a speed.) This would need to be doubled during somewhat overcast weather, and doubled again (e.g., 1/25th second) during dull weather.

When using extension tubes some increase in exposure is necessary. Roughly 1½ times the normal exposure can be used for tubes about ¾in. to 1¼in. long, with double the exposure for tubes 1¼in. to 2in. long. Here, the exact figure depends upon the focal length of the lens, but is not critical. If desired, the user may work it out by measuring the length of the tube and noting what proportion this is to the distance

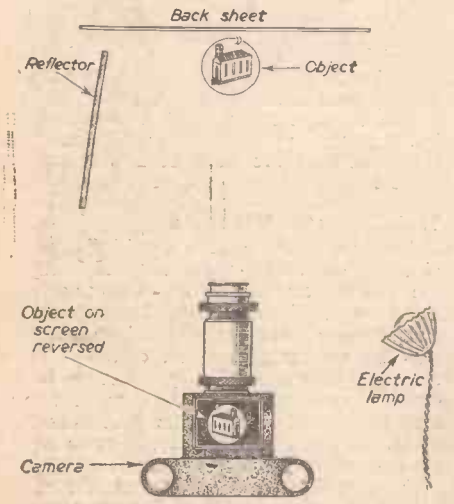


Fig. 4.—A useful lighting arrangement when taking photographs indoors.

between lens and film with the former in its usual position.

Indoor Photography

Indoor photographs by artificial light are particularly suitable during the darker evenings, and the arrangement shown in Fig. 4 is both simple and satisfactory. The back sheet may be cloth or paper. A dark sheet is best if the object is light; with a dark object a light background will throw it into relief. White paper can be used for the reflector; its purpose is to lighten the shadows on the side away from the lamp. Assuming that a 100 watt lamp is used, in a holder with reflector, then 1/5th second exposure at F8 would be correct, for normal subjects, with the lamp 1ft. from the subject and using 30° Sch. panchromatic film. For orthochromatic films the exposure should be doubled. If the lamp only has an ordinary type of shade the exposure should be doubled again. The light should be allowed to fall directly on the subject, but not upon the lens of the camera.

Subjects

These are numerous, and some have been suggested. Others include models of all kinds, copies of illustrations, pictures, and so on. There are also many natural-history subjects, and lighting and other conditions can be adjusted exactly according to the photographer's needs when the objects are photographed indoors. As a guide, the appended photographs serve to show what is possible, and to suggest subjects.

That of the fly was taken by daylight, indoors, extension tube and close-up lens being used together to obtain a large image. The elder-flowers were taken by artificial light, a close-up lens being used. The midget receiver was taken by daylight, no close-up lens being used, but an extension tube added as explained. There is scarcely any limit to the degree of magnification which may be obtained. It might be added, in conclusion, that the purchase of a camera for such photography may have come to the reader's mind. If so, a second-hand plate camera will be most suitable (excluding the more expensive film cameras).

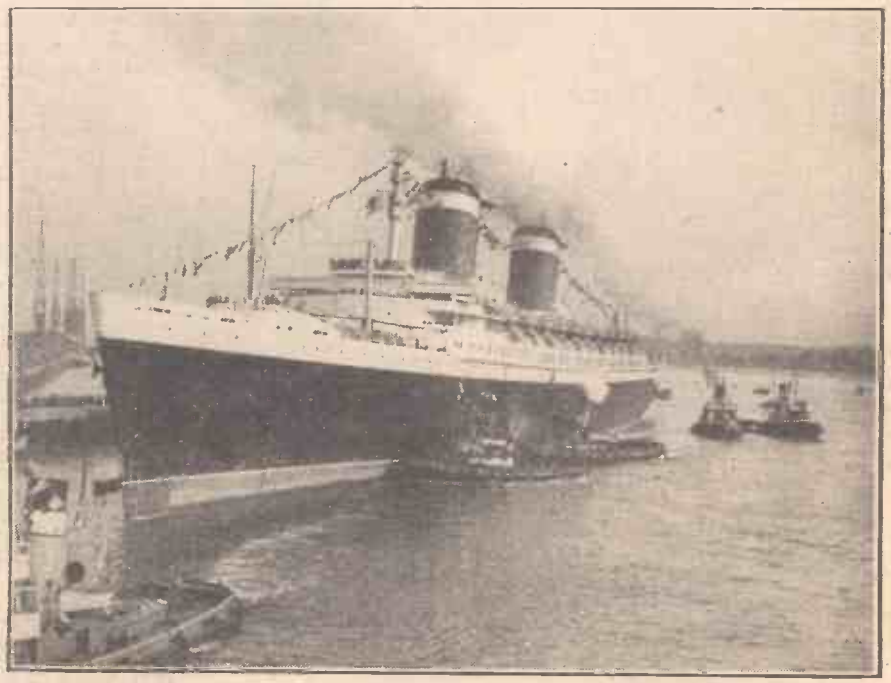
Using Plates

It will have a focusing screen, and such cameras may be obtained very readily and cheaply because the average person now prefers to use film. Plates (¼ plates—4¼in. x 3¼in.—are a useful size) can be purchased easily, and have the advantage that even one or two alone may be developed, whereas the whole spool needs to be used, with roll film, before the results can be seen. Storing and indexing is also simplified.

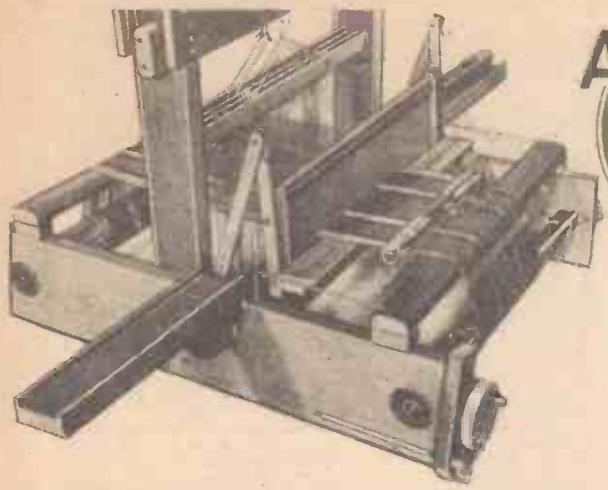
Another advantage in using plates is that they remain flat thus making printing so much easier.

Miniature 2-valve radio made by the writer shown in comparison with a matchbox. (The original photograph showed the set approximately full size.)

The New Liner "United States"



The new 53,000-ton U.S. liner "United States," the largest commercial vessel ever built in America, arrived at Southampton recently after crossing the Atlantic in record time on her maiden voyage. She completed the crossing from Ambrose Light to Bishop Rock in 3 days 10 hours 40 minutes at an average speed of 35.59 knots—10 hours 2 minutes faster than the "Queen Mary's" record of 1938.



A 15" FOUR HEDDLE HAND LOOM

Constructional Details of an Inexpensive and Efficient Weaving Machine for Home Use

By G. G. CRAWSHAW

(*Continued from page 408, September issue*)

THE reed unit is now mounted in a floating frame and this consists of two side pieces 12in. long, each let into the corner of a block 2¾in. × 1¾in. × ¾in. and firmly fixed thereto by two screws. (The lower corner of the block and attached side pieces must be rounded off for about ½in., as in Fig. 8.) A hole to accommodate a stout 1¾in. screw freely is drilled through the ends of the blocks opposite the side pieces about half an inch from the end and equidistant from the top and bottom edges. These two blocks are now joined by screwing on to the end faces a piece of wood 18in. × 1¾in. × ¾in., using two 1¼in. screws at each end.

A ¼in. hole is now drilled ½in. from the top end of all four side pieces and the reed frame hung in the outer frame by passing a ¼in. rod 18¼in. long through the four holes, placing a small plain washer between each pair of side pieces when doing so. Not more than five or six 4 BA threads should be cut on each end of the rod, and nuts are screwed tightly thereon to secure it in position. The object of having so few threads is to obviate the necessity of having an additional lock nut at each end.

Main Frame

We now come to the main frame of the loom which consists of two side members 25½in. × 5½in. × ¾in. (or 1in.). These pieces are joined together by the front and back bars of the loom and are also screwed to the heddle mounting frame by means of four stout screws each side, as previously mentioned. The position of this frame is about 13½in. from the front of the loom and about 9¾in. from the back. The front and back bars are 19¾in. × 1¾in. × ¾in. and are mounted on a ¾in. block by means of a 2½in. screw driven through both into the edge of the frame, the object being to raise the top edge of the bars 1½in. above the level of the frame. The screws must be very stout and well driven home. The bars are located 2in. from the ends of the loom, and the top edges should be rounded off and well smoothed down with fine sandpaper.

The holes for the rollers are cut centrally in the side pieces, the centres thereof being 1½in. from the ends. The rollers have been made from old blind rollers and are quite satisfactory. The plain disc at one end was retained, as it forms a good stop to prevent the roller from sliding out of its position; otherwise a disc of larger diameter than the roller must be screwed or glued on. The other end of the roller requires squaring off carefully to make it a good fit in the socket of the ratchet wheel which has to be screwed on to it. The rollers used are 1¾in. in diameter and the length between the inner face of the retaining disc and the ratchet wheel allows a clearance of ¼in. for free turning, and, similarly, the bearing holes must have a slight clearance for the same reason.

A dowel rod 17in. × ¼in. should have a ¼in. hole drilled through it 1in. from each end and a matching pair of holes also drilled through the roller which should allow the rod to be centrally placed when tied thereto by means of cords through the holes. Both rollers are treated similarly.

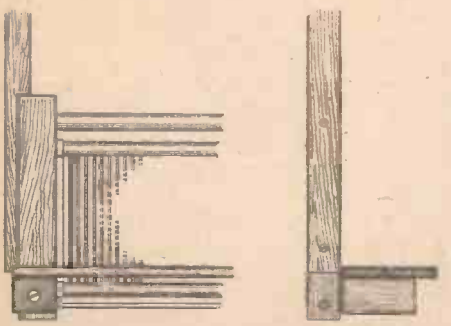
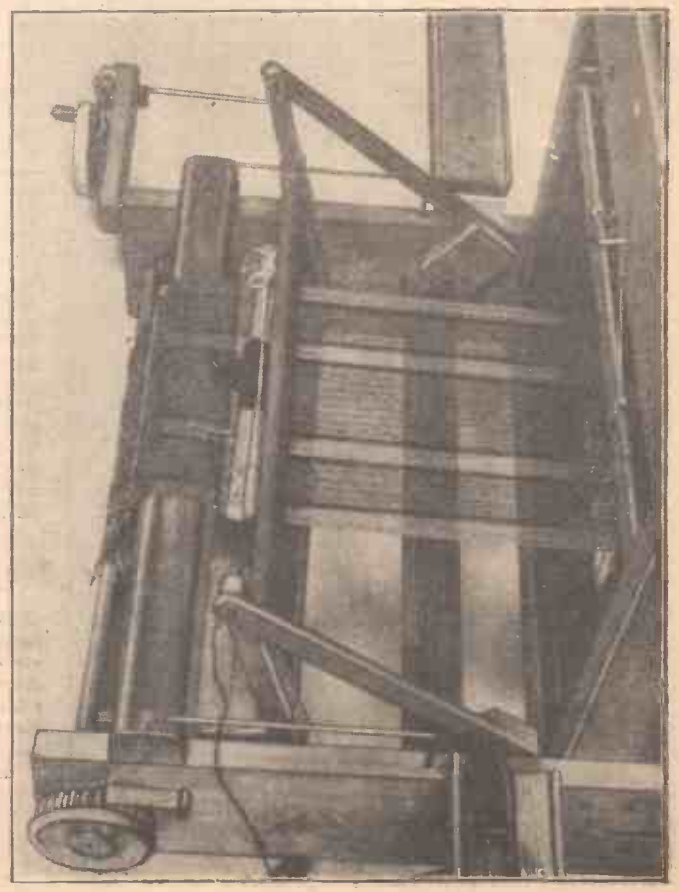
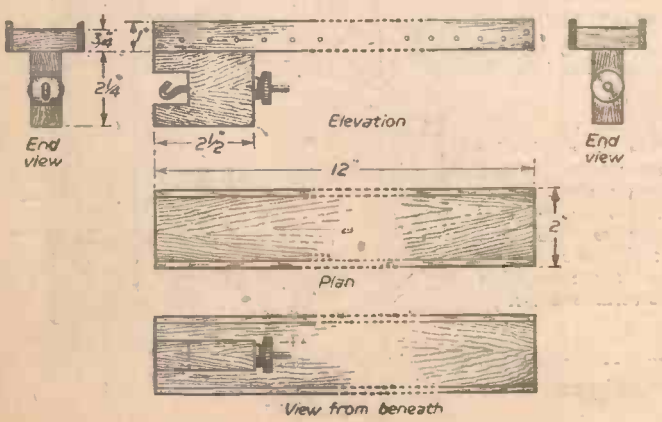


Fig. 9.—Showing the approximate position of the shuttle-race.

(Right) Showing the construction and placing of the reed mounting. The reed is in the fully forward position.



(Below) Fig. 10.—Elevations and plan views of the shuttle rests.



A ⅛in. hole 1in. deep should be drilled vertically in the top edge of each main frame side member 3½in. in front of the edge of the heddle frame box. Two 9½in. × ⅛in. steel rods should have a length of 2⅝in. bent at right angles at one end and ½in. at the other end. Push the longer end into the 1in. hole drilled to receive it and drill a ½in. × ⅛in. hole to receive the other end in the front bar in the place now indicated by its position. Drive in firmly, seeing that the rod is reasonably level, the purpose being to provide a rail to hold the trailing weft out of the way of the lower end of the reed and its form of shuttle race.

The loom should now be stood on end, front uppermost, and the reed assembly laid in position with the lower ends of the dents about ½in. below the level of the heald eyes, as previously mentioned. Make sure that the assembly is laid truly in position, then carefully mark the position of the bearing screw holes against the inside of the frame and make gimlet holes for the screws, which should be driven in firmly enough to keep each side of the mounting from rubbing on the inside of the loom frame, but not so tightly as to make it in the least stiff to swing backwards and forwards.

Shuttle Race

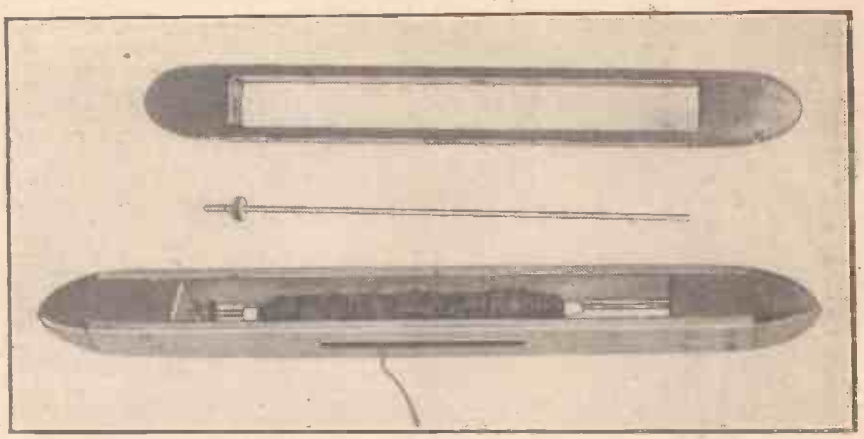
For this type of loom, two unusual, but invaluable accessories make their appearance; namely, a miniature shelf fixed on the front of the reed mounting to serve as a form of shuttle race; and a pair of detachable brackets, to be used as shuttle rests, and from which the shuttle may be slid directly across the loom as required, thus obviating the necessity of laying it down and picking it up again and manœuvring it into the correct position every time it is used—and that means every thread!

The "shuttle race" (Fig. 9) is made of two 17½in. lengths of lath mounted side by side, thus forming a single piece 17½in. × 2in. They are affixed to a block of wood at each end 1in. × 1in. × 1½in. by means of a number of panel pins driven in near the edges of the blocks, thus leaving the centre clear for a hole to be drilled to take a fine 1½in. screw. A good piece of wood should be used for these blocks or they may split easily. They should not be fitted until a few threads have been passed between the rollers, via the heddle eyes and through the reed, and then pulled fairly tight. With all the heddles in the lowest position, the race must just clear the threads when the reed is moved to its highest working position, which is about 3in. in front of the heddles. When fixing with fine 1¼in. screws, take care not to split the reed mounting. Carefully make suitable holes for the screws in order to minimise this risk.

The brackets, or shuttle rests, Fig. 10, are made from a piece of wood 12in. × 2½in. × ⅝in. along each edge of which a similar length of lath has been fixed with panel pins, thus forming a kind of shallow trough. Underneath one end of this is screwed a piece of wood flush with the end and at right angles to it, 2½in. × 3in. × ⅝in., to form a mounting bracket, from which is cut a gap 1in. × 1in., see Fig. 10. From end to end and situated exactly in the middle of the gap a ⅛in. clearance hole is drilled for a ⅛in. rod 3½in. long which has a hook turned at one end and the other threaded 4 BA for about 1in. A screw-eye is screwed into each side of the loom so that when the top of the bracket is level with the top edge of the shuttle race, and the inner face of the back rim just level with the front face of the reed mounting, the hook on the bracket may be engaged with the eye. If a 4 BA milled knob (such as those found on bell batteries with screw terminals) is used on the rod, it can be screwed up tight, which will pull the bracket firmly up to its position.

(Left) Side view showing heddle lever construction and mounting—one up and one down. (The hook on reed mounting is to hold weft threads which are not in use out of the way when using several shuttles.

(Right) Fig. 12.—Front and side view of the bobbin winder.



Details of a shuttle body, and a view of a finished shuttle.

Shuttles

A number of shuttles will be required, as it is upon these the weft thread is wound to enable a reasonable quantity of it to be passed expeditiously through the warp shed (the upper and lower layers of thread formed by lifting one or more heddles). A primitive form of shuttle can be made by cutting a U-shaped slot in each end of a warp stick. The thread is wound round the stick from end to end. The whole is then passed through the shed and the thread unwound as required. This is very cumbersome, but it is as well to have a few available as spares. The bobbin type of shuttle is far more convenient and about five times quicker to use; it is easy to make and well worth the slight extra trouble. At least two should be made, but each colour in any design needs its own shuttle. It has

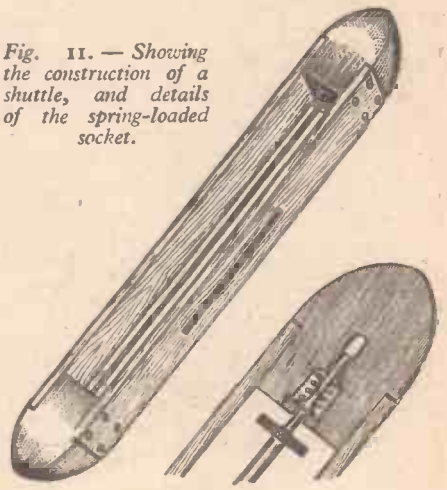
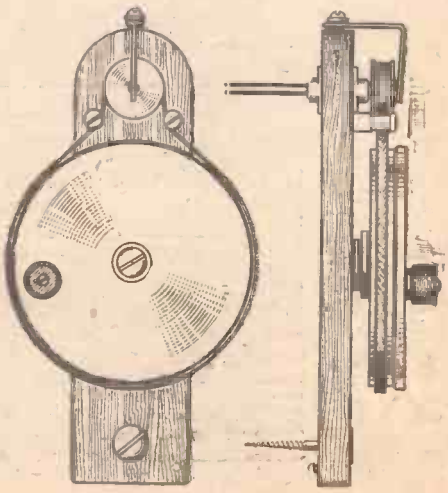


Fig. 11. — Showing the construction of a shuttle, and details of the spring-loaded socket.



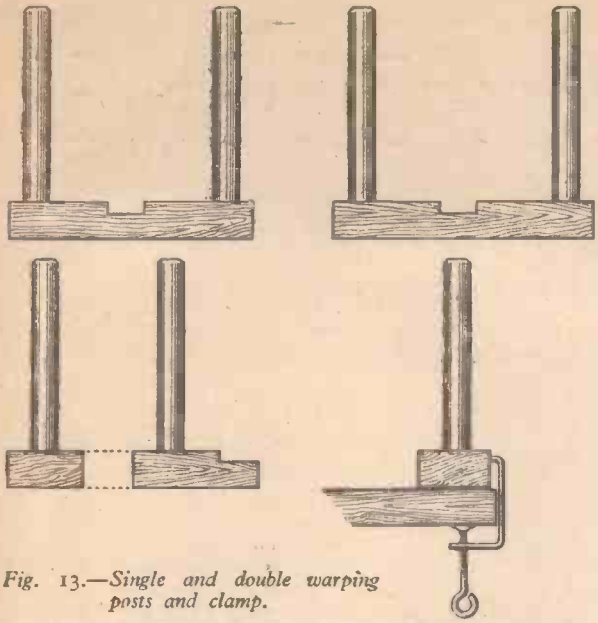


Fig. 13.—Single and double warping posts and clamp.

been found that these shuttles can be made for about 5d. each as against 10s. each, plus postage if they are purchased ready made.

A bobbin shuttle (Fig. 11) consists of a piece of wood, preferably a hard wood, 12in. × 1in. × 1⅛in. with pointed ends and has a slot in it, practically from end to end, about 8½in. × 1in. Down the centre of this slot is a ⅛in. steel spindle resting in sockets at each end, one of which has a spring-loaded pin in it to enable the spindle to be removed and replaced when required. The thread is wound on to a paper tube about 4in. long (on a bobbin winder). This bobbin of thread is then placed on the spindle in the shuttle and the end of the thread passed through a 4in. slot in the side of the shuttle. In practice it is much easier to assemble the shuttle from two separate end pieces and two separate side pieces, these being 1⅛in × 1⅛in. × 1in. and 10½in. × 1in. × 3/16in., respectively. Cut two rebates opposite each other at the end and on the narrower sides of each end piece 3/16in. deep by 1in. Into these the side pieces are screwed with four small screws at each end, the heads being carefully countersunk below the surface of the wood. Before any assembling is done the sockets for the spindle must be made. Each one can be made from any nut which will comfortably allow the ⅛in. spindle to slide through it. For one end drill a hole slightly smaller than the external diameter and only just the same depth as the nut, which may now be either hammered in level with the surface of the wood or squeezed in with a vice. At the other end a similar hole is drilled, but this time it is continued about half an inch deeper than the length of the nut.

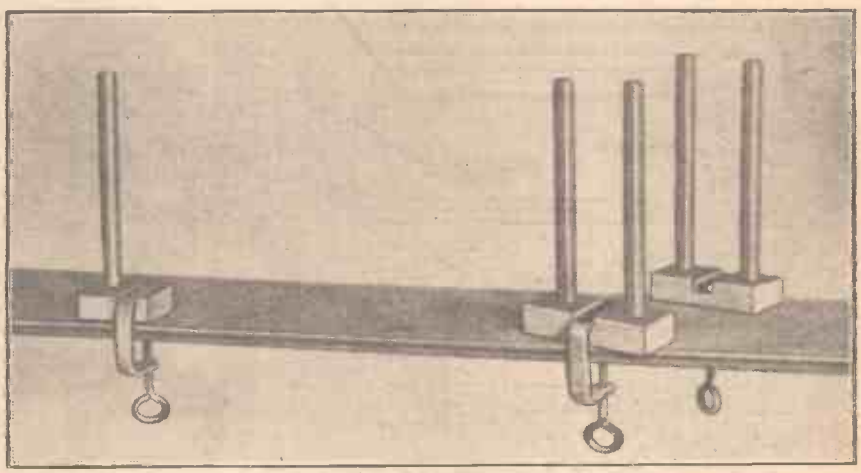
The hole is now extended another ⅛in. with a smaller drill which should just allow the free insertion of the shank of a rivet described below. It will be seen that if a rivet about ⅛in. long with a head larger than the hole in the nut, but just smaller than the upper part of the hole in the wood is placed therein with a ⅛in. spring under the head, a spring-loaded base to the socket is formed. The spring is made from 21 S.W.G. piano wire. In one of the side pieces of the shuttle a centrally placed slot 4in. long by ⅛in. wide is cut. The four pieces are now assembled and a ⅛in. steel rod of not less than 8⅛in. is cut for the spindle. It is best to cut this definitely oversize, finding out by experiment how far the spring-loaded pin can be pushed down, and cutting the rod just short enough to allow easy insertion of the other end in the plain socket. If the latter is, by chance, too deep and the rod goes slack when in position hammer a very small nail or boot brad into it until it leaves the hole just the right depth. The ends of the shuttle should now be sawn, planed and then sandpapered to a curved, pointed finish and the whole rubbed down with fine sandpaper until all surfaces are quite smooth, and then polished. It was found that a good finish was obtained by heating the wood in sections and brushing in dark tan boot polish. A good polish on the shuttles is essential or they will not slide freely when in use, and it may be necessary to repolish them occasionally. (The shuttle dimensions given are suitable for a 15in. loom, but for a 32in. loom they should be about 13in. × 1⅛in. × 1⅛in. in view of the larger amount of thread used.) About 3/16in. of one end of the spindle should be threaded 4 BA and another of the bell battery terminals screwed tightly thereon—to enable it to be removed easily—after which the threads below the terminal should, for convenience, be filed smooth. If a 4 BA nut has to be used instead of the wider terminal top a washer should be placed between it and the bobbin to prevent the end of the latter from being damaged by the sharp edges of the nut.

Bobbin Winder

A bobbin winder is essential as it is quite impossible to wind the bobbins of thread by hand. If one is purchased ready made, it will cost about £2. However, a most serviceable one has been made for a few pence—the cost of a ⅛in. steel rod about 8in. long—the rest being scrap material. A boot polish tin 2⅜in. in diameter and ⅛in. thick has a hole bored exactly through the middle of both the lid and base which must just fit a 1⅛in. screw which fixes it 2½in. from the lower end of a piece of wood approximately 6in. × 1½in. × 3in., washers being placed between it and the wood to enable it to turn freely. At a distance of 2½in. up from this fixing screw a ⅛in. hole is drilled to take the rod, ⅜in. of which was threaded—any thread. A ⅜in. diameter × ⅜in. hardwood pulley was turned with substantial flanges and a flat based groove 7/32in. wide and with a central hole slightly less than ⅛in. diameter (Fig. 12).

This pulley was then screwed straight on to the threaded end of the rod which was then passed through the hole in the top of the wood mounting, washers, etc., amounting to at least ⅛in. being placed under the pulley to hold it out and directly over the larger driving "pulley"—or polish tin. The driving band is the rubber ring from a 2lb. preserving jar, and the rod and pulley are kept in position by a piece of bent rod screwed to the top of the mounting at one end and bearing lightly on the centre of the pulley at the other end. Two little subsidiary jockey pulleys were cut from ⅜in. lengths of cane and mounted by means of 1½in. screws so as to rest against the driving band, keeping it in position. Owing to the overhang of the small pulley, it was thought advisable to mount a ⅛in. thick piece of brass on the mounting and to drill right through that and the wood to form a bearing for the rod. A 2½in. piece of paper 5in. wide at the base and tapering to a point is gummed and wound tightly on to the rod, so as to form a slightly tapering shaft from which the bobbin may easily be removed. This winder is now screwed fairly firmly to the front end of the left hand side of the loom, and a ⅛in. from the top edge by means of a 2in. screw which passes through the base of the bobbin mounting ⅜in. from the end. In the bottom left hand corner of the mounting (viewed from the back) and on the same side as the loom a round-headed ⅛in. screw is driven in 3/16in. from the corner and is left projecting to form a stop. It will be found that the winder may be turned upright for use, where it will be held by the stop, or turned down against the left hand side of the loom out of the way when not required.

To wind a bobbin, a piece of paper about 4in. × 4in., with rounded corners, is wound on the rod to form a tube on which the thread is wound from end to end until a roll the required thickness to fit a shuttle has been completed. It will be found that this slips off the rod quite easily. Do not attempt to wind too many threads at the ends of the bobbin, or they will slip off and cause a lot of trouble all round.



Warping posts, which can be used on a table, shown correctly mounted on a suitable board.

Warping Posts

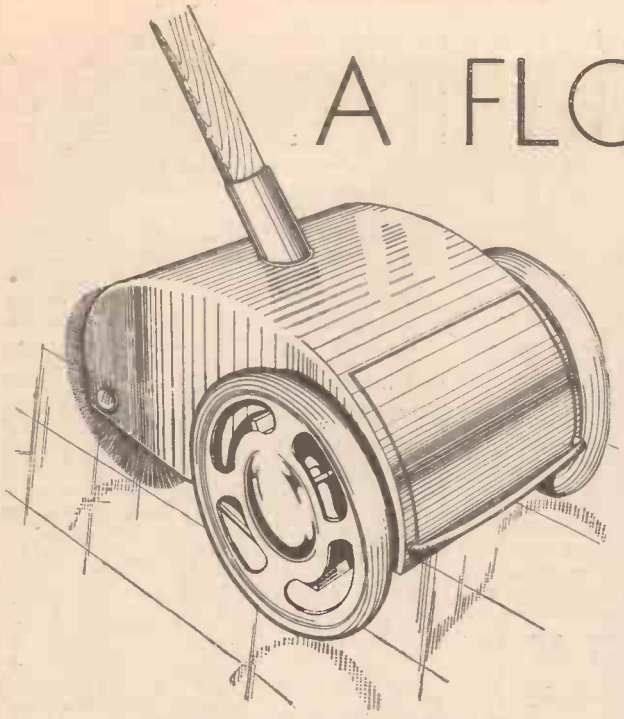
Another item of equipment is a set of warping posts which may be fixed on to a table by means of simple screw clamps. For warps longer than about double the width of the table available, an extra post, or posts, should be provided, or the set of three may be mounted on a board which is at least half the length of the proposed warp.

These posts are expensive to buy, but merely consist of two pairs of ⅛in. or ⅜in. × 6in. dowel rod mounted in two blocks of wood and a similar single one so mounted, plus the relative number of screw clamps to hold them to the table, etc. The illustrations (Fig. 13) make the construction quite clear.

(To be concluded)

A FLOOR POLISHER

This Design, Submitted by Mr. W. E. Davies, Won First Prize in Section 2 of Our Recent £200 Free-for-all Competition



General view of the floor polisher.

THIS device is a machine for applying polish and doing all the work of polishing floors, apart from the final shine, which can best be done by a dry mop. The machine consists of two rubber-tyred wheels fixed on an axle to which are also fixed two vee-pulleys, four blades arranged at right-angles, a polish tray suspended from the bearing housings by adjustable stays, and provided with screwed sleeves and spindles operated by ratchet wheels, actuated by pins driven into the sides of the driving wheels, so that each quarter of a revolution of the driving axle slightly raises the level of the polish tray. The tubular metal framework to which are welded the bearing housings, extends across the machine at the top, and in the centre is a socket for a broom handle. The supports extend to the rear and carry the rotary brush and its bearings, as shown in Fig. 2.

Construction

Most of the constructional details are explained by the illustrations, Figs. 1 and 2, except, perhaps, the arrangement of the driving axle and tray-raising device. Centrally mounted on the radial arms, which are secured to the axle by welding, are the four polish blades. Screwed into the inside faces of the two driving wheels are four short, steel pins which engage with two twelve-toothed sprocket wheels to each of which is connected a spindle with a ¼in. B.S.F. thread, which screws into ¼in. B.S.F. internally threaded sleeves, fixed to the ends of the polish tray. The polish tray frame is steadied at each corner by adjustable stays, as shown in Figs 1 and 2.

Wheels and Axles

The wheels and axles could, if necessary, be made up from old pram wheels keyed to the axle. The vee-pulleys, belts, ratchet gears and bearings are best purchased. Polish blades, supporting arms and adjustable stays can be made from ⅛in. m/s strip, and the cover from 22 s.w.g. sheet. Bearing housings are best turned from bar to suit the bearings used.

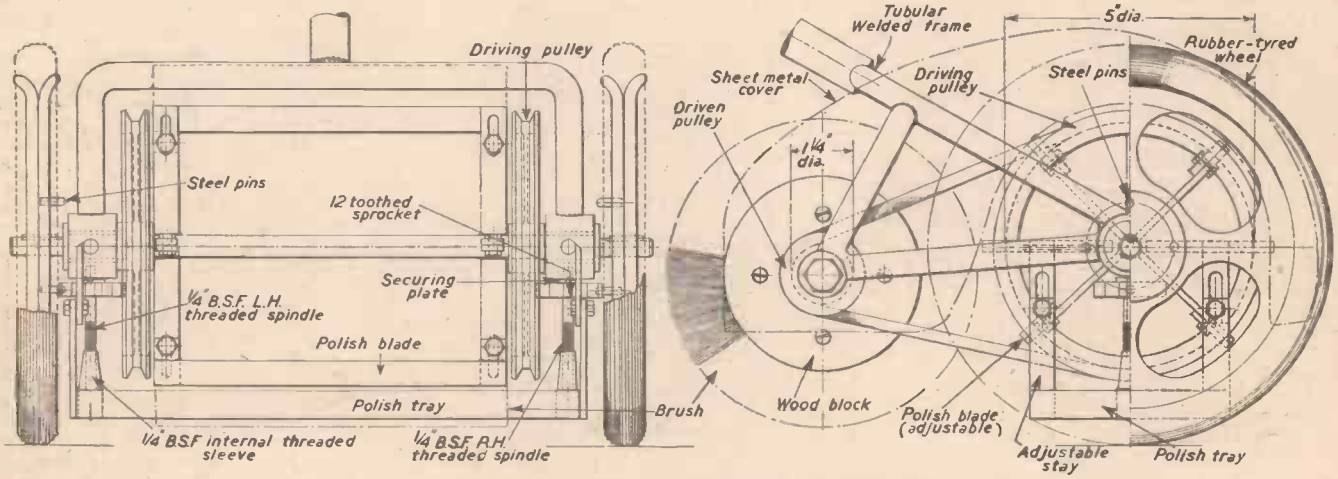
For the framework any weldable tube of light gauge, such as old cycle frames, could be used with care; the centre-piece should be of a size to suit the handle available.

Operation

With the polish tray supplied with polish and the tray set to the correct level, hold the handle and push away as in sweeping. The vee-belt will drive the rotary brush at the ratio of 4:1, and the polish blades in rotating dip into the polish and apply it to the rotating brush, which, due to the difference in speed ratio, takes on the polish over a wide area, and brushes it into the floor.

Driving Pins

The pins on the driving wheels move one tooth of the ratchet wheel as each blade passes over the polish tray. On the return stroke the ratchet "free wheels" so that the level of the polish tray will not be altered. When required for buffing the polish tray may be removed.



Figs. 1 and 2. Part sectional front and side views of the completed floor polisher.

Lead Glazing

With Particular Reference to Stained Glass Windows

By E. W. TWINING

DESPITE the broad scope implied by the title of this article it is not the whole of the operations and processes of leading up glass with which it is proposed to deal, but only one or two unusual features which are occasionally met with and these, more particularly, in connection with stained and painted windows.

As all glaziers know, the stained glass artist and designer often calls for glasses of greatly varying thicknesses, which are used solely to obtain certain effects, in either texture or colour, or a combination of the two, and the discriminating artist will always, himself, select each individual piece of glass. It is then the glazier's job to cut it and, after it is painted and fired, to lead it up.

Now certain fastidious artists not only are lovers of Norman slab glass but they like to double-plate certain portions of their windows and even to double-plate with Norman slab. The beauty of a window so treated is enhanced to an infinite degree and well repays the designer for the extra work which it entails for his glazier.

This use of Norman slab and double-plating sets up mechanical difficulties, if ordinary milled leads are used for glazing, because of the great differences in thicknesses of adjoining glasses, the thick and the thin both have to go on opposite sides of the heart, into the same lead, and the heart of that lead must obviously be deep enough to take the maximum thickness of the thicker glass; but since that maximum extends often for a short distance only, due to the fact that a slab varies in thickness between ⅛in. and ¼in., the usual method of dealing with the difference is to divide the heart of the lead where it is required to be spread, as shown in the cross section in Fig. 1. If, where I have put "antique," there should happen to come a cross lead at right angles to the divided one—which cross lead I have drawn and marked: "C.L."—then some special means would have to be contrived for soldering up that cross lead to the upper half of the divided lead. Many glaziers would, I suppose, lift the antique glass and slide the cross lead in to the divided heart and then depend upon getting such a blob of solder in as will connect up the cross lead to the upper part of the divided lead, but at best it is a poor and clumsy job.

Another orthodox method of dealing with great differences in glass thicknesses is by using a lead which is deep enough in the heart to embrace the thicker glass, without any dividing of the heart, but this also is crude and a mere makeshift and it leaves the thinner glass with nothing to support it but a deep filling of soft cement, as is the case in Fig. 1.

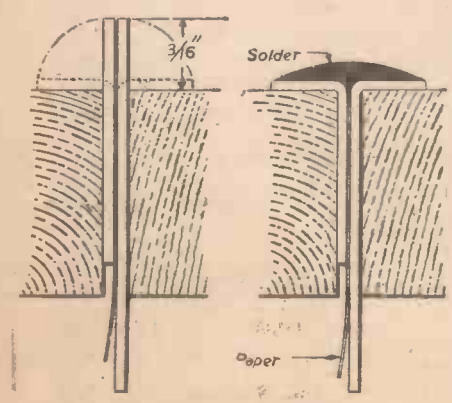


Fig. 4.—Forming special deep leads.

A New Method

In Fig. 2 is drawn a cross section of a junction between glasses which I think the skilled glazier will admit is far neater and mechanically more efficient than any of the recognised methods. I, myself, first used it over 20 years ago. It is capable of accommodating itself to any thickness and all the variations in thickness, including the undulations in slab glass. The leaf which is shown turned over on to the slab can not only follow the undulations but the whole lead can be bent to follow the shapes of the glasses in accordance with the cut line, just as does the milled lead.

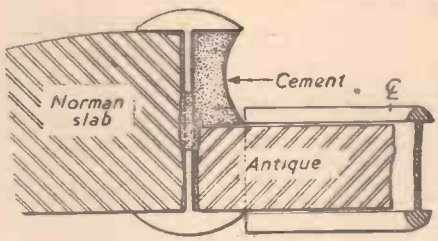


Fig. 1.—One orthodox method : divided heart.

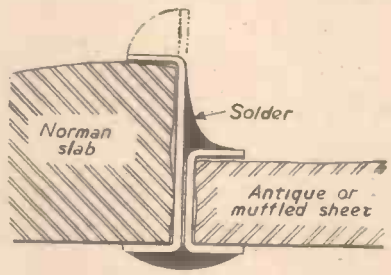


Fig. 2.—Leading up thick and thin glass.

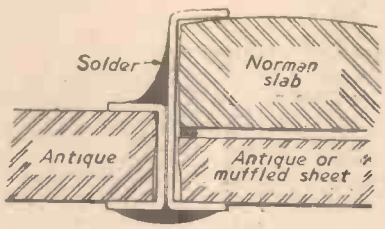


Fig. 3.—Method of double plating.

Fig. 3 shows the application of the same principle to double plating. Here is shown a little item which I consider is very necessary in plating, i.e., a line of something soft between the glasses to serve the double purpose of acting as a cushion and to prevent the possibility of cement being forced into the inter-glass space. The cushion which I have generally used is a piece of ordinary cotton string which is first impregnated with cement paint and then allowed to partially dry before being placed on the first, or lower, glass, sufficiently far into the angle to be hidden by the leaves of the lead.

It will be understood that the fillet marked "solder" in Figs. 2 and 3 is added after leading up is completed, when the whole light or panel is being soldered.

Making Special Leads

The special leads shown are, as I have indicated, not milled but fabricated from two straight strips of ordinary sheet lead having a thickness of a little less than 1/16in. These are cleaned bright with, say, a scratch brush and clamped with a strip of paper between them, between two pieces of wood, the edges of which are planed straight, as shown on the left of Fig. 4. The 3/16in. leaves are then turned sharply over on to the wood and a good half-round line of solder run along, as on the right of Fig. 4. The object of the paper is to prevent the solder from flowing down too far between the strips, so the paper should, therefore, come to 5/16in. or ⅜in. below the upper edges of the leads before bending over. After soldering the paper is pulled out.

When leading up, the bead of solder shown in Fig. 4 is laid downward on the cut-line. If this lead were used for slab glass, or double plating on both sides of its heart, the two strips of sheet lead would have to be of equal width. Where they are shown unequal, in Fig. 4, they are intended for unequal thicknesses of glass, as in Figs. 2 and 3.

Joints in Panels at Make-offs

Different glaziers use differing methods of finishing at the make-off at the tops and bottoms of panels and of the way in which an upper panel fits over a lower one at a saddle bar. A very common one is shown, together with a tie wire, in Fig. 5, where both of the leaves of the lower lead are folded flat, down on the heart. This is very good mechanically, it certainly stiffens the edge of the lower panel, but such stiffening is quite unnecessary because the tie wires and saddle bar will take care of rigidity. There is this objection to folding over the leaves: it increases the total depth of the whole joint—if ½in. leads are being used at make-off—to as much as 11/16in. at least; an amount which is greatly in excess of the diameter of the saddle bar. If ½in. bars are used to cross the light where there are no make-offs then these wider bands of dark, at the make-off, will disfigure the window, for they will definitely show where the joints come.

In my opinion it is much better to cut

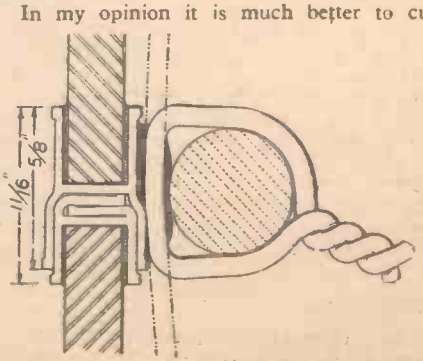


Fig. 5.—An orthodox make-off joint and wire tie.

away the leaves from the lower lead and let the upper one saddle over it as drawn in Fig. 6. By this means the total depth of the joint is only 1/32in. in excess of the saddle bar diameter, and this can be reduced by using the main portion of a 7/16in. lead on the lower panel instead of ½in.

Tie Wires

The tie sketched in Fig. 5, notwithstanding all its faults, to say nothing of its failings, has been used from the earliest ages of stained glass work and is still used with conservative persistency. Its failings are: that being a single wire, and straight when soldered to the lead, it, after a time, breaks away from the solder and this breaking, or tearing, is often commenced when the wire is first bent around the saddle bar. Then, again, the twisting together of the two ends puts torsional stresses in the wire, at the commencement of the twist, which weakens it very considerably.

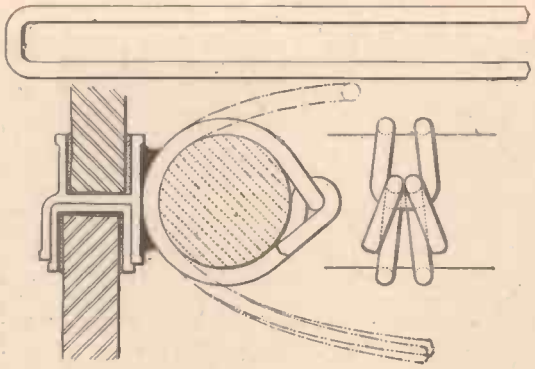


Fig. 6.—Proposed new make-off joint and tie wire.

I have examined windows, which had been installed perhaps fifty years and over, in which one half of the wires were either broken at the twist or, more frequently, torn away from the solder on the lead.

A far more reliable kind of tie is that shown in Fig. 6, where the wire is doubled into the form of a hairpin; this is soldered by both legs of the pin to the lead, after bending to the curve of the saddle bar, not put on straight and then bent. When the window is being fixed, the two free ends of wire are laid up over the bar, the loop brought down over them and then the ends are pulled through, bent sharply and tucked down on to the bar; any excess can be cut off. As a tie it is much neater than the old form, there is no torsional stress in the copper and there are two wires in the solder instead of only one. These features make it at least 50 per cent. stronger.

Hammered Metalwork

Making Small Plates and Trays

By H. C. PIGGIN

IT should be emphasised that the production of a true flat surface is possibly the most difficult of all hammered metalwork techniques, so that the making of a plate or small tray is no light task, and its successful accomplishment may be regarded with some pride by the amateur coppersmith!

The plate or small tray is sunk on the edge of a hardwood block held in the vice (Fig. 1). Two concentric circles as far apart as the required depth of the plate may be scribed lightly on the disc of metal so as to guide the fall of the hammer. Two large nails set in the block on which the sinking is done will provide a handy means of locating the disc accurately so as to keep the width of the rim as even as possible.

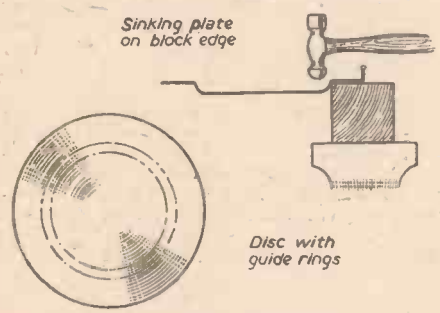


Fig. 1.—Shaping the blank.

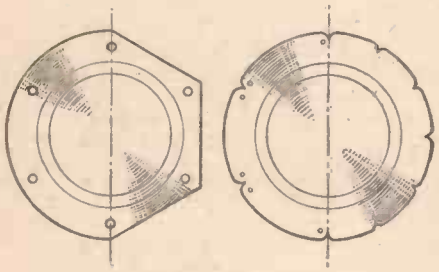


Fig. 3.—Edge treatments.

With the disc held firmly in position on the block, the ball end of the hammer is used to beat down the metal. The small depressions resulting from each blow should overlap slightly, the disc being rotated a little at each stroke.

After each round of "sinking" it will be found that the rim and bottom of the plate are buckled, and these must be trued-up before making the plate any deeper. Place it right way up on a flat surface, and tap over the bottom with a flat mallet. With the plate upside down, correct the rim similarly. Anneal the work as required, i.e., as soon as the metal becomes so hard that the hammer has little effect on it.

Check that the inner edge of the rim maintains a true circle, by spinning the dividers from the centre point of the bottom and noting that the radius is true all the way round.

Planishing

When the required depth has been reached the plate is planished as follows:—

The bottom is best done on a surface of at least the same size (e.g., an iron surface plate), but if great care is used a large bottom stake will do (Fig. 2). With pencil-rings to guide you, planish with a flat-face hammer, starting *lightly* from the centre and working outwards to the curve of the side with *increasing strength of blows*.

The curve of the side can be planished over a suitably-sized stake such as a poker-knob, or ball-peen hammer.

To planish the sharp inner corner between the rim and the side, hold the plate vertically with this corner on the edge of a bottom-stake. Strike with a large ball-peen hammer and slowly rotate the plate. When the inside of the corner is planished, hold the plate horizontally with the rim flat upon the bottom-stake, and the inner-corner well up to the stake edge. Planish the rim flat. Make sure that the plate is truly round and the corner set square.

To true the plate finally to size, scribe the required circumference from the centre point, checking that both rim-corner and rim-edge will be concentric. Cut and file the edge as necessary.

The plate is now ready for any of the countless decorative treatments of the flat rim or edge which will suggest themselves, and which may be carried out easily with file and punches (Fig. 3).

Fig. 4.—A wooden mould for small work.

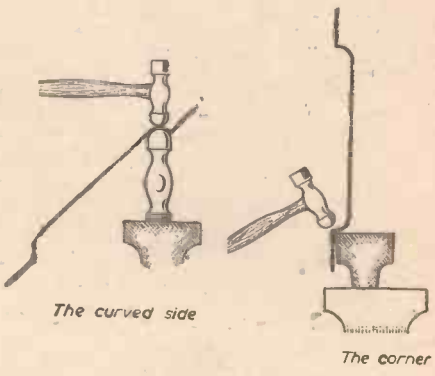


Fig. 2.—Planishing.

Making Small Plates

Small plates or trays up to about 3in. internal diameter can be more easily made as follows. Gouge out a block of hardwood to the depth and size of the plate (Fig. 4). See that the bottom of the recess is level and smooth. Take a suitably sized piece of annealed metal, place it over the block so as to cover the recess, and carefully hammer it down. Anneal it as required and continue to drive it down carefully until it fits the wooden "mould." As with the "sinking" of larger work, make sure that the rim remains flat and does not buckle. Planish and true the work in the order described for larger work.

Such small plates are extremely quick to produce. The mould can be so shaped as to include small recesses radially across the rim, as are quite often found on ash-trays.

Making Concrete Paths

How to Prepare the Ground and the Concrete Mix

By W. P. MATTHEW

THE laying of a concrete path is not a complicated business, but there are certain conditions to be observed if the path is to be durable. One sees so many paths which in a comparatively short time have cracked and crumbled that it is obvious that these essential conditions are not always complied with.

Siting the Path

First decide on the site of the path in relation to the garden plot. The path will be a permanent feature, and if wrongly placed in the first instance it may be a permanent nuisance. Sited directly down the centre of the plot it may leave insufficient room on either side for a well proportioned lawn, as well as giving an impression of undue regularity and formality. On the other hand, in most cases the path is used by the housewife when hanging washing on the line, and if it is sited too far to the side the clothes may blow on to the fence.

Paths should preferably lead directly to some feature which forms a strong focal point. It may be a summer house, a pool, or a bird bath and feeding table, but in any case the path should not merely trail out indeterminately.

The lay of the land, too, should be studied. On a gently falling site the path may be laid to follow the slope of the ground, but if the fall is steep it will probably be better to run level sections of the path, say, 15 or 20ft. long, breaking each section with a step. This in itself will lend interest to the path as a garden feature and will be well worth the effort of excavating the soil where necessary.

Preparation of the Ground

Having sited the path, define the site with pegs and string or a garden line, and remove the turf and any loose surface soil. On loose, soft ground ram in stone, broken brick, clinker, and so on, to form a solid base. On firm, heavy ground this is generally not necessary, and a sufficiently firm foundation may be formed by rolling, or even beating with the flat of a spade.

Formwork

The formwork for a straightforward concrete path is very simple. Boards are laid along each side of the site of a width equal to the thickness of the path. In the case of paths of up to 3ft. wide on a solid foundation, 2in. of thickness is ample. Wider paths and those on loose, soft ground should be 3in. thick to avoid subsequent cracking, and drives which have to withstand the weight of cars should be at least 4in. thick.

The side boards are held in place by stout pegs driven firmly into the ground on the outside of the boards (see Fig. 1). Cross-pieces are then fixed at about 5ft. intervals. These can be of ½in. thickness, in which case they are left in after the path is laid, or they may be stouter boards which are removed as laying proceeds. If the cross-pieces are to remain, the laying of the concrete is done continuously from bay to bay, but if they are to be removed alternate bays are laid; the cross-pieces are removed when the concrete has set and the intermediate bays then filled. Cross joints, made by either method, are necessary to prevent risk of subsequent contraction cracks, or warping of the slab due to expansion. To economise in timber, 20ft. of the formwork may be fixed at a time and moved on when the first section is laid and set.

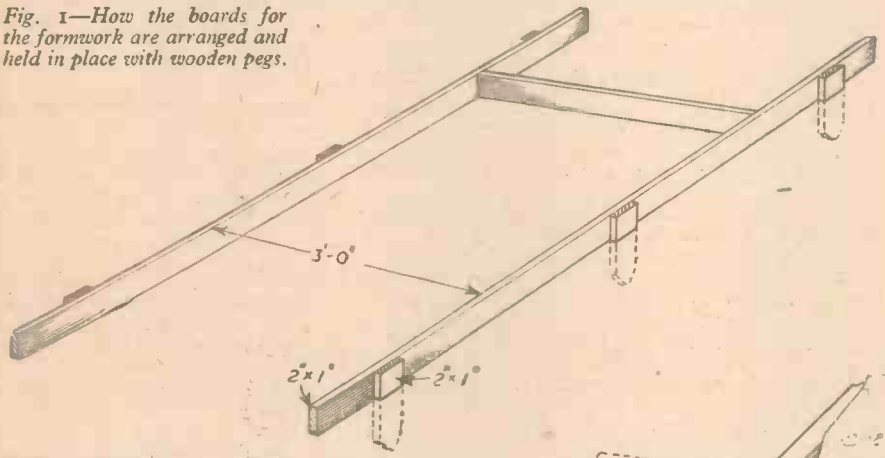


Fig. 1—How the boards for the formwork are arranged and held in place with wooden pegs.

The Correct Concrete Mix

For work of this nature there are two alternative mixes. The first, known as the "one-two-three" mix, consists of one part cement, two parts sand and three parts shingle. The other is of one part cement to four parts of mixed ballast. Shingle is usually easily obtained at builders' yards. Mixed ballast should be graded from about 1½in. down; that means that the largest stones are not more than 1½in. in diameter. If a few larger stones are present they should be removed when mixing for paths of 3in. thickness or less.

Quantities

As a rough guide to the quantities required it may be calculated that, for a path 90ft. long and 3ft. wide and 2in. thick, you will require 9 cwt. cement, 1 cu. yd. of sand and 1½ cu. yd. of shingle, using the one-two-three mix. If using mixed ballast you would, of course, need 2½ yd. of ballast and 9 cwt. of cement. These quantities are calculated to the nearest cwt. of cement and the nearest ½ cu. yd. of aggregate, and are on the generous side.

Mixing the Concrete

The concrete must be mixed on a clean surface, and a swept area of paving or concrete is ideal. Measure the quantities accurately, and an ordinary bucket is convenient for this. For one bucket of cement, two of sand and three of shingle you will need a little over half a bucket of water to produce a usable mix.

Spread the measured quantity of aggregate in a flat heap. Aggregate, by the way, means the coarse part of the mix—the sand and shingle or the ballast. Now spread the cement evenly over the heap. The whole is then thoroughly mixed by being turned over

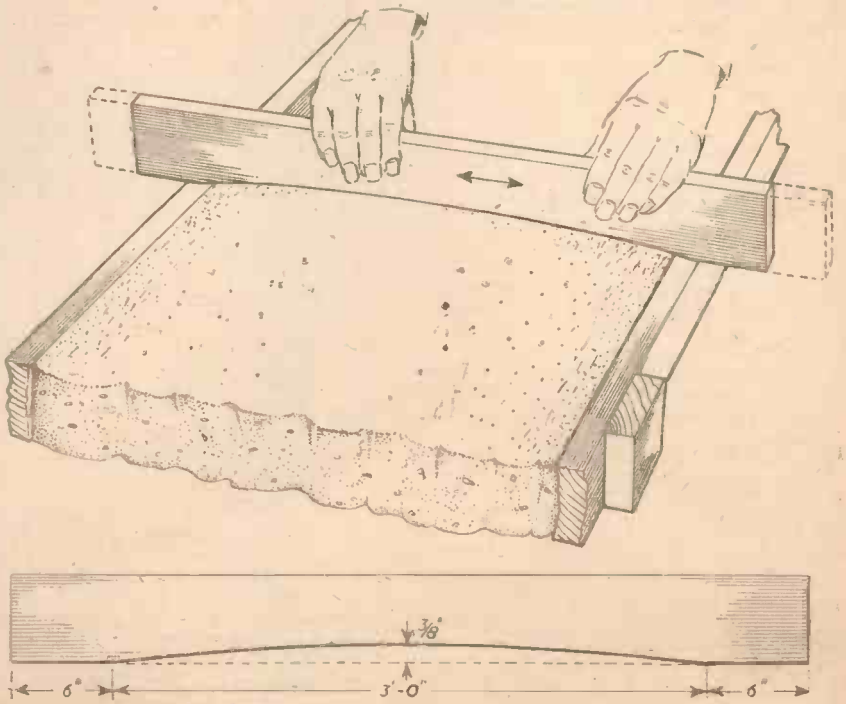


Fig. 2.—Using a screed, and detail giving dimensions.

with a shovel until the mass is of a uniform colour, with no streaks of brown or grey. At least three complete turnings will be necessary.

Measure the correct quantity of water into a watering can with a rose nozzle and sprinkle it slowly over the heap, pausing frequently to turn it over with the shovel. Continue until you have a thoroughly mixed plastic mass of uniform colour and consistency. You can test for a good mix by taking a handful of the concrete and squeezing it. It should retain its shape under slight hand pressure and the surface at the same time should become moist without dripping.

Placing the Concrete

It is of the utmost importance that concrete should be placed as soon as possible after mixing; certainly no longer than half an hour should elapse. If the ground is dry the surface should be sprinkled with water just before the concrete is placed. If the surface is waterlogged, place sheets of old newspaper over the site before laying the concrete.

Fill one bay at a time, working the concrete well into the side boards and then distributing it with an ordinary garden rake. At this stage let it be up to ½in. above the height of the formwork. Level it off with a wooden screed, used first with a chopping motion and then with a backwards and forwards sawing action. Notice that the screed shown in Fig. 2, which is made out of 4in. x 1in. timber, has its lower edge shaped to a slight curve. This curve should be about ⅜in. depth for a path 3ft. wide. It gives a camber to the surface of the path which throws off the rain.

By the above method of screed finishing a rippled, slightly roughened surface is obtained, which is non-slip. If, however, a smooth surface is desired it is obtained by subsequent smoothing with a wooden float. This need not be an elaborate affair, and Fig. 3 shows one which may be made in a few minutes out of waste wood. This trowelling must not be overdone or fine hair cracks will develop later. Further, a glassy surface will be produced which will be positively dangerous in frost.

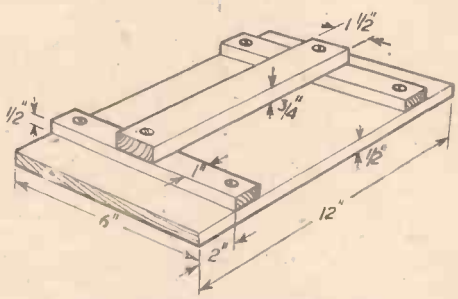


Fig. 3.—Details of a wooden float.

Shingle Surface

Another form of surface finish given to a path made with shingle and which has the appearance of a gravel path is obtained if, about one hour after the concrete has been laid, it is brushed with a hair broom to remove surplus mortar. Some time later, when it is found by experiment that the shingle is not easily dislodged, it is again brushed with a stiff broom, leaving the stones of the shingle slightly proud of the surface.

It is very important to protect newly laid concrete from the effect of fierce sunlight and drying winds, and if these conditions obtain during the first week or so after laying, the surface should be protected with wet sacks, strips of old carpet, etc.

Coloured Paths

The best-laid path of ordinary concrete is apt to be rather dull, and it is well worth while considering the effects which can be obtained by the addition of colouring powders to the cement. For this purpose ordinary dry colours may be used, but those made specially for the purpose are well worth the little extra cost. They have a much greater staining power and permanence of colour, and are resistant to frost, heat and light. They are used in the proportion of 1olb. of powder to each cwt. of cement, and they are thoroughly mixed with the cement before it is added to the aggregate.

These powders are made in about a dozen colours, and are intermixable so that almost any shade may be obtained. If more than one colour is used, however, great care should be taken in measuring so as to avoid differences in shades in a long path. This consideration is not so important if the path is laid in paving slabs.

In the next article it is proposed to deal with the whole subject of the making and use of *in situ* and pre-cast slabs for paths, dry walling, steps, pergolas and other features in the garden.

Items of Interest

An Ejectable Cockpit

AN entirely new protective system of bailing out of very high-speed aircraft has been successfully developed and tested by the Douglas Aircraft Company Inc., at El Segundo, California. Whereas present pilots have only the British-designed medium altitude, medium-speed Martin-Baker ejector seat to turn to for their chance of eventual escape and descent to safety, the new Douglas system features complete ejection of the cockpit and certain fairings attached to it, thus forming a streamlined capsule.

In future practice, when a pilot finds it necessary to abandon his aircraft he ignites a rocket charge and the entire cockpit is thrown clear of the doomed airframe. Within a few seconds three fins automatically unfold at the tail end of the newly created capsule to act as stabilisers; simultaneously, a small parachute billows out and slows down the forward speed. When a safe speed is reached (one that will not cause dangerous stresses) a main parachute unfolds and the capsule begins a gentle descent to the surface.

Because the capsule is highly pressurised it becomes possible, for the first time, to bail out at heights of over 50,000ft. It is dangerous with current equipment to bail out at more than 30,000ft.

For Water Landing

In the event of a water landing the capsule will float, with the electrical storage battery of the abandoned aircraft acting as as ingenious keel. Survival equipment, as stored on a Naval life raft, is stowed internally, while the motion of the waves pumps fresh air into the sealed and insulated compartment. The capsule has already been tested in the water by Douglas and the U.S. Navy at Long Beach, California, and has been dropped into rough seas from a crane at a velocity of 25ft. per second to simulate a parachute descent.

Many other convincing tests have been concluded. In static trajectory observation tests the capsule was propelled from a stationary position into a rope net. Final tests were conducted on the 10,000ft. aero-ballistic track at Naval Ordnance Test Station, Inyokern, to ensure satisfactory ejection at sea level speed of sound. To do this the forward part of a fighter aeroplane was fixed to the track and hurled down the rails by rocket propulsion at about 760 m.p.h. Half-way down the track an ejection charge was fired and the capsule sped forwards and upwards to function as intended.

It has been authoritatively stated that the new system can be applied advantageously to all aircraft cockpits. Too often these days we hear of a pilot escaping from a crashing jet aircraft, only to perish in the cold winter seas or to strike his plunging machine. At last, it seems, we are to welcome a development which makes it difficult for a pilot to die.

New Inshore Minesweepers

HER MAJESTY'S *Inshore Minesweeper Number* 5 was recently launched at the shipyard of Messrs. Vosper Ltd., Portsmouth. The ceremony was performed by Mrs. J. S. Purvis, wife of the Warship Production Superintendent, Southern Area.

The Navy Estimates for the current year show that 29 of this class of vessel were in course of construction but not launched at the end of March, 1952.

Of 106ft. 5in. in length with a beam of 20ft. 6in., these inshore minesweepers are designed to operate in shallow waters, such as rivers and estuaries. They are an entirely new type of vessel and embody novel features resulting from lessons learned during the war and in the course of subsequent developments. In addition to minesweeping equipment, each will mount one small gun.

A Tiny Model Ship

THE accompanying illustration shows what is said to be the "smallest actual model sailing clipper in the world." It was made by Mr. C. V. Thompson, of West Kensington, London, W., and it sails excellently, all sails and yards being movable. The minute size of the model can be gauged by comparison with the halfpenny shown in the illustration.

The tiny scale model clipper is only 2 1/16 in. long overall.

Industrial Infra-red

These Rays are Now a Necessity for Quick Drying

By Professor A. M. LOW

INFRA-RED is a rather impressive name for a very old thing. Call it radiant heat and much of the "mystery" surrounding it disappears. It is literally as old as the sun and no doubt its first application to industry was in the drying of the skins which primitive man used for his clothing. But so long as the sun remained the only source of these rays the possibilities for the extensive use of infra-red in industry were limited. Heat generated by the impact of waves of energy from the sun was very difficult to concentrate and, especially in a country like Britain, extremely capricious in its availability.

It was, in fact, the need for much more rapid application of local heat that gave rise to the use of infra-red in industry. With the coming of mass production and conveyor belt methods of manufacture, it was essential that heating processes, particularly in the drying of paint, should be speeded up. The pace of a whole chain of operations might be determined by the rate at which certain products could be dried. It was inconvenient and wasteful for the drying process to take hours or days. Even with the use of convection ovens to speed drying, such a process took far too long. Such is the delicacy of modern mass production methods that the time taken for the panels to dry might determine whether a motor-car was made at a profit or a loss.

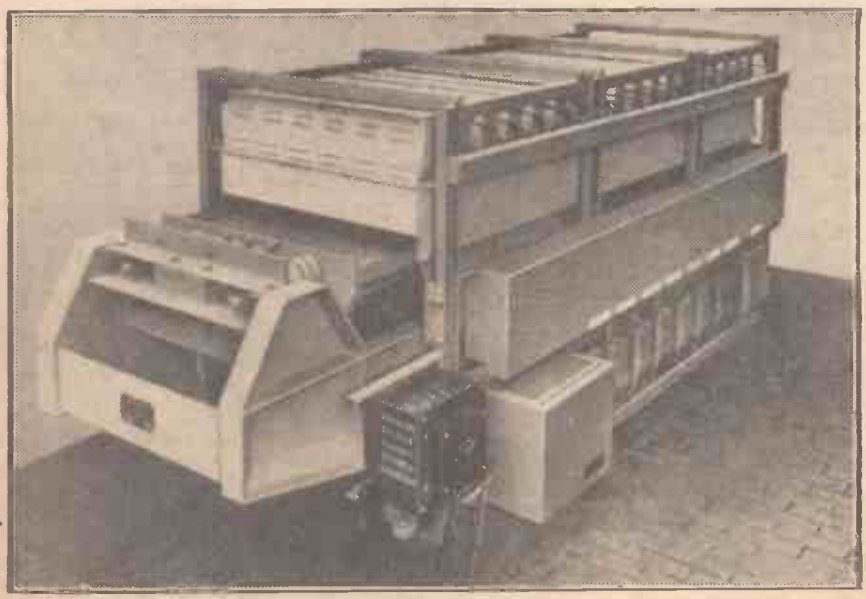
For Drying Paint

Taking the example of paint, there are three ways in which the heat required can be transferred: conduction, convection and radiation. Conduction is obviously impracticable in the majority of cases. Not even the amateur would try to dry paint on metal by applying a blow-torch to the metal. Convection in which the heat is transferred to a gas (generally air) which circulates round the paint was for long almost the universal method. Its disadvantage is the time required due to the losses of heat in the transfer and the comparatively low limit of temperature possible.

Radiation has the advantage that the energy needed to produce heat is transferred rapidly and with low losses, yet can be strictly controlled. It is for this reason that during recent years infra-red has been increasingly used in many industries for all processes where rapid drying is required. It is equally suitable for drying paints on metal objects and varnish on delicate electrical components. It is also used where heat is required to soften parts for bending or cutting, as in the case of certain plastics. Infra-red often enables the temperature required, generally between 400 and 700 deg. F., but with a higher possible maximum, to be attained within a matter of minutes or even seconds. Ten minutes may be considered a long time for stoving, where before one to five hours was short. In some cases the time has been cut from several days to the same number of hours.

Infra-red, of course, is that section of the spectrum just below the visible red and the actual radiations are invisible. It is, however, sometimes difficult to produce "commercial" infra-red radiations without some visible red. An efficient infra-red radiator should give the maximum amount of radiations between the comparatively narrow limits of infra-red and the minimum radiation of greater frequencies, exactly the opposite effect required of the illuminating lamp. Almost any "red-hot" substance radiates infra-red, but the design of infra-red for industrial purposes often calls for complete control over the intensity of the radiation, simplicity of construction, and ease of maintenance. Many substances which emit infra-red when heated are unsuitable because of their short "life."

A very obvious source of infra-red is refractory brick heated by gas jets—the ordinary gas fire radiates a considerable amount of infra-red. It is only recently, however, that completely satisfactory industrial units have been evolved by British research to meet the growing demand for infra-red in factories. These have one striking advantage over other systems. A small amount of the heat produced is transferred to the air in the oven and sets up convection currents. Now, while convection is a comparatively slow method of transferring heat it has the advantage that it "gets round corners" and is not affected by the colour of the material about which it circulates. In an infra-red oven, therefore, the convection currents compensate for "shadowing," the "shading" of uneven surfaces, and for difference of absorption by different coloured surfaces. The result is an even drying which it is seldom possible to obtain when infra-red alone is used.



The feed end of an infra-red ore-drying machine, manufactured by the Fraser and Chalmers Engineering Works of the General Electric Company, Ltd.

A Simple Unit

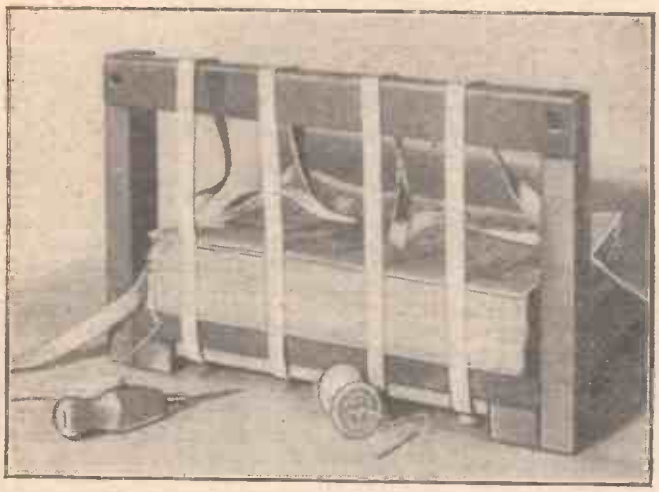
The construction of the latest type of unit is extremely simple. It consists essentially of a metal panel which holds the refractory brick and the gas jets, ten to each unit. It is interesting to note that neat gas, without admixture of air, is used; this permits of better control. The back of the panel is well insulated and the infra-red radiated from the front. These units can be built up in many different patterns according to the article being handled. They can, for instance, be built into circular ovens through which such articles as fireplaces can be carried by conveyor, the drying process taking place in the very short time required for the article to travel the length of the oven. They can be built up into a cube-shaped oven for dealing with batches of articles, or again into a cupboard-like oven on wheels for portability.

For ordinary purposes there are no particularly unpleasant gases, and the excellent insulation means that an oven can be used in a workshop without special ventilation or over-heating. Whatever the size and design of oven required, the same type of unit is used, only the supporting framework being altered. One very considerable advantage of this system is that an existing drying plant can be extended without interruption of its use.

Various Processes

Amongst the processes carried out with the aid of these infra-red units are not only rapid drying of paints and lacquers, but also the heating of Perspex for moulding, the softening of plastic materials for punching and extrusion, the dehydration of paper pulp and similar materials, the rapid drying of ceramic materials, drying printing ink and curing sheet rubber. The variety of these operations shows the flexibility of the system as well as the many applications of infra-red in modern industry.

Infra-red is also being used in industry for warming the workers as well as the articles they make. By mounting heaters about 12ft. apart at about 8ft. from the floor it is possible to cover an area of 100 sq. ft. with radiant heat, the warmth of which is quite independent of the movement of the air between. Apart from the feeling of comfort given by direct infra-red heating, the advantages are the directional effect, the rapidity with which warmth is obtained after starting, the low cost of installation and the great economy in use.



Bookbindin

How the Handyman Can Bind His Own Volumes

Fig. 2.—The volume being sewn. Twenty-three issues of Practical Mechanics are seen on the sewing frame. The bodkin is for beginners use.

SUCH work as the binding of a two-year volume of PRACTICAL MECHANICS cannot ordinarily be done except in a special workshop because of the need for bulky appliances too cumbersome to be kept in a private house for occasional use. Here, nothing but the resources of an ordinary household have been used, except for the sewing frame and special clamp or press, both of which the handyman will have no difficulty in contriving, and which may be easily stowed away during the long intervals in which they are likely to be idle.

After arranging the numbers of the magazine in their proper order, face up on the table, straightening out dog ears at the same time, the next thing to be done is to sew the "sections" together. "Section" is the term for each bundle of leaves to be sewn as a unit, in this case a whole issue of the magazine. A "sewing frame" will be needed for this, and is illustrated in Fig. 1.

The Sewing Frame

The measurements in the diagram need not be followed closely. All that is needed is that the baseboard will freely accommodate the largest book to be bound, and that the frame be strong and firm. For easy stowage the frame and baseboard may be made in separate units, to bolt together.

The tapes are fixed to the top bar and the front edge of the baseboard by drawing pins, so be careful not to use hardwood for these parts. If you do not take this precaution you will find it impossible to press the pins home, and will have to add softwood battens —this unnecessary complication can be seen in Fig. 2.

Use strong linen tape about half an inch wide and before starting the sewing you will need a large, easily threaded needle and some stout cotton, some yard-long lengths of tape, and a thimble—if you can use one. The number of tapes to be used depends on the size of the book. A prayer book will need two tapes, an ordinary octavo novel three, and in the case of PRACTICAL MECHANICS four can be used. Put the first section on the baseboard, back to front and face down, so that it will be in its proper place when the sewing is finished. Place the tapes at reasonable intervals fixed in position; leave about two inches of tape to spare below the bottom and the rest flying loose from the top bar. The drawing pins ordinarily go in the front of the bar and baseboard.

To start sewing, thread the needle with an arm's length of cotton and make a knot in the end. Again make certain that the correct section is properly placed on the baseboard, put the left hand inside the centre of the section, holding it partly open at the middle and ready to receive the needle as it comes through. Put the point of the needle on the outside of the folded edge about ¾in. from the "head" and central. Push the needle through until the left hand inside can catch hold and pull it, followed by the thread, right through. There will be a tail of thread behind the knot; do not cut this off yet.

With the left hand push the needle back through the fold so that its point comes out just to the right of the first tape. This is not easy at first, and the point will probably show itself anywhere up to half-an-inch or so either side of the correct place. Trial

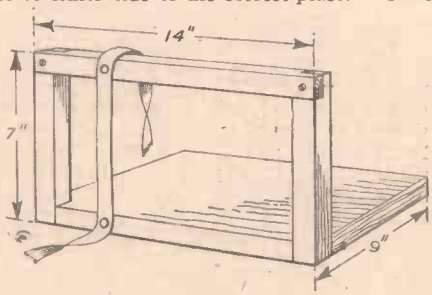


Fig. 1.—Sewing frame with one tape pinned in position.

and error is the proper way and within ⅛in. is good enough, but do not go through the tape on any account. The tape must be free to slide inside the stitching.

An exasperated beginner contemplating a fold rapidly becoming a line of perforations may be excused for using a subterfuge. With a bodkin, shown in Fig. 2, pierce a hole from the *outside* at the proper place and then, looking over the top, let the left hand guide the needle through this hole. This is an unorthodox proceeding, but not really bad practice except for the time wasted. But there is a great pleasure in doing it the proper way and seeing the needle point appearing in the right place with only an occasional miss.

In this way go on sewing the entire section to the tapes, finishing with the needle coming out ¾in. from the bottom, on the left. Again make certain that it has been number one section that has been operated on, that it is page one down, and that it is has been sewn through the middle pages of the section, for it is easy to miss them. After making sure that there is nothing to be corrected in the first section, place the second section in position on top of the first, centred exactly over the first section should the two be of slightly different size. Push the needle in through the new section exactly above the hole it last came out of, and complete the sewing of this section to the tapes. Then you will have the thread, led by the needle, coming out exactly above the place where sewing started with the knotted end still hanging out. Pull both parts taut and knot them together and cut off the original end, but not the part threaded through the needle.

Put the third section in position and sew it the same as the other two. On arrival at the other end of this section the time has come to make the first "kettle stitch." This

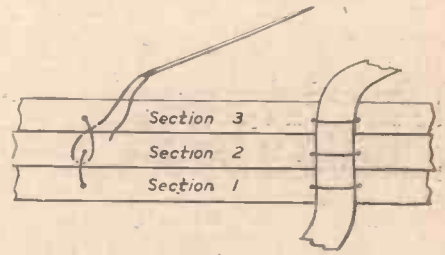


Fig. 3.—The kettle stitch. Thread shown dotted where passing under.

is a simple half hitch made with the working part of the thread round the stitch joining the two sections below it (see Fig. 3). Push the needle between the two lower sections from inwards out (or right to left in this case) inside the stitch, then pass the needle through the loop of cotton beneath the last-made hole and the stitch underneath, following the line in the figure. Pull taut and go on with the sewing, and so on till the end, making a kettle stitch at the end of each section. After sewing the last stitch, knot the last kettle stitch doubly, but do not cut its end off too closely; the ends of cotton hanging out are taken care of by the glue in a further stage of the binding.

The sewing will not be completed with one length of cotton—the several lengths are knotted together, each one to the last *outside* the book in front of the frame. Do not try to be too economical with the thread in doing

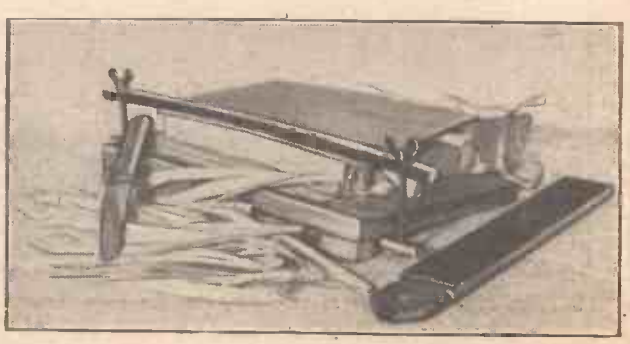


Fig. 4.—Cutting the top edge. The press is made from scrap iron, the boards are loose. The knife is a leather knife and is whetted on the firestick made with medium emery.

g Simplified

Efficiently and Cheaply

By S. H. SMOXLY

this for it will be difficult to get the knot in the right place unless there is a comfortable amount of thread to play with. The knot is so placed that it will be pulled through the next hole after the needle and left *inside* the section when the thread is taut and the next hole made.

The volume is now beginning to look like a book. Cut off the tapes 1½in. to 2in. long and save the rest of the tape for next time.

A professional does not call this process "bookbinding" at all; to him it is "casing." The superior term is applied to that way of covering books in which the boards of the cover are applied first and their covering and embellishment later. The sort of cover that we are going to put on, made separately and complete, is termed a "case."

Fly Leaves and Edge Trimming

Next come the fly leaves or "end papers." Each end paper is the size of a double page and is folded in two, one half to form the fly leaf and the other to be pasted inside the binding case. The end papers are pasted to each end of the volume by an eighth-of-an-inch wide smear of paste along one side of the middle edge. As to paste, flour paste is the regular thing, but any office paste will do, thinned for the bigger jobs so as not to dry out too quickly. Leave under a board and a heavy weight to dry.

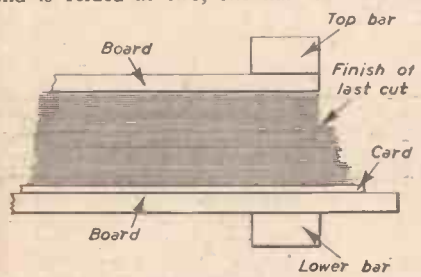


Fig. 5.—Book between boards in clamps, showing the edge partly cut.

If the book is to have its edges cut, now is the time to do it. Cutting is not really necessary, but it adds a lot to the looks, makes possible the dusting of the book when lodged on a shelf, and is a source of satisfaction to the binder. However, should the binder feel that he is undertaking quite enough without cutting the edges, he is advised to drop this process with his first volume.

Fig. 10.—A pile of bound books. The bottom volume is the one whose binding has been described. The white book is bound in a scrap of American cloth.

An Improvised Press

A simple press will be needed and a suitable knife. The press can be made with two strong battens coupled together with two ¼in. Whitworth bolts and butterfly nuts. In Fig. 4 the press used is made from two lengths of iron from an old window grill—iron is good for the top bar to avoid damage from the knife, but wood can be made to do. To clamp the book for cutting, a piece of board for the book to lie on, a piece of card to cut on and another piece of board to lay over the top will be needed.

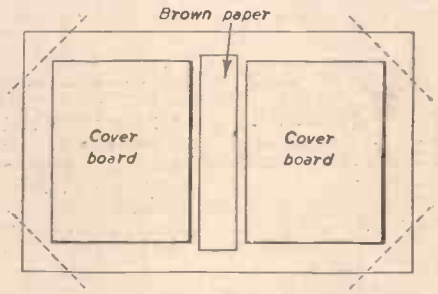


Fig. 6.—The cover cloth freshly glued with cover boards and brown paper in position ready for folding the cloth over.

Knock the volume up on the table so that it is all square. Rule in with a set-square two lines at the top and bottom on the end papers to show the depths of cut to be made to ensure flush edges. It will not be possible to take off more than a bare minimum, or the finished margins will be too small. The fore-edge will also need a cutting line.

Having pencilled in the guide lines, put the book with the boards and cardboard in the press. The fore-edge (pronounced exactly as the stuff horses eat) is the first to be cut, so arrange the top bar and top board to lay along this guide line. Make sure that the book has its top and back all square. Screw the bars as tight as possible without damaging the paper.

For cutting, a pocket knife makes a passable job; razor blades will not do at all; and the best of all is a shoemaker's leather knife costing about two shillings. A sharpening stone will be necessary and also a "firestick," which is a piece of medium emery paper glued to a board (about 10in. by 2in. is a suitable size). The knife must be kept sharp during cutting and about half-a-dozen whettings on the firestick will be needed while cutting the fore-edge. To whet, hold the knife flat on the stick with a slight pressure on the cutting edge, and draw it along the stick blunt side first, giving it a heel-and-toe motion at the same time. Don't hurry the stroke or the knife will heat and the cutting edge lose its temper. The toe needs most sharpening, especially the thickness of the toe. The stone is used for more drastic action and for thinning away the toe. A knife can easily be inspected for sharpness by glancing down the edge: if the edge shows a white line it is blunt and needs whetting.

Cutting Technique

For good cutting the pressure holding the paper together must be more than that on the knife. Here the press provides pressure, but even so, it is as well to start by cutting lightly and find out by experience how much pressure on the knife the job will stand. Start by cutting a page or two at a time and increase gradually up to about half-a-dozen pages. Too much pressure on the knife will cause a crooked cut.

Start cutting along the pencilled line, guiding the knife by the top bar, the flat of the knife against the bar, and the length of the knife as nearly horizontal as possible, so that it slices through the paper. Guard against raising the handle end at the finish of the cut, and use the tip of the knife to flip the waste away. As cutting proceeds a small cliff of cleanly cut paper will form. At the beginning of each cut make sure that the knife starts at the foot of this cliff following exactly the trace of the previous cut; it is easy to start the knife a hair's breadth away from the previous cut, and in this way miscuts are made. Once a cut is properly started the knife tends to follow its nose and keep right.

After the first few cuts, about a quarter-of-an-inch down, the top bar will no longer serve as a guide (Fig. 5). If the knife were to be kept pressed against it each time, its cutting edge would stray outwards and the edge of the book would slope outwards. After the first few cuts the knife must be guided by the "cliff" so as to keep the cut vertical.

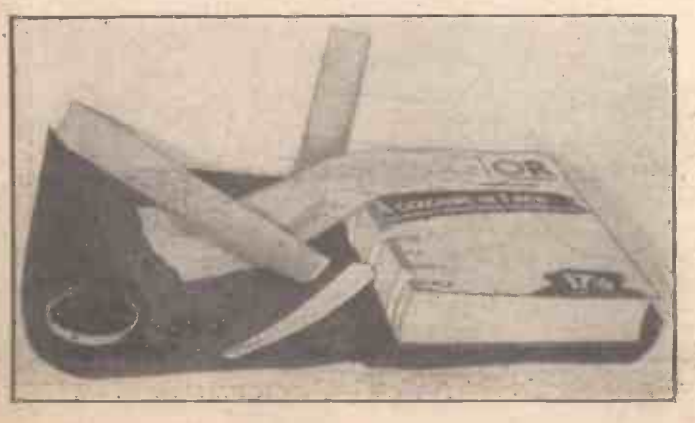


Fig. 7.—Making the cover. The cloth is roughly cut to size, and the book with its boards is put in position. The mull and two pieces of brown paper are shown, also glue pellets and a bone folder.

After cutting the fore-edge, do the top and the bottom in the same way. It does not matter whether you cut towards or away from the spine. The thickness of the back due to the stitching makes the book lie slantwise in the press, but this cannot be helped.

Gluing

Gluing up the book comes next. Put the book back in the press between two pieces of board with about 1in. projecting. Use ordinary glue, weakened with water for all bookbinding purposes. Thoroughly brush up and down the back, working the glue into the spaces between the sections and the end-papers too, the object being to glue the sections together. Then put the book aside for some hours to dry.

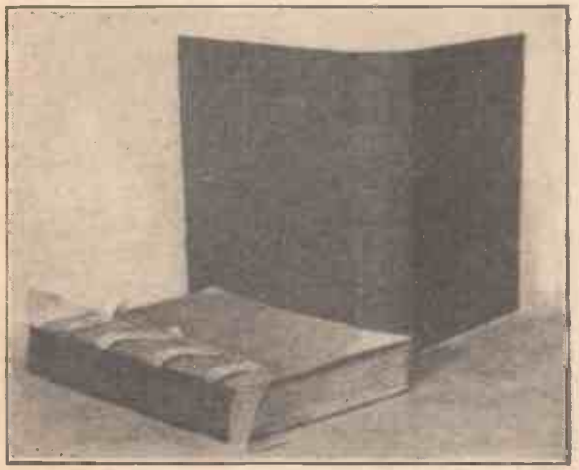


Fig. 8 (Left).— The finished cover and the volume with mull and brown paper glued on, but the ends not yet trimmed with scissors.

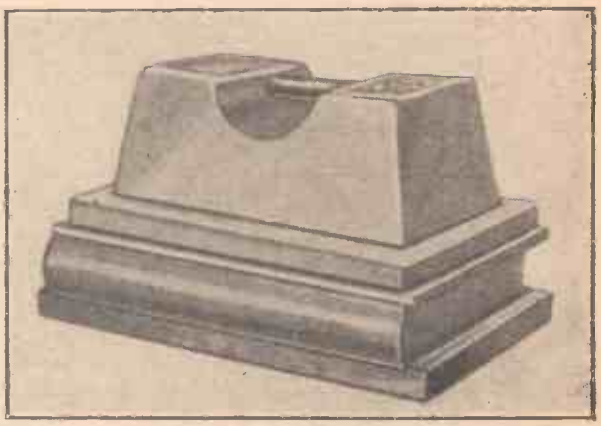


Fig. 9 (Right).— The book pasted into its cover and drying under a heavy weight.

When dry to the touch, but before drying completely, take the book out of the press and shape it with a round back. To do this lay the book on the edge of a table and push and pull it till it gets the round shape on the back and a similarly concave fore-edge. A practical bookbinder would use a hammer to beat the book into shape, and there is no reason why the handyman should not do so as well. A shoemaker's hammer with a broad, flat pane is the best to use. This rounding is not strictly necessary; it is only a matter of looks but helps the book to look ordinary and not amateurish. The fan-shaped splaying out of the sections at the back cannot be done without a heavy press, but its absence is not very noticeable.

Making the "Case"

For the "case" there will be required cloth, boards, glue, mull and a "folder." The boards are cut from cardboard, and old cartons and boxes provide suitable material. The size is such that the bare boards will cover each flypaper, overlapping ⅛in. on the cut sides, but coming up the same amount short on the back side to make a hinge. As for the cloth to cover them with, a special bookbinding cloth is naturally best, but a variety of household off-cuts can be made to serve. American cloth left over from the kitchen table was used for *The Readers' Digest*, the second volume down in Fig. 10. The material from which blinds are made is also good. Messrs. Aero Spares, who advertise in this magazine, often have pieces of real bookbinder's cloth at a shilling a piece in their Holborn window. In addition to the cloth, two pieces of ordinary brown paper cut to the width of the spine and about ½in. longer will be required.

Lay the book on the cloth on the table, with the boards in position, being careful to place them ⅛in. from the spine, leaving a strip of fly leaf showing. Arrange the cloth so that it can be drawn over the top board, leaving about an inch of margin all the way round. Pencil in on the cloth the shape of the underneath board as it lies so that it can be quickly replaced in its proper position. Now heat up the glue and brush it all over the cloth, having first cut it to shape, of course, with an inch to spare all the way round. Use watery glue, or it will dry too quickly.

Lay the glued cloth on the table, very carefully assemble the book with the boards in place, and lower it on to the glued cloth with the under board to the pencil marks. Once the lower board is in position it stays there, and there is no need to jiggle it about to get it exact. Now pick up the cloth by the left end and, slightly stretching it, draw it up over the book till it lowers on to the top board, to which it sticks. Now fold back the cloth flat on the table again and remove the book, leaving the two boards sticking to the cloth. With a pair of scissors cut off the four angles about a ¼in. from the boards, so as to make folding the cloth easy (see Fig. 6).

Take one of the pieces of cut brown paper and lay it evenly down the spine of the cloth (with a gap each side showing cloth) between the boards, and rub it down with a "folder." The folder is a piece of bone like a paper knife; an old toothbrush cut and filed to shape makes a good one, but it is more proper to take a bone that the dog has done with and shape one end to that purpose—such a folder is shown in Fig. 7.

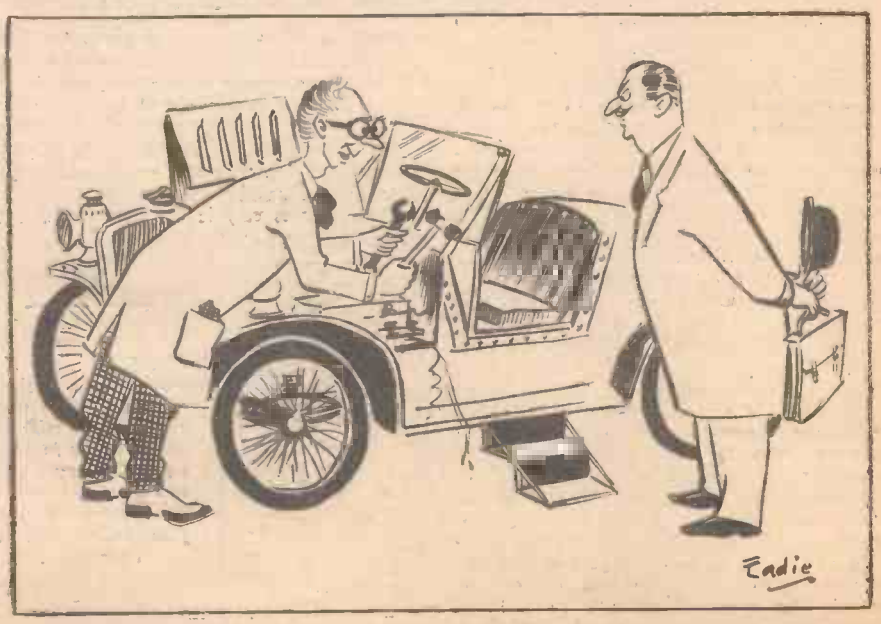
With the folder smooth down the brown paper on the spine and turn the edges of the cloth over the boards, being careful about the folder work at the corners. Then turn the whole thing over on the table (there will be no exposed gluey parts that matter now) and rub down all parts with the folder; the ridges and pimples will easily smooth out. With the folder rub down the creases where spine joins the sides, gluing the cloth to the edges of the boards; rub very well here. Now the cover can be put aside to dry.

Back Covering

While the cover is drying, the back of the book is covered with a layer of "mull" and the other piece of brown paper glued on. "Mull" is a kind of coarse net, and although very cheap is not easy to come by; but any kind of light, strong material will do. An inch of mull either side is left free, and the ends trimmed up with scissors when the glue is dry. (Fig. 8.)

Then the book and its case, or cover, are brought together. The fly leaves, tapes and mull are thoroughly pasted (but not the back) and all pressed together, then placed between boards, so that the spine is free, under the very heaviest weight that can be mustered. (Fig. 9.) Apart from a neat label pasted on, the volume is finished.

BOFFIN



"I've been retained by the Mercedes-Benz people to build a successor to the B.R.M."

Silvering Clock Dials

Methods of Waxing, Silvering and General Finishing of Dials for Clocks and Instruments

By J. F. STIRLING, M.Sc.

THE silvering and resilvering of clock and other instrument dials, and of nameplates of various kinds, is usually regarded as a complicated and exacting process suitable only for the experienced trade worker, and hedged all round with numerous "trade secrets" which make the whole procedure impossible of adoption by any amateur manipulator. So, also, is supposed to be the re-lettering of the engraved figures and other characters which are usually present on such nameplates and dials.

The fact is that, given reasonable skill and a little prior practice, the art of silvering and waxing dials and engraved or incised plates is an easily acquired one, thus making it possible for a careful amateur worker at a minimum of expense to turn out work which may compare favourably with even the best of professional efforts.

Instrument plates and dials are usually of brass or copper, particularly when they are to be surface-silvered by the chemical method, the reason being that only these metals take the white, matt, silver deposit well. When the plates are not required for silvering, they may be of any metal, ranging from aluminium to stainless steel or even common lead. Brass and copper dials and plates, as well as those of bronze, are the more usual because these metals permit of ready and accurate, clear-cut engraving, stamping or other means of forming the incised characters which are afterwards to appear in black against a plain, polished or silvered background. The traditional example of the old-time workmanship is to be seen in the well-known silvered "chapter" or numeral circle on the dials of old clocks, on old barometer dials, and on other instruments of various descriptions. It should be understood, however, that it is possible to produce a passable imitation of these old and often very beautiful silverings merely by a process of printing in black on an aluminium, or on an anodised aluminium background.

In order to illustrate the correct method of working the matt silvering process, let us take by way of example, one of the silvered dial rings or circles of a domestic clock which, in the course of time, has become more or less badly abraded, discoloured and tarnished, or even, perhaps, actually blackened. The many "brass-faced" clocks of the grandfather type which are seen nowadays usually have other silvered circles, too—the seconds ring, the calendar ring, and, often enough, the maker's nameplate, which, in these days, is coming more and more to constitute a valuable feature of the clock. The silvered dial plates of the old domestic barometers are all similarly made-up, so that the procedure herein described and illustrated can be applied to any type of dial or nameplate, old or new, provided that it is of copper or brass.

The four illustrations given below show successive stages in the waxing and resilvering of the seconds circle of a grandfather clock dial.

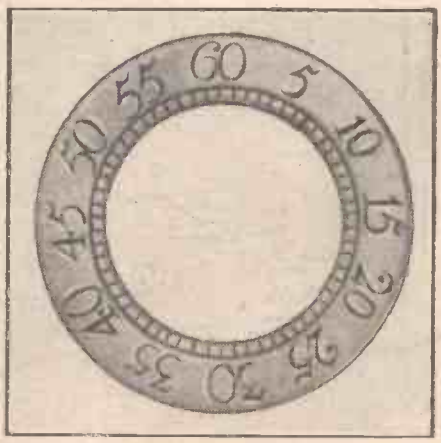
Preliminary Cleaning

First of all, the dial or plate must be detached from its support on the instrument which carries it and then immersed in a solution of 1 part of caustic soda in 6 parts of water contained in an enamelled tray or other suitable non-metallic vessel. The tray is placed over a large pan of gently-simmering water in order to warm up the caustic solution. On no account should any article of zinc or aluminium be submitted to this treatment, since such metals are dissolved by the solution. After some 10-15 minutes' immersion, the part is withdrawn from the solution and gently scrubbed with a soft brush. This will remove the existing lacquer on the silvered part, together with the black wax paint or filling in the engraved numerals or other characters. For obstinate cases, two or three treatments of this nature may be required. Remember that warm caustic soda solution will readily remove the skin from the fingers, so that, after much manipulation of the parts immersed in such solution, the fingers should be rinsed constantly in cold water and dipped from time to time in strong vinegar or in weak hydrochloric acid.

After the silvered part has been stripped in the above manner, it should be thoroughly well rinsed in warm water and laid down on a flat table or bench top on which it can be dried properly.

The cleaned, desilvered brass circle from which the old wax in the engraved numerals has been removed.

The brass circle surface coated with hard engraving wax, a portion of which latter has been removed by gentle abrasion, revealing the filled engraving.



The complete circle as it appears before silvering but after the removal of the wax. The numerals are now filled with the hard wax which is flush with the surface of the metal.

Waxing the Dial

The article is now laid face upwards on a clean iron sheet which is gently heated by being placed over a gas ring, the object being to heat the component gently and uniformly. If the object carries any soldered parts (the relics, perhaps, of former repairs) great care must be taken during this process not to melt or soften the solder. All that is required is that the object should be heated uniformly and to a temperature which makes it too hot for handling. Excessive heating is quite unnecessary and should be avoided.

Take a stick of black engraving wax (which is usually obtainable from dealers in clockmaking materials). Hold it between the fingers and rub it vigorously and forcibly over the surface of the heated article so that the entire surface is blackened. This done, increase the heat slightly so that the applied film of wax becomes more fluid and sinks

The finished result. The wax-filled seconds circle of a clock dial after its final silvering and lacquering, showing the characteristic contrasts between the black waxed numerals and the matt-silvered background.

down into the engraved characters. Rub a hot flexible steel spatula blade over the blackened surface in order to press down and to consolidate the wax into the incised figures or letters. Then turn off the heat and allow the article to cool down itself to normal temperature.

Removing Surface Wax

The next operation is the most tedious of all. It consists in removing the surplus wax from the surface of the plate without, at the same time, pulling it out of the engraved hollows or other markings which the wax has filled. There are various methods of doing this. You can, for instance, try gently wiping over the wax-filmed surface with a soft cloth saturated with petroi, paraffin, white spirit, benzene or some other solvent. Usually, in this instance, it will be found that the solvent, whilst readily and quickly dissolving the unwanted wax coating on the surface of the plate, will also remove some of the wax from the engraved characters, so that when the surface of the plate or dial has been finally cleaned the filling of the characters will look poor and uneven.

The surface cleaning-off of the wax without affecting the fillings should preferably be done by abrasive methods rather than by solvent ones. It is best, in the long run, to go over the entire wax-coated surface of the component with a soft cloth charged with a paste of fine pumice powder and water, or, better still, silica flour and water. Keep the surface well swilled with plenty of *cold* water and keep the rubbing in one direction only. Given patience with the job,

Pressing the applied layer of wax filling into the engraved surface by means of a hot spatula blade.

this procedure will remove all the surplus wax from the surface of the component without tearing any of the wax out of the "fillings," however fine the engraving may be. What is more, the abrasive treatment imparts a finely matted surface to the plate or dial which is admirable for silvering or for direct lacquering. Moreover, the wax in the fillings will not stand up with an objectionable gloss. Still further, as a result of this treatment the surrounding metal surface will be made chemically clean and free from tarnish.

If the plate is not required to be silvered it may be lacquered by brush or spray methods, care being taken to choose a transparent lacquer in which the wax filling is not soluble. Usually, the average clear cellulose lacquer suffices for this purpose.

Making Silver Chloride

If the plate has to be silvered, this operation will be found quite simple and rapid. Various silvering powders can be bought ready-made from dealers in clockmaking requisites or the amateur can make up for himself quite a good silvering powder by grinding together equal parts (by measure) of silver chloride, cream of tartar, and common salt. Note here that silver *chloride* is stipulated, not the more readily available silver nitrate. Silver nitrate is obtainable from most pharmacists, but not silver chloride. The nitrate, however, can be converted into the chloride by dissolving one part of silver nitrate in about four parts of warm water, and then by adding to the resulting solution, drop by drop, a solution of one part of common salt in four parts of water. This will precipitate the silver chloride as a white, curdy mass which is insoluble in water. It should then be filtered off through blotting paper, washed by pouring cold water through the mass, and then spread out to dry without heat.

Precipitating pure silver chloride by adding a common salt solution to a solution of silver nitrate. The heavy white insoluble precipitate of silver chloride rapidly sinks to the bottom of the vessel.

Be careful not to add too much common salt solution to the solution of silver nitrate, because the precipitated silver chloride is soluble in excess of common salt solution and, in this way, some of the valuable silver chloride would be lost. The correct procedure is to add the common salt solution drop by drop to the solution of silver nitrate and to stop adding it when it is seen that no more of the white silver chloride is being formed.

Just another precaution. The handling of silver nitrate solutions indelibly stains the skin black, and also destroys it, for which reason this salt is much used for the removal of warts. Silver chloride has not this effect, although it will blacken if exposed to strong light. But if silver nitrate solution is splashed on to the skin it should be washed off at once.

In the operation of silvering, a little of the above silvering powder, either ready-made or home-produced, is taken up on a wet, soft woollen pad; and is rubbed gently but firmly over the cleaned surface which has been previously waxed in the manner above described. The film of white, matt, metallic silver appears almost immediately. It may be thickened and whitened a little with continual rubbing with the pad. If the under metal surface has been nicely and very finely matted the new silver surface will have the same character. This appearance is usually aimed at in the best work, but if the under surface has been polished the silver layer will likewise tend to acquire a polished and lustrous appearance.

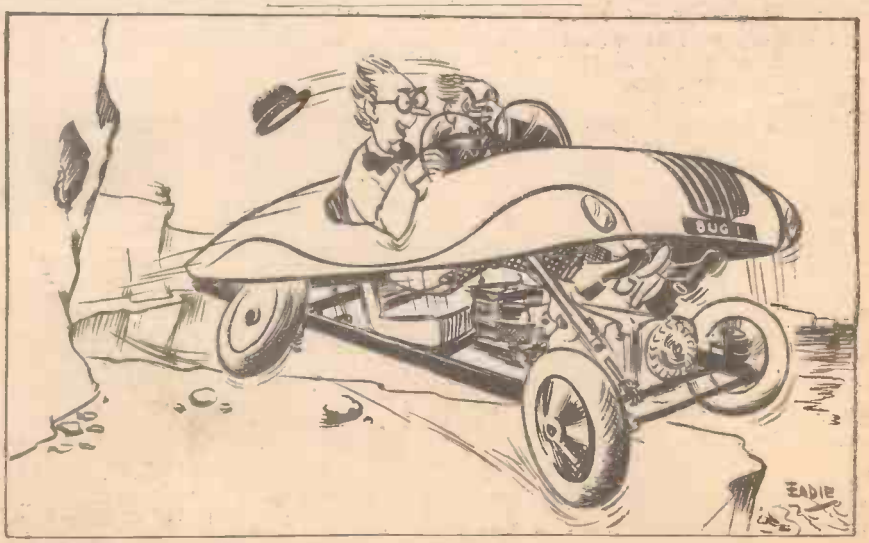
All that now remains is to rinse the silvered article well in cold water, and then to wipe it roughly dry with a soft cloth, allowing it afterwards to dry completely in the air and without heat.

Lacquering Necessary

If left in this condition, the newly silvered or re-silvered surface would quickly tarnish under ordinary atmospheric conditions. It must, therefore, to complete the job effectively, be given a thin coating of a clear cellulose lacquer, this being applied either by spray or by means of a soft brush. If this particular type of lacquering is overdone, or if the lacquer is too thick it will impart an objectionable glaze or shininess to the silvered part. In order to guard against this, it is usually advisable to use the latter in a diluted state, employing, say, two parts of a standard cellulose lacquer thinned down with one part of either acetone or toluene.

New brass and copper parts can be silvered in precisely the same way as the parts which require to be stripped before the work is commenced, but it should be noted that only copper and brass articles are amenable to the process. Articles made of other metals must be brass or copper-plated (preferably the former) before they can be matt-silvered in the above manner.

It is possible when dealing with purely letter nameplates to fill in the lettering with coloured waxes.



"With the new Boffin independent suspension you seem to be riding on air, eh?"

Gas Firing Pottery Kilns

How to Convert a Small Solid Fuel Burning Pottery Kiln to Gas

By D. A. YOUNG

WITH modern developments in insulating materials, this easily controlled method of firing becomes a practicable and not expensive proposition. Three or four visits during an eight-hour firing are all the attention needed. In addition, a muffle can be dispensed with, increasing the capacity of the kiln and reducing the mass to be heated.

Gas Supply

A kiln with an interior capacity of one cubic foot can be brought to the desired temperature by the consumption of 80 to 160 cubic feet of gas per hour depending upon the efficiency of the insulation and the internal construction of the passages which remove the waste gases. Not less than a ¾in. gas supply is needed. The following information relates to what is commonly known as town gas to distinguish it from natural gases and "bottle" gas, for which different provision must be made. I have found it helpful to connect the burner to the gas tap by means of a stout flexible hose. This enables the burner to be withdrawn for lighting, which is a great advantage from the safety point of view.

Burners

As will be seen in Fig. 1, burner bars are taken off the main stem from the gas supply. They are constructed of ordinary gas barrel, using caps, collars, and T-junctions. These can be cut to size and threaded up by a plumber if facilities are not available in your own workshop. The part of the burner actually in the kiln may burn to such an extent that the burner-port area needs replacement, and it is for this reason that a collar is placed at A. It is a great advantage to use heat-resisting steel for this length.

Injectors

A thin stream of gas must be injected into the burner bar drawing with it, through openings in the side of the bar, the right amount of primary air to secure maximum heat liberation. It is possible to make up a primitive kind of injector by rolling a copper cone, brazing it into the mouth of the burner bar and drilling out the required hole in the narrow end. (See Fig. 2.) Alternatively, where a lathe is available a jet can be made up as shown in Fig. 3. The efficiency of the jet will depend upon the accuracy of centring of the jet aperture. The commercial product of a firm specialising in the manufacture of jets will give the best result. In addition to the accuracy of the jet aperture, the placing of a venturi tube immediately after the intake for primary air ensures that the stream of gas picks up and mixes with the proper amount of primary air.

TABLE OF JET ORIFICES

Gas consumption in cubic feet per hour	Diameter of jet orifice
40	.121in.
60	.148in.
80	.171in.

Burner Ports

The first burner port must be not less than six times the diameter of the burner bar away from the injector orifice. You may find that the pressure builds up towards the ends with the result that there is a longer flame at the sealed ends. To counteract this the burner ports can be made to vary in size provided the total area remains constant. A rough rule is to allow a ⅛in. hole for every cubic foot of gas consumed per hour. A more accurate method is to calculate the total burner-port area by allowing .015 sq. in. for every cubic foot of gas, and devising a suitable number of holes with suitable diameters. Make use of the following formula.

Where $.015x = y \times \pi r^2$

x = consumption of gas in cubic feet per hour
y = number of burner ports
r = radius of burner ports

By fixing any two of these factors the third can be readily obtained.

For example, to find how many burner ports of $\frac{3}{16}$in. would be required where 60 cubic feet of gas is consumed in the hour.

$$60 \times .015 = y \times 3.141 \times \frac{3}{32} \times \frac{3}{32}$$

$$y = \frac{.9 \times 32 \times 32}{3.141 \times 3 \times 3}$$

$$y = \frac{32 \times 32}{31.41}$$

or 32 approx.

The resulting flame should be a row of tight, blue-green flames similar to those of the domestic gas stove. Soft, woolly flames of a yellow appearance indicate insufficient primary air, which in its turn is due to too slow a rate of gas release over the burner-port area, i.e., too few holes. If the flame, on lighting, runs back to the jet orifice, there are too many holes in the burner-port area. In this type of kiln the ware is heated by the flow of hot gases and not by contact with the flame itself.

Secondary Air

Secondary air is the air required by the burning gases to complete the process. Suitable arrangements must be made for the admittance of sufficient secondary air around the burner-port area of the burner bar to ensure that all the gases are consumed and the maximum heat liberated within the kiln. Flames coming from the chimney are spectacular but wasteful!

Exhaust Gases

Provision must be made for the removal of burnt gases. A nice balance must be preserved between the need for a clean atmosphere and the retention of the hot gases to enable the heat to be transferred to the ware and the lining of the kiln. Generally speaking any construction which will cause the hot gases to circulate within the kiln or behind a thin lining will keep the heat in the kiln where it is wanted. An aperture of 1 sq. in. for every 10 or 15 cubic feet of gas consumed should be made in the kiln leading to a length of drain pipe which will act as a chimney. Three or four feet of chimney will be enough. More will create too big a pull and draw the gases through before they have released their heat to the ware. Less chimney may result in pressure being built up inside the kiln, retarding the admittance of secondary air and resulting in a reducing atmosphere. If the kiln is indoors and the gases have to be led out of the building by means of a long chimney, a break should be made about 3ft. above the kiln to prevent the updraught becoming too fierce.

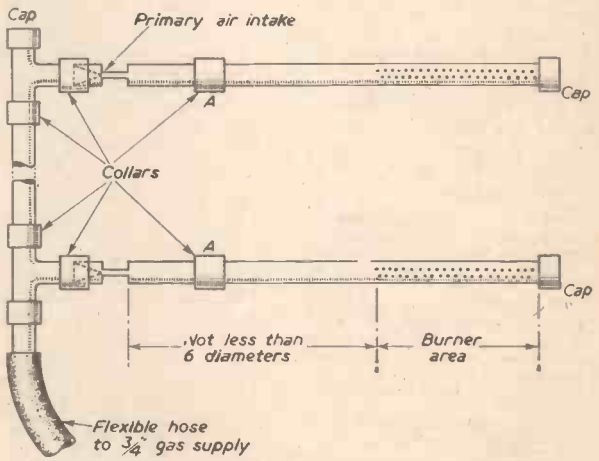
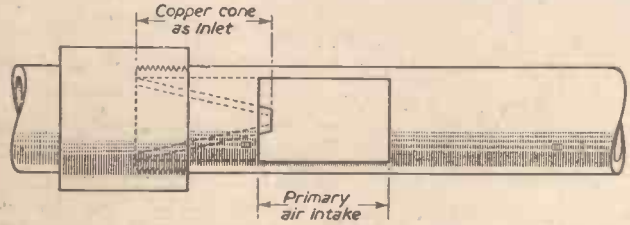


Fig. 1.—Showing the method of connecting the burner bars to the main stem of the gas supply.

Kiln Atmosphere

The atmosphere inside the kiln is of great importance to the potter. A reducing atmosphere is one where there is no free oxygen. Thus in a biscuit firing carbonaceous matter may be left to burn out later, in a glost firing, spoiling the glaze. In a glost firing the reactions of the glaze are quite different in a reducing atmosphere. The colour of the metal, e.g., copper red, is obtained instead of the colour of the oxide of the metal, e.g., copper green.



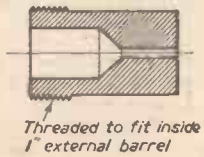
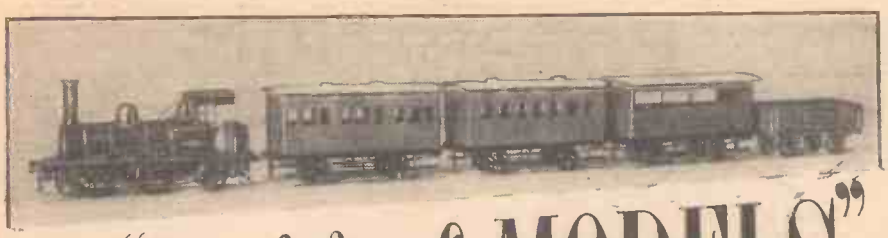


Fig. 2.—Showing injector made by rolling a copper cone and brazing into mouth of the burner.
Fig. 3.—Jet turned up on the lathe.



The "World of MODELS"

By "MOTILUS"

Modern Motorship Model : Model Half-timbered Village

IT is not very often that I hear of a model of a modern cargo ship built to the free-lance design of the model-maker. Free-lance models are, I find, generally of old-time sailing ships or, if modern, then they are usually model yachts. In the main, however, ship modellers are ship lovers, so they often build to a favourite prototype.

Earlier this year I was very interested to receive, from a correspondent in the United States, photographs and particulars of a ship model which he had not only made but had also designed himself. Mr. John D. Hungerford, of Seattle, Washington, is the ambitious modelmaker who, during 1951, designed and built the model cargo and passenger motorship illustrated in Fig. 1. Mr. Hungerford informs me that his design is on the lines of a modern Scandinavian diesel-engined cargo ship.

Mr. Hungerford's prototype would have an overall length of 314ft., breadth 46ft., DW capacity 3,150 tons, and a service speed of 18 knots. The model is to a scale of ⅛in. to 1ft. and thus measures 3ft. 3¼in. from stern to stem.

The model is built in the traditional style of a full-hull display model and is mounted in a glass showcase. The hull is red below the waterline and white above, with a broad black boot-topping. The superstructure is mainly white and also the masts, while the funnel is buff. Particular attention has been paid to comprehensive deck detail and, as a result, Mr. Hungerford has produced an excellent and interesting modern ship model.

Fig. 1 (Left).—A view of the decks on Mr. Hungerford's model ship, showing the careful detail work, as befits a display model.

Fig. 2 (Above).—This realistic model of an English half-timbered village was built from "Puffin Building Books." All these cut-out models are based on authentic prototypes and are ready for assembly when cut from the pages of the books.

A Model Half-timbered Village

An attractive, coloured model of a half-timbered village, displayed by Messrs. Bassett-Lowke, Ltd., in their London shop in High Holborn, tempted me into making further inquiries. I found that this model has been made from the set of three "Puffin Building Books," published by Messrs. Penguin Books, Ltd., earlier this year. This is the second of the series, the first having been a model Cotswold village.

This simple card village was so effective that before I left the shop I purchased a set of Building Books (13s. the set or 4s. 4d. each book), and spent a few hours making up the models. No glue, pins or paint are necessary: just a pair of scissors, pencil and ruler, and a good, sharp blade for cutting slits. (I used an X-Acto knife for this last operation and found it an admirable tool for the job.) I was impressed by the accuracy with which the printed parts fitted together if cut with care and precision.

When completed, the individual buildings, such as farmhouse and barn, manor house, guildhall, etc., can be arranged to suit the owner's taste, and, incidentally, they would be admirable for use as village scenery on a gauge 00 model railway layout.

The illustration (Fig. 2) shows my own model village when I had finished it.

An American Railroad "Old-timer"

Mr. H. Bühlimann, of Zurich, Switzerland, has sent me a photograph (Fig. 3) of the latest addition to his collection of models of old-time American steam locomotives. This is the 1890 "Jupiter" of the Baltimore and Ohio Railway, and it is similar to the "Commodore Vanderbilt" of 1885, featured in my article last March. All Mr. Bühlimann's old-time models are gauge 0 scale and electrically operated.

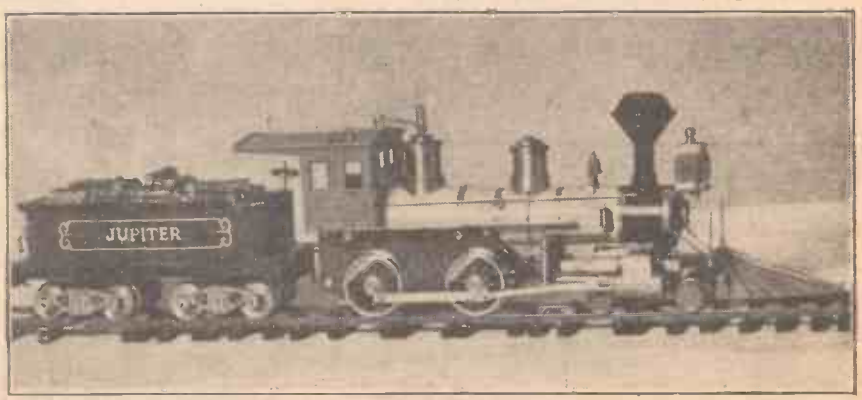


Fig. 3.—A Swiss-made model of an 1890 locomotive of the U.S.A. Baltimore and Ohio Railroad. This model is in the collection of Mr. H. Bühlimann of Zurich.

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Crystal Sets. Our latest Model is a real radio receiver, which is fitted with a permanent crystal detector. Why not have a set in your own room ? 12/6, post 8d. De Luxe Receiver in polished oak cabinet, 18/6, post 1/-.
Spare Permanent Detectors, 2/- each. When ordered separately, 2/6. With clips and screws, 2/10, post 3d. **Headphones**, brand new, S. G. Brown, G.E.C., etc., 15/-, 23/-, and super-sensitive, 30/- a pair, post 1/-.

New Headphones, 10/- a pair. Balanced armature type (very sensitive), 12/6 a pair. Both post 1/-. New **Single Earpieces**, 3/6. Bal. armature type, 4/6 ; ex-R.A.F. earpiece, 2/6, post 4d. **Headphones**, in good order, 6/- (better quality, 7/6), all post 1/-. **Headphones** with moving coil mike, 15/-. Similar phones with throat mikes, 12/6, post 1/-. **Headphones Cords**, 1/3 a pair, post 3d. **Replacement Bands**, 1/3, post 4d. **Wire Bands**, 6d.
(All Headphones listed are suitable for use with our Crystal Sets.)

Bell Transformers. These guaranteed transformers work from any A.C. Mains, giving 3, 5, or 8 volts output at 1 amp., operate bulb, buzzer or bell. Will supply light in bedroom or larder, etc. PRICE 9/-, post 8d. BELLS for use with either the above or batteries, 6/8, post 6d. **"Big Ben" Chimes.** Housed in Cream Plastic Case. Easily connected to give Two-Note Chime from Front Door, and Single Note from Rear. Operates from 6-9 volt Batteries or Transformer (shown above), 23/-, post 1/-.

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Soldering Irons. Our new streamlined iron is fitted with Curved Pencil Bit. 200/250 v. 50 watts, 11/6, post 6d. **Standard Iron** with adjustable bit, 200/250 v., 60 watts, 13/6, post 6d. **Heavy Duty Iron**, 150 watts 16/6, post 8d. All parts replaceable and fully guaranteed. **Small Soldering Irons**, for use on gas, 1/4, post 4d. Resin-cored solder for easy soldering 6d. packets or 1lb. reels, 6/-, postage extra.

Microphones.—Just the thing for impromptu concerts, room-to-room communication, etc. Bakelite table model, 6/9 Suspension type, 8/6. Post 6d. **Mike Buttons** (carbon), 2/-. **Moving Coil**, 4/6 ; **Transformers**, 5/-. All post 4d. each.

Rotary Transformers, 24 v. input ; Output 1,230 v., .2 amp. in case with suppressors, etc., easily converted to run as a high voltage motor, 25/-, carr. 5/-. Also 12 v. input ; Output 6 v., 5 amp. ; 150 v., 10 mA. ; and 300 v., 20/240 mA., 22/6, carriage 5/-.

Morse Keys.—Standard-size keys wired to work Buzzer or Lamp, 3/-, post 6d. Slightly smaller keys, 2/6, post 4d. **BUZZERS**, 3/9, or heavy duty, 4/6, post 5d.

Terminals, brass, 2BA, mounted on strip, 6d. pair. .0005 Airspaced **Variable Condensers**, 2/6, post 4d. .00003 twin gang with trimmers, 2/6, post 4d. 24 volt, 15 m/m., **M.E.S. Bulbs** for model railways, etc., 1/- each, 10/- doz., post 4d. **Wander Plugs**, Brass, 1/6 doz., post 4d. **Fuses.**—1 amp., 1¼in., packet of 10, 2/6, post 3d. Also 150 mA. and 250 mA., same price. **Hydrometers, Standard Type**, 6/-, post 6d.

Bargain Parcels of really useful equipment, containing Switches, Meters, Condensers, Resistances, Phones, etc., 10/-, or double assortment, 17/6 ; treble 25/-. All carriage 2/-. This country only.

Field Intercommunication Sets, complete with ringing hand generator, bell, signal lamp, morse key, relay, in strong metal case with circuit diagram, 30/- each, carr. 2/6 ; 57/6 pair, carr. 3/6. Ex-G.P.O. Telephone Twin Bells, with box, 5/-, post 9d. Telephone hand generator, with handle, 9/6, post 1/6 ; Bell, 3/6, post 6d.

Meters. 10 v., 2½in. Rectifier (A.C.), in wooden carrying case, 14/6 ; 15 v., 2½in. m/c., 9/6 ; 150 v., 2in., m/c., 10/- ; 3.5 amp., 2in., T.C., 6/- ; 4 amp., 2½in. T.C., in case with switch, 9/6 ; 100 mA., 2in., m/c, 7/6 ; Meter Units containing 2-500 microamp. movements, 6/-, post 1/-.
All meters post extra.
Money refunded if not completely satisfied.

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Imagine! One sturdy HANDY-UTILITY power tool, a selection of HANDY-UTILITY accessories and attachments, and you're ready for anything —sanding, grinding, wire brushing . . . buffing, waxing, polishing . . . and the same magnificent tool can be used as an electric drill, with ¼" capacity in steel! There are two robust Stands to increase the usefulness of your 5" Sander-Polisher still further. Full particulars from your HANDY-UTILITY dealer.

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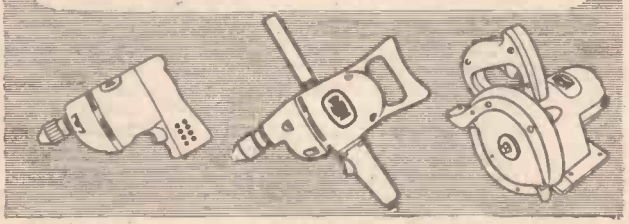

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EARLY CLOSING DAY THURSDAY

EX-U.S.A. W.D. ROTARY TRANSFORMERS, 12 volts D.C., input 500 volts, 50 m/amps., 275 volts 100 m/amps D.C. output. Complete with smoothing switches, fuses, etc., as new, 17/6 each, carriage 2/6, can be run on 6 volts, giving half the stated output.

MAINS TRANSFORMERS (NEW), 200/250 volts input, in steps of 10 volts, output, 0, 6, 12, 24 volts 6 amps, 42/6 each, post 1/6. Another as above but 10-12 amps, 55/- each, post 1/6 ; another, as above but 25/30 amps, 75/- each, carriage 3/6 ; another, input as above, output 0/18/30/36 volts 6 amps, 47/6 each, post 1/6.

EX-NAVAL ROTARY CONVERTERS, 110 volts D.C. input, output 230 volts A.C. 50 cycles, 1 phase, 250 watts capable of 50% overload, weight 100 lb., price £10/10/- each, carriage forward.

ROTARY CONVERTERS, 24-28 volts D.C. input, 1,200 volts 70 m/amps, D.C. output, 10/- each, F.F.

SWITCHBOARD METERS, 4in. scale moving coil (D.C.) only 0 to 14 amps, 17/6 each, post 1/6.

MAINS TRANSFORMERS (NEW), input 200/250 volts in steps of 10 volts, output 350/0/350 volts 180 m/amps, 4 volts 4 amps, 5 volts 3 amps, 6.3 volts 4 amps, 45/- each, post 1/6 ; another 350/0/350 volts 180 m/amps, 6.3 volts 8 amps, 0/4/5 volts 4 amps, 45/- each, post 1/6 ; another 500/0/500 volts 150 amps, 4 volts 4 amps C.T., 6.3 volts 4 amps, C.T., 5 volts 3 amps, 47/6 each, post 1/6 ; another 425/0/425 volts 160 m/amps, 6.3 volts 4 amps, C.T. twice 5 volts 3 amps, 47/6 each, post 1/6.

MAINS TRANSFORMERS (NEW), input 200/250 volts in steps of 10 volts, output 350/0/350 volts 300 m/amps, 6.3 volts 8 amps twice, 4 volts 4 amps, 5 volts 4 amps, 70/- each, carriage 3/6 ; ditto, 450/0/450 volts 250 m/amps, 6.3 volts 8 amps twice 4 volts 4 amps, 5 volts 4 amps, 70/- each, carriage 3/6 ; another, input as above, output 500/0/500 volts 250 m/amps, 6.3 volts 8 amps twice, 6.3 volts 4 amps, 4 volts 4 amps, 5 volts 4 amps, 75/-, carriage 3/6. Another, wound to (electronic) specifications, 350/0/350 volts 250 m/amps, 4 volts 8 amps, 4 volts 4 amps, 6.3 volts 8 amps, 0/2/6.3 volts 2 amps, 70/- each, carriage paid ; another, input as above, output 500/350/0/350/500 volts 250 m/amps, 6.3 volts 6 amps, 0/2/6.3 volts 2 amps, 0/4/5 volts 4 amps twice, 75/- each, carr. 3/6.

MAINS TRANSFORMERS (NEW), suitable for spot welding, input 200/250 volts, in steps of 10 volts, output suitably tapped for a combination of either 2/4/6/8/10 or 12 volts 50/70 amps, 95/- each, carriage 7/6.

MAINS TRANSFORMERS, 230 volts input, 150/0/150 volts 200 amps, 6.3 volts 8 amps, 5 volts 2 amps output, 23/- each.

AUTO WOUND VOLTAGE CHANGER TRANSFORMERS, tapped 0/110/200/230 volts 350 watts, 55/- each, post 1/6 ; as above, but 500 watts 70/- each, carriage 3/6 ; as above, 200 watts, 40/- each, post 1/6.

EX-RADAR MAINS TRANSFORMERS, 230 volts input 50 cycles 1 phase, output 4,500/5,000 volts approx. 80 m/amps, 6.3 volts 2 amps, 4 volts 1¾ amps, 2 volts 2 amps, these transformers are new, immersed in oil, can be taken out of the oil and used as television transformers giving output of 10 m/amps, overall size of transformers separately 5½in. × 4½in. × 4in. and 3in. × 3in. × 2½in., price 75/- each, carriage paid.

ELECTRIC LIGHT QUARTERLY TYPE CHECK METERS, all for 200/250 volts A.C. 50 cycles 1 phase, 5 amps load, 17/6 each, post 1/6 ; 10 amp 21/- each, post 1/6 ; 20 amps load, 25/- each, post 1/6.

EX-R.A.F. ROTARY CONVERTERS. 24 volts D.C. input 50 volts, 50 cycles, 1 phase at 450 watts output, complete with step-up transformer 50 to 230 volts, £9/10/- each, carriage 10/-.

EX-NAVAL ROTARY CONVERTERS, 230 volts D.C. input, 230 volt 50 Cys. 1 phase output, 250 watts, £15 each, carriage 10/-. Another 110 volt D.C. input 230 volt 50 Cys. 1 phase output at 850 watts, £25 each, carriage 20/-.

IN STOCK.—Meters, Chargers, Rheostats. Transformers specially made to order. Please forward your enquiry.

Amateur Telescope Discs

SIR,—With reference to the correspondence published on page 358 of your July issue concerning the making of a telescope reflector, your readers may be interested to know that we can supply amateur telescope makers with the necessary blanks made in the finest quality white optical glass. They can be supplied in 6in., 8in., 10in., 12in., 14in., 16in. and 18in. diameter, both in white crown glass and in low expansion glass, with or without the edges machined. We can also offer discs in well annealed green plate glass for grinding "tools." Any of the above sizes are usually held in stock, but we can accept orders for non-standard sizes at slightly increased prices. In either case we are happy to deal direct with the telescope maker.

It might also be of interest to know that we can supply blanks for crown and flint combinations for object glasses, also material from which eyepieces can be constructed.—CHANCE BROTHERS LIMITED, 28, St. James's Square, London, S.W.1.

Tramway Exhibition

SIR,—With reference to the notice in PRACTICAL MECHANICS concerning our recent Tramway Exhibition.

We had a very successful show, and were very agreeably surprised at the public's interest in Tramway History. Most of our models were up to Science Museum standard, and all in ¾in. scale representing cars from Colchester, East Ham, West Ham, Erith and London County Council. Smaller exhibits ranged from "oo" to "o" gauge, and comprised S.M.E.T., Croydon, M.E.T. and Blackpool.

I should also like to mention that PRACTICAL MECHANICS was the means of a very early relic coming to light, to wit, an early brass Token, given in exchange for the necessary cash, before the introduction of the paper ticket dating back to 1864. This was sent to me by one of your readers named Mr. Miles, of Stoke-on-Trent. One side portrays in relief, Francis Train's Marble Arch Tramway, and the other side Staffordshire Potteries Street Railway Co., Limited, "Train's Patent." Many thanks are due to the journal and to Mr. Miles.—F. J. ROCHE (East Ham).

Boat Engine Problems

SIR,—Here are a few suggestions regarding boat engine problems mentioned in an inquiry from J. Lappage published in the August issue of PRACTICAL MECHANICS.

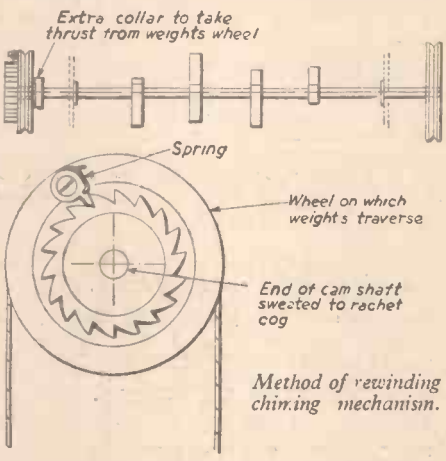
I would like to point out that conversion kits can be obtained for Ford, Austin and Morris engines (to convert from car to marine engines) from a number of firms including A. C. Whitehorn, Ltd., 110, Ashley Rd., Bristol, who would probably suggest the best propeller for the converted engine and hull.

Also, a closed-water circuit is better in muddy water, in order to prevent the jacket silting-up. It is comparatively easy to make a heat exchanger for the cooling water and fit it under the hull in contact with the river water.—A. BROWN (Cardiff).

Westminster Chimes

SIR,—I wish to submit an idea which I think improves "Westminster Chimes." The same arrangement is useful for rewinding and setting the chimes, and can be adapted very simply to the specification given in PRACTICAL MECHANICS for May, 1952. I have had this idea working very efficiently in the set I made some while ago.

Instead of having the grooved wheel (in which the weights are suspended) the wheel on which a rachet is fixed revolves freely on the camshaft. Engaging the ratchet is a cog-wheel which is sweated to the camshaft end.



Method of rewinding chiming mechanism.

The operation for rewinding is, therefore, to pull down the light weight (as in winding a clock) until the trigger in the relay just clicks and it is then ready for a further period of chimes.—T. A. DEIGHTON, (Cottingham).

Model Diesel-driven Launch

SIR,—The enclosed photograph shows a two-thirds of a metre model launch I have built similar to streamlined constructional details of which are given in your book "Model Boat Building." The engine is an E.D. Mark II diesel and the propeller is cast in aluminium and hand finished. The boat weighs 4lbs. in sailing trim, and this includes a 4oz. fuel tank made of copper tubing 2in. diameter added since the photograph was taken.


Mr. N. I. S. Crossley's model launch.

The rudder is the same size as fitted to the metre boat, as the smaller one originally fitted allowed the boat to wander off course. She is too fast to handle comfortably, except on a line.—NORMAN I. S. CROSSLEY (Hazel Grove).

Tropical Aquariums

SIR,—I read with interest the article in the August issue by H. R. Hodgkinson on making a safety device for tropical aquariums. I would like to point out that unless the author is concerned with the requirements of the rarer and more delicate species of tropical fish he is mistaken when he states that the water temperature of a tropical aquarium must be maintained within 2 deg. of 75 deg. F., and that should the heater fail the fish will die in a few hours.

The majority of tropical fish which have been hardened, by being accustomed to a temperature which varies by 3 or 4 deg., being higher in summer than in winter, and lower during the night than during the day, are unaffected by a temperature as low as 68 deg. F., and only when the temperature drops to 65 deg. F. is there imminent danger of the health of such fish being imperiled. However, fish which are accustomed to a water temperature continually kept at 75 deg. F. are very susceptible to a sudden slight drop in temperature, caused either by the failure of a heater, or by the aquarium being in a cold draught from an open door or window.

The important point is, that should for any reason the temperature be allowed to fall, it must be restored to its normal value very gradually if no ill effects on the fish are to be experienced.

It would take much longer than a few hours for the water temperature of an averaged sized tank, kept in a living room, to fall below the value required by hardened fish.

I mention these points to try to prevent the potential aquarist from getting the impression that he must become a slave to his thermometer, if his fish are to be healthy.—P. R. C. STANDEVEN (Bradford).

Interplanetary Space Travel

SIR,—With reference to Arthur C. Clarke's book, "The Exploration of Space," also to letters from readers Dennis Urch and H. H. Porritt in a recent issue.

Einstein's theory of Relativity is incorrectly and optimistically used to save time in space travel to the distant stars. Stating that time in a rocket near light speed is slower than Earth's time is only half the picture.

According to Einstein's theory, absolute motion (speed) cannot be measured or detected, and only *relative* motion can be measured.

If we take an object A and say that it is at 98 per cent. light speed, we must ask relative to what? Then A is at 98 per cent. L.S. to object B; *also* it is equally true to say that B is at 98 per cent. L.S. to A. We can take our choice. Another point is that the speed of light will remain constant to both A and B, no matter what their speed or direction. This is a fundamental of the relativity theory.

Now as we can only measure relative motion, the speed of our rocket must be measured *relative* to some other body, such as the Earth. But if the rocket speed is relative to the Earth, it is just as correct to say the Earth is travelling relative to the rocket. And in this case it is the Earth's time that is slower than the rocket's.

This leaves us with a situation which depends on our point of view. Is it the rocket

(*Continued at foot of page* 38).

Trade Notes

"Handicrafts with X-acto"

TRIX LIMITED, of 11, Old Burlington Street, London, W.1, have just issued the second edition of their comprehensive handbook bearing the above title. Written by W. A. G. Bradman, F.R.S.A., the book, which is well illustrated, is intended to show how the well-known X-acto tools can be used for a variety of purposes including chip carving, inlay stringing, intarsia work, wood joints, pictorial marquetry, paper sculpture, scraper board work and lino-cutting. Further information concerning this useful handbook (priced at 4/6) can be obtained from Trix Ltd., at the above address.

Water-bottle Tops

A NEW water-bottle top was recently introduced to the motoring trade by Creators Ltd. It is manufactured from P.V.C., and will fit most bottle necks up to 1¼in. diameter. It is ideally suited for the motorist who wishes to keep his own supply of distilled water in an old oil or mineral water bottle. The cap is resistant to acids, grease and water, and is supplied in two colours—red and green.

Retail price is 1/- each (supplied to the trade in display cards of eighteen, and subject to full retail and trade discounts).

Further information can be obtained from Strand Publicity Ltd., 10, Stanhope Row, Mayfair, W.1.

The new water-bottle tops, by Creators Ltd.

Johnsons Photographic Apparatus and Accessories Division

WE are informed by Johnsons of Hendon Ltd., that the progressive expansion of this section of their business has necessitated a move to much larger premises in Hendon. As from Monday, September 15th, the address of the photographic apparatus and accessories division of the company will be: Apparatus House, 35 and 37, Brent Street, Hendon, N.W.4. (Telephone (unchanged): HEN 7671.

The head office, laboratories and works remain, of course, at 335, Hendon Way.

It would prevent delay and help considerably if orders and correspondence referring only to apparatus and accessories were in future addressed to the Brent Street premises.

"Gryphon" Fractional H.P. Motors

AS a result of continued research in the Brook laboratories, since the introduction of their fractional horse-power motor, they have now developed a new type embodying many improvements in design and performance. The stator is housed in a heavy steel shell with a strong, detachable cast-iron foot. End shields, too, are of sturdy design with reinforcing rings and ribbed openings, all of which contribute to quieter, vibrationless running and consequent lessening of strain on the bearings.

Further particulars are obtainable from Brook Motors, Ltd., Empress Works, Huddersfield.

BUILDING A TAPE RECORDER

(*Continued from page* 13)

(earth) pin on the plug used on the chassis. If it is found that there is a slight residual hum a separate wire must be connected to the chassis and taken to a good earth connection. A length of standard 80 ohm coaxial cable is joined to the soldering lugs of the recording head, and a coaxial plug attached to the other end for insertion in the socket on the top of the chassis.

Operation

To use the recorder, place an empty spool on the right-hand spindle and a spool of tape on the left-hand spindle, with the end leading off from the left, so that it may be taken across the table to the right, and attach the adhesive end of the tape to the centre of the right-hand spool. Looking down on the deck the tape should come down from the left-hand side of the left-hand spool across the deck to the right-hand side of the right-hand spool, this revolving in an anti-clockwise direction when switched on. The right-hand spool should be rotated by hand anti-clockwise until two or three turns of tape have been taken up, and then the length of tape between the spools should be carefully lifted and placed across the copper face of the two heads, and round the capstan top, and the slack taken up. Turn the tape-deck switch to its centre position ("play"), and the main panel switch to "record." Set the record volume control about half-way on, and turn the play-back control until the mains switches click to the "on" position. Do not turn the control any farther. Wait a few moments for the valves to attain maximum temperature, plug a microphone into the Input 1 socket and then close the tape-drive control which will switch on the motor and cause the tape to be slowly wound off the left-hand spool on to the right-hand one. As soon as it is seen to be moving smoothly, speak a few words close to the mike, stop the tape by opening the tape control and turn the record volume control back to zero.

Now lift the tape clear of the heads and turn the tape-deck switch to the left, which is the position of rapid re-wind. Holding the tape drive control knob carefully, close it until the motor starts and as soon as a few inches of tape have been wound back (approximately as much as was wound off to make the test recording), open the switch, replace the tape and you are ready to play back the recording. Turn the tape-deck left-hand switch to its central position again, and turn the main switch to "play-back." Turn up the volume control (VR2) to maximum, and start the tape. You should hear the test recording, and if heard but not clear, a slight adjustment should be made to the slotted control on the bias unit. This will probably have to be about one-quarter of the way on in a clockwise direction. The correct setting of this bias control depends upon the tape used, and too high a bias will give a weak signal as it will partially erase it, and too little bias will give a distorted signal. A few test recordings should be made to find the best setting, and once adjusted this will not have to be touched again unless a different make of tape is used.

The play-back volume control may be set to about ¼ to ½ way on and used as a monitor when recording, provided that care is taken to keep the microphone facing away from the speaker, as otherwise microphonic feed-back will take place and a howl will start which will be difficult to stop. For testing the recording section when first setting up a pair of headphones may be connected by means of a suitable plug to the socket on the top of the chassis, disconnecting the lead from here to the recording head.

MODEL OF HYDRO-ELECTRIC POWER STATION

WITH reference to our "World of Models" article in the September issue, concerning model hydro-electric power stations, "Motilus" writes to us as follows:

"I was given wrong information and I must apologise to the North of Scotland Hydro-electric Board and the firms concerned. I have now ascertained the correct information which is as follows:

"The model is to illustrate a pipe-line for a hydro-electric scheme. It is not full length to scale, as it would have been too long for general purposes, but it does include every essential detail. It was constructed from drawings and photographs of the Grudie Bridge installation, to the order of Messrs. Mechans, Ltd., of Glasgow, who supplied the pipe-line for the prototype."

LETTERS FROM READERS

(*Continued from page* 37)

or the Earth at 98 per cent. Light Speed? We make our choice and it is *that* one's time which is going slower.

One other point which seems to have been overlooked: at near light velocity, to an observer (if that were possible) there would be a space time continuous expansion, i.e., slowing of time and increase of space (distance) for the pilot of our rocket. This means that the pilot would gain nothing from the slowing of time, as the distance to a star would increase by the same factor.

Also, to our pilot's point of view, space and time would be normal. To him it would be the observer's space time that had expanded.

So there is nothing to justify the view that light velocities would shorten the time or distances to the stars. It will still take 100 years to travel 100 light years at the speed of light.—A. J. BULL (London, W.6).

QUERIES and ENQUIRIES

A stamped, addressed envelope, three penny stamps, and the query coupon from the current issue, which appears on page 8 (THE CYCLIST), 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.

Paper Making at Home

I WOULD like to carry out an experiment at home of trying to make a rough or crude type of paper. Is it at all possible and, if so, could you give me any information on how to proceed ? —E. Minshall (Northwich).

TO make even the crudest of papers you must have some sort of "beating engine." This consists of a wooden drum with nails around its periphery. This drum is revolved under water so that the peripheral nails come into close contact with a series of nails driven in the side of the vat. Whilst the drum is revolving paper is pushed down on to it so that the paper is forced into contact with the nails on the side of the vat. Between these nails and the nails on the drum it is gradually shredded. Gradually, paper fibre will be suspended in the water and it will give a white, milky appearance to the latter. When the water has attained a full milky appearance it is run off through a fine metallic gauze. This retains the shredded fibres of paper and enables them to be laid out on the gauze, thus bringing into being a sheet of paper-like material. The thinner the paper used for shredding, the better will be the latter process and the better the quality of the paper prepared. For an experiment, ordinary tissue paper shredded into, and boiled up with, hot water will give quite passable results, although the newly-made paper would be much more enduring if it were passed through a size bath containing 5 parts soap, 3 parts alum and 92 parts water.

Modernising Old Picture Frames

I WISH to give a modern finish to a number of old picture frames, and would be very grateful if you could advise me in this matter. I have seen various finishes, some smooth and some rough, but they are generally off-white in colour. —K. Bachmann (Hove).

THE following is the usual procedure for giving a modern finish to old picture frames of the average type, contour, surface and colouration :

Obtain from any artists' colourman about 1 oz. each of Flake White (white-lead), Yellow Ochre, Raw Umber and Terre Verte, all these being in fine powder form. You will also require a pot of gum or paste, a good table knife or a suitable steel spatula together with a sheet of glass of suitable dimensions.

Place some of the Flake White on to the glass sheet and add to it cold water, a small amount at a time, mixing the white pigment with the table knife or spatula to the consistency of a thin cream. When this cream has been prepared work into it a very little of the Yellow Ochre and a similar quantity of the Terre Verte. Remember always that the Terre Verte, being of a greenish hue, will give a colder colouration, whilst the Yellow Ochre will give rise to warmth and lightness of colour. A darker colouration can be obtained by substituting Raw Umber for the Yellow Ochre. In fact, by the judicious admixture of these pigments and, if desired, by their dilution or thinning out with ordinary whiting, quite an extensive range of frame colourations can be obtained.

When the frame distemper has been prepared in shade to your satisfaction, stir into it a little of the gum and it will be ready for use. Apply it to the frame with a brush and allow it to dry. It will dry, usually, several shades lighter. When dry rub the distempered frame with a damp soft, cloth (one which is almost dry) and if the original decoration of the frame has been in gold, the gilding will show through on the high spots. Wax polish may then be applied and rubbed lightly in, but this treatment is not always necessary.

This decorative treatment of picture frames is quite a straightforward procedure. It can be done at relatively low cost and, with very little practice, some exquisite and charming effects, as well as very novel ones can be obtained with comparative ease.

If by any chance you find the result not satisfactory, the whole of the frame can be wiped over thoroughly with a wet soapy rag and the procedure recommenced.

If you have any trouble in obtaining a suitable gum you can make this for yourself by dissolving about 15 parts of cooking gelatine in 85 parts of water and by stirring into the clear solution about 5 parts of Lysol, the function of the latter being to prevent the formation and development of mouldy growths in the gelatine medium.

By obtaining the colours in quantity and by making the gelatine binding medium yourself, the whole cost of the picture decoration can be reduced to an absolute minimum.

Dental Waxes

I. The enclosed sample of wax is used for sticking artificial teeth in boxes and on display cards. Could you give me the composition and any idea of how it is made, and what ingredient would raise or lower its melting point? I will need to make it into strips of ⅛in. x ¼in. Could you suggest a way of doing that and a lubricant for the mould employed ? Please give the names of suppliers of the ingredients.

2. The enclosed wafer is part of a "base plate" which is used for reinforcing wax "try ins." Could you tell me its composition, where the ingredients may be obtained, and a suitable mould lubricant for it ?—M. Behan, L.D.S. (Drogheda).

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

I. It would take about two weeks of an analyst's time to investigate the composition of the two wax samples which you have submitted for examination, particularly in view of the complexity of the modern dental waxes. We feel sure, therefore, that you will not expect our query service to undertake this specialist and professional work for you.

There are, however, innumerable wax mixtures which you could make up for yourself fairly easily. Here is one of an average, simple composition :

Paraffin wax	90	parts	(by weight).
Ceresin	39	,,	,,
Beeswax	40	,,	,,
Japan wax	17	,,	,,
Prime yellow Carnauba wax ...	3	,,	,,
Venice turpentine	30	,,	,,

Melt the waxes in a pan heated on a steam or water bath. Add a little wax or oil-soluble dye to give the shade and colour required, or, in place of this, stir in a small quantity of rouge or finely-ground iron oxide. Finally, stir in the Venice turpentine. Pour the mixture, whilst still warm, into narrow wooden channels made by nailing wood strips together, using a strong paste of soap and water as the mould lubricant.

Any ordinary pharmacist should be able to supply the above materials and thus save you the cost of carriage. If not, apply to a good London firm of laboratory suppliers, such as Messrs. Baird and Tatlock, Ltd., 14-17, St. Cross Street, Hatton Garden, London, E.C.1, or Messrs. Hopkin and Williams, Ltd., St. Cross Street, Hatton Garden, London, E.C.1.

2. The "wafer" which you mention is built up on the same lines as the above, but is softer and more adhesive. You can lower the softening-up point and increase the plasticity of these waxes by increasing the amount of Venice turpentine which is incorporated, by increasing the amount of the white waxes (paraffin and ceresin) or by adding one or two parts of a plasticising liquid, such as tricrescyl phosphate. You can harden the wax mixtures by reducing the proportions of the above ingredients, and, also, by increasing the amounts of the Carnauba wax, which is the hardest of all the waxes.

It would, in our opinion, be far better for you to obtain these particular waxes from a dental manufacturing firm, rather than to attempt to make them up on your own initiative and without adequate experience and "know how."

Formula for Flexible Moulding Compound

COULD you supply me with a formula for making a flexible moulding compound for plaster casting ?—P. Reed (Greenock).

YOU will find yourself very much restricted in the small-scale making of the flexible moulding compounds which you require, because most of these have to be processed from ingredients such as rubber compounds and synthetic resins, all of which are most difficult to deal with on a small scale, although they can now be obtained commercially.

In your case, the best flexible moulding compound which you can prepare for yourself will consist of a mixture of equal parts of glue and gelatine dissolved in water. The actual amount of water used will depend upon the degree of stiffness and also the flexibility which you require of the moulding compound. This will call for some experimental work on your part. We suggest that you begin by dissolving 3 parts of a 50-50 mixture of glue and gelatine in 7 parts of hot water. To this solution you should add about 1 part of glycerine, the more glycerine the greater the flexibility of the compound will be, and in this respect you will have a very fine control on the properties of the material. It is most necessary that you add about ¼ part (or even less) of carbolic acid or Lysol to the liquid solution, otherwise it will turn mouldy and will become unpleasant to deal with.

For use, the stiff product should be placed in a basin and surrounded by hot water, or even merely warm water. It will quickly become as flexible as rubber, and when allowed to cool will rapidly set stiff again. We take it that this is the sort of thing which you desire.

Frosting Electric-light Bulbs

PLEASE tell me how to "frost" clear electric light bulbs (230 v.). The type of bulbs I have had to use can only be obtained in the clear state and they give too brilliant a light.—G. W. Eyre (Cleethorpes).

THE only method of permanently frosting the outside of clear electric-light bulbs is by means of the fumes of hydrofluoric acid. This substance actually corrodes the glass surface and thereby renders it opaque very effectively. Place a small quantity of powdered fluorspar at the bottom of a lead or iron vessel and cover the substance with strong sulphuric acid. Place the bulb to be frosted in the upper part of the vessel and then put the whole assembly in a pan of hot water. Under the influence of heat, the fluorspar-sulphuric acid mixture will generate free hydrofluoric acid which will pass off as a gas and thereby make contact with the glass of the bulb above. When the bulb has become frosted sufficiently it is merely rinsed in water and dried.

A still simpler method of effecting this result is to dip the bulb for a few minutes in a warm dilute solution of hydrofluoric acid which latter can be obtained in special containers from Messrs. Oswald M'Cardell & Co., Ltd., Sudbury Hill, Harrow, Middx.

If you use the alum solution method of superficially frosting the bulb dissolve the alum in a 5 per cent. solution of gelatine. This will have the effect of keeping the alum crystals on the glass and of retarding their flaking-off.

Damp-proofing Window-sill

I AM experiencing dampness beneath a bay window, and believe that rain is seeping through the rough concrete window-sill on the outside. Can you advise me how to render this weatherproof or if I should "fill" in rough surface and finish with hard gloss paint ? I would prefer the sill to be its natural colour if possible.—T. Whale (West Bromwich).

THE trouble is probably due to the fact that the lower wooden window frame is resting directly on the brickwork underneath without any damp-insulating membrane, such as slates or bituminised felting between the two. This is a common defect these days. We note that you wish to retain the natural colour and a rough surface of the window-sill surround and yet, at the same time, to render it damp-proof.

There is one good way, although a rather expensive one, of doing this. It consists in making-up a thin "paint" of stone-dust (of the required colour) and

hydrolysed ethyl silicate (a transparent liquid) and brushing this on to the surrounds of the window, particularly outside, but, if necessary, inside the room. Choose fair weather for the job, when all the dampness has disappeared. Within a week the silicate mixture will have become rock hard, in which condition, it will be insoluble and damp-resistant, and will act as a binder for the powdered stone which has been mixed with it. When hard, the area can be brushed over with paint or treated in any other manner which you may desire. Hydrolysed ethyl silicate is not a very stable substance. It must be used within one month of its delivery. It seeps into the stone or brickwork and slowly releases silica within the pores of the work, which silica forms a sort of continuous film which is impervious and completely damp-resisting. Hydrolysed ethyl silicate can be obtained from Silicaseal, Ltd., Westgate Hill Grange, Newcastle-on-Tyne, 4, which firm will no doubt send you particulars of this substance in response to your inquiry.

As an alternative, the stonework should be brushed liberally with raw, hot linseed oil. After one or two applications of this, the area should be given a good coating of any white or red-lead paint, which, when dry, may be given a surface coat of paint as required. The most suitable substance for your use in this case is undoubtedly the hydrolysed ethyl silicate, since it gives efficient damp-resistance without materially altering the colour or appearance of the treated area. Only its initial expense is against it for this class of work.

Covering Damp Walls

I HAVE recently moved into a house, built in 1939, and have started interior decorations. The wall covering, instead of being the usual plaster, appears to be a very hard, smooth and impervious cement. The walls are inclined to be damp, due, I think, to condensation, as interior partition walls are as bad as exterior walls, but the condition soon clears up when the weather allows plenty of ventilation. My difficulty is in renewing wall covering. Wallpaper bubbles and soon becomes loose, and unless distemper is put on so thick that the brushmarks spoil the finish it just runs down the wall.

How can I treat this surface so that ordinary distemper and wallpaper can be applied, and also what should be used for filling cracks ?—K. L. Peers (Hayes).

YOUR trouble is that your walls have been rendered with an impervious coating of material. If the walls had been of plaster the trouble would not have arisen and it is difficult for us to see why, in fact, the walls were not originally so plastered. An ordinary plastered wall absorbs a small amount of damp or moisture which is deposited on it by condensation from the atmosphere or from other sources. When the room becomes warmer the absorbed moisture is again given off from the plaster and it is not noticed therein. But when the wall is not able to absorb moisture, the latter collects on the wall surface and, in the end, begins to trickle down the wall in an unpleasant manner. To make a really good job of your walls the impervious material would have to be chipped off down to the brickwork or, at any rate, for about one inch of depth and then replaced by ordinary wall plaster, this latter being given a skim coat of Keene's white cement. This would provide a very excellent "eggshell" finish on which any colourwash or distemper could be coated. Wallpaper could be then laid on this, either with or without the intervening of distemper or colourwash, but, usually, when a room is apt to give rise to a good deal of condensation, it is better to do without paper on the wall and to have merely a plaster or other rough-surfaced absorbent coating.

For the same reason a plaster surface should never be painted, nor should any treatment be applied which will destroy the essential porosity of the plaster surface.

An alternative treatment open to you is to remove the paper from the wall and then to apply several coats of an ordinary distemper in the hopes that this layer will effectively be sufficiently absorptive to deal with an excess moisture which may be present in the air of the room.

A further alternative is to use the "Murac" flat distemper paint which is manufactured by Messrs. John Hall & Sons, Ltd., Hensgrove, Bristol, which, although rather expensive, is, we think, sufficiently absorptive to deal with variations of moisture contents in room atmospheres.

For filling cracks in wall plasters there is nothing better than wall plaster itself, ordinary cement or Keene's white cement. The edges of the cracks should be thoroughly wetted before the new filling material is put in, otherwise the dry edges of the cracks will absorb moisture too rapidly from the fresh filling material and will, in the end, result in the filling material becoming loose and falling away.

Blooming Lenses

PLEASE supply me with details of the process used in blooming optical lenses. I have considerable experience of camera and instrument repairs including binoculars and the removal and reassembly of the lenses present no difficulty.—M. Bardell (Sutton Coldfield).

THE "blooming" or "coating" of lenses and other optical glass surfaces is, in general, a fairly straightforward process, but it necessitates costly apparatus, for which reason it is not generally undertaken by individual workers.

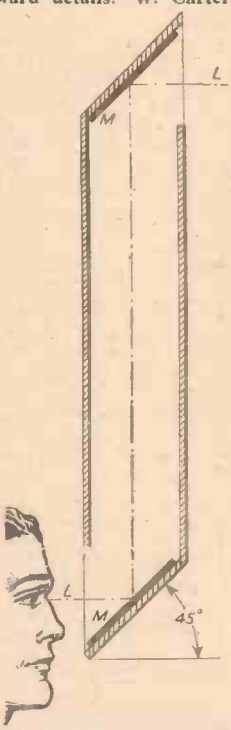
Essentially, the optical components are stripped of all their metal work and placed in a special holding-frame in which they are enclosed within a dome-shaped stout glass vessel which is then highly evacuated. A mineral fluoride, usually magnesium fluoride, is then electrically heated within the same evacuated enclosure. By this means the fluoride is, as it were, evaporated and a "mist" or "rain" of the fluoride is thus created within the enclosure. The mist of fluoride subsequently condenses on the glass surfaces, with the result that a very thin layer or coating of the fluoride is deposited thereon in a more or less uniform layer. The coating is obtained in the crystalline condition. As such, it is perfectly transparent and it does not interfere with the direct transmission of light, merely hindering the passage of oblique rays of light. It is these properties which render so valuable the deposit on the glass surface.

To be of greatest efficiency, a lens, such as a camera lens, should have all its glass-to-air surfaces, at which reflection of the light rays may take place, bloomed, but more usually only the front and back lens surfaces are thus treated, because it is found that this "semi-blooming" gives fairly adequate results. The same applies to binoculars. Thus, if you want the highest degree of efficiency in any of these instruments, you will have every glass-to-air surface systematically bloomed. If otherwise, merely the first glass-to-air surface of the objective lens will be sufficient for such treatment. If you find yourself unable to undertake this optical work, it can be done for you by a firm such as Messrs. C. J. Whilems, Ltd., Ilford Optical Works, Forest Road, Barkingside, Essex. Equipment for the blooming process can be obtained from The Cambridge Instrument Co., Ltd., 13, Grosvenor Place, London, S.W.1, or from Messrs. Philip Harris & Co., Ltd., 144-146, Edmund Street, Birmingham, or from most firms of laboratory dealers specialising in optical work.

A Simple Periscope

I WISH to make a simple periscope (to be used on land, of course) and should be obliged if you would kindly forward details.—W. Carter (Birmingham, 23).

A SIMPLE and efficient periscope can be made of thin wood, such as plywood, boxed up as shown in the sketch. The top and bottom ends can be either square or bevelled, as shown, but in either case the two mirrors, M, must be fixed at an angle of 45 deg. Openings are arranged on opposite sides and at opposite ends of the box for collecting the light rays which form the picture L.



For small periscopes the mirrors such as are carried in ladies' handbags would be suitable. Obviously the height of the viewer and the height of the obstruction to direct vision must determine the length of the periscope.

Making a Dress-making "Judy"

I WISH to make a dressmaking form, or "Judy," at home. This, apparently, will entail two processes: (a) making the mould of myself; (b) using the mould to cast the "Judy."

Can you please tell me what materials to use, and the cheapest and easiest method?—Marie Moore (Co. Sligo).

IT is very difficult to make for oneself the dressmaking forms or "Judies" which you describe. The simplest method (which requires the services of an assistant) is to strip to below the waist and to cover the skin all over with olive oil or Vaseline. Then take a length of stout tape about 1in. broad, secure the end of it to a point low down at the back by means of sticking plaster. Bring it tightly but comfortably over the shoulder and secure the other end of the tape to a point low down on the abdomen in a similar manner. On each side of the body secure two of these vertical tapes. Cross tapes must then be very carefully applied between the vertical tapes, being stitched to the latter. At times the vertical tapes may have to be secured in places to the skin by means of sticking plaster, and it is here that the necessity of oiling or greasing the body will be appreciated, since the oil or grease film on the skin will enable the sticking plaster points of attachment to be varied and altered without painful pulling.

Having thus taped and criss-crossed the whole of the body between hips and neck, the entire structure is carefully cut into two longitudinal halves. Each half is then tried on to make sure of a comfortable fit. Whilst the tape structure is in position, it is lightly covered by stitching or pasting with a thin fabric or even with paper. One by one the tapes are cut away and replaced by stout wires so that, gradually, a sort of wire frame conforming more or less accurately to the contours of the figure is brought into being. The opposite side of the body is similarly treated. It will not be difficult now to join the two frame halves together to form a complete form for the body, and from the wire "skeleton" thus resulting, a papier-maché mould may be prepared by pasting or gluing newspaper sheets over the wires until an adequate thickness of paper has been built up. When dry, the newspaper form may be surface painted to give it protection and great stiffness. In this manner you will be able to create a "Judy" replica of the figure using a minimum of materials.

Modern establishments which do this work use a synthetic resin moulding material which is placed over a rubber-like, skin-tight garment worn by the "subject." Moulding material of this type is "Vinamold," manufactured by Vinyl Products, Ltd., Butter Hill, Carshalton, Surrey, but we do not think that you, even with the aid of an assistant, would be successful in working this method.

Soft Bromide Paper

I HAVE some soft bromide paper which is of little use to me unless I can get it to give similar results to normal paper. Is it possible to make it more contrasty, either by a treatment before exposure, or by an addition to the de-developer, or by an after-treatment?—F. R. Nunn (Derby).

WE presume that you are referring to the "soft" bromide papers of ex-Service origin, of which there are large quantities on sale. These materials are quite unsuitable for printing or enlarging from ordinary negatives, and it is quite impossible to alter the printing characteristics of a bromide paper. For example, you cannot by any simple immersion treatment obtain hard or contrasty or even a normal printing paper from one which has been coated with a soft emulsion. This is a fact which many people have found to their cost, and in our opinion these ex-W.D. "soft" papers should not be sold without some assessment and statement of their characters and potentialities. They require heavy, dense and contrasty negatives—the sort of negative which would be ideal for the old type of carbon or platinotype printing.

In the circumstances, all you can do is to give the paper a minimum exposure and a forced development with a strong M.Q. developer, but if the development is forced too greatly, the entire paper will "veil" with a greyish sort of chemical fog. Alternatively, you can print the paper as well as possible in the ordinary way and then reduce the greyish prints in a weak hypo-ferricyanide solution which will have the effect of increasing the contrasts. Such a solution is:

Potassium ferrocyanide, 50 grains; water, 1oz.

This is added to an ordinary solution of hypo (about 20 per cent. hypo solution) until the hypo solution is coloured a pale yellow. The greyish "soft" prints are placed in this solution and gently rocked therein for about 15-20 minutes until their contrasts improve. But by any of these expedients you will never get the good, clear results obtainable on contrastier grades of bromide paper.

Painting and Re-covering a Car Sunshine Roof

I WISH to re-cover the sunshine roof panel of my Standard 8 car and I also wish to change the colour to another shade of fawn to match the present finish. What kind of paint should I use for this purpose and where could I obtain a small quantity? A paint which would also improve the weatherproofing would be preferred. — C. J. Northam (Swindon).

THE car roof covering fabric consists of a stout fabric base surface impregnated with a transparent synthetic resin which has probably been heat-treated by running through hot rollers in order to give it greater stability and insolubility. We take it that you do not wish to apply a mere stain to the surface of this material but an actual paint. This would, of course, cover up the grain or surface pattern of the material, but, as you say, it would certainly improve its water-resisting qualities. You have a very free choice in this matter. Having got the material well fastened down, you can apply almost any type of paint, but it is most advisable that the paint should be of good quality, having good drying properties. We recommend two thin coats of any gloss paint of which latter there are numerous proprietary makes. It is not advisable to endeavour to cover up the grain of a fabric with thick paint application, because a thick paint coating would only tend to crack and to craze under the heat of the sun and, in consequence of sudden temperature changes. Start with one thin layer of good oil paint, as above recommended, and only give a second coat when you think the fabric is really in need of it. In other words, keep the paint coating down to a very minimum. No priming coating is, or should be, necessary.

A Correction

WITH reference to the query by W. B. Gilmore on reflecting telescopes which appeared in the July issue.

In the reply to (3) *Is it possible to use a convex parabolic mirror in place of the usual prism arrangement*, the answer should have read, "In both Cassegrainian and Gregorian types of reflecting telescopes, perforated primaries and small convex *or concave* secondary mirrors are used. . . ."

In the published sketches, for the Newtonian (left) read "1/40th of mirror area silhouetted by prism" *not* one-quarter. For the Cass. or Greg. (right) read "Convex or concave secondary mirror" *not* convex parabolic mirror. In neither case would the figure of the secondary be parabolic.

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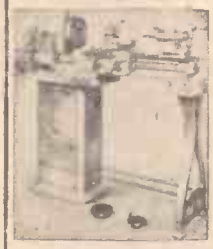

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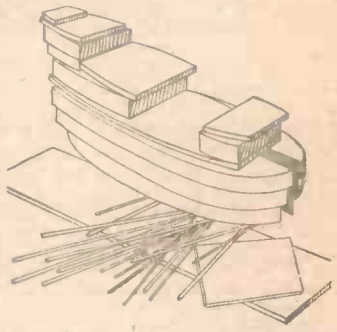

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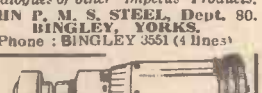

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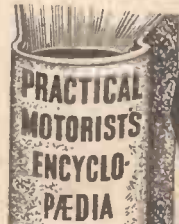

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THE Cyclist

Editor : F. J. CAMM

VOL. XXI OCTOBER, 1952 No. 365

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

Phone : Temple Bar 4363
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Comments of the Month

By F. J. C.

Minimum Charges for Cycle Repairs

THE National Association of Cycle Traders has recently produced a schedule of minimum charges for cycle repairs. These charges relate to labour only, for it is clearly stated that "all goods supplied will be charged extra." The object behind this list is to ensure that all cycle traders conform to the standard charges and do not cut prices. The only method of ensuring this would be to publish the list of charges or to have them prominently displayed in every cycle shop. There could then be no possibilities of one dealer overcharging, which is far more important to the cyclist. Whether a dealer undercuts or not is a matter of trade policy, but in the long run will benefit the cyclist. There is nothing like free competition to keep prices down.

Some may think the charges perhaps a little on the high side. For example, a complete overhaul of cycle, taking down, examining bearings, small new parts where required, correctly adjusting, greasing, lubricating thoroughly and completing will cost the cyclist £1 17s. 6d., or, say, 12½ per cent. of the cost of his machine. The basis of the charge is set out to make it appear to be a major job, but in reality the cyclist will find other charges tacked on such as replacing cone bearings and cotters. There is no definition as to what are "small new parts." To clean a bicycle costs 9s. 6d., and to dismantle it completely ready for frame repairs and enamelling, £1 11s. 6d. If a gear case is fitted there is an extra charge of 6s. 3d.; straightening the pedal spindle costs 2s. 9d., whereas straightening a crank (ordinary), "not removing," costs 1s. 3d. Surely no cycle repairer worthy of the name would straighten a crank without removing it because of risk of damage to the bottom bracket, etc.

To fit a new chain and adjust the rear wheel and brake would cost 3s., and to fit a new connecting link 1s. 3d. Some of the charges seem exorbitant, and will be honoured more in the breach than the observance; whilst in general we are in favour of standard prices for parts and for labour, we think the public should be made aware of those prices. The Ford Motor Car Company have had such a system in operation for years and owners know precisely what labour and spare parts will cost. Merely to publish a schedule of prices and not put it into the hands of the user, which is the best means of enforcing it, is to defeat its very object.

The World Buys British

NOTWITHSTANDING the competition of the Germans and the Japanese, bicycle exports have increased by over £2,000,000 during the first seven months of this year as compared with the corresponding period in 1951. The number of bicycles exported was 1,738,005. This is 151,666 more than during the first seven months of 1951. Bicycles alone brought in £14,518,426. The total value of the industry's export was £28,109,485.

The Tour of Britain

THE Tour of Britain passed by without any untoward incident, as was naturally to be expected, except by those carping critics who have been attacking it for years, and refuse to acknowledge that they are wrong. The two national bodies have been trailed at their heels, but now that the race is over the results must give them their quietus, for the race brought a large amount of publicity to the sport, and the trade is at long last veering round to the point of view that road sport of this type is better for it than secretive time trials. Let the time trialists run their sport in the way they like, and let others run theirs as they wish.

One has only to read of the enthusiasm for cycling sport in the early part of the present century to realise what can be done. The trade then took a great interest in road racing, and no doubt open road sport would have persisted but for the shamatuerism, trade rackets, and patent frauds which were practised in connection with it. Gradually rules were framed to clean up the sport, and if these have not entirely succeeded they have gone a long way towards it. Unfortunately in obliterating the rackets they have largely erased interest in the sport, which has been driven underground and remained there all these years.

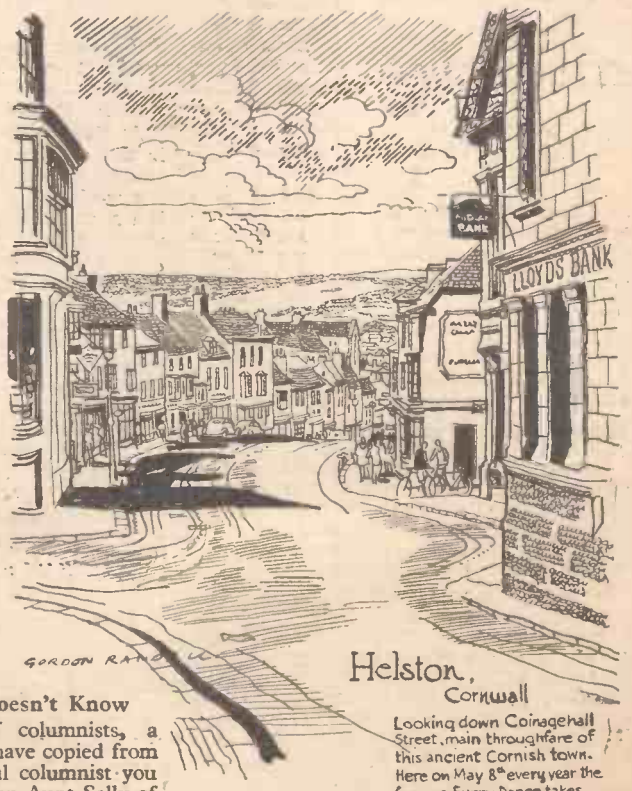
The public is now becoming cycling conscious, and if spectacular road sport continues to develop it must, in the passage of years, do to time trials what trade rackets did to road sport in the early part of the present century.

Time trialing will always have its followers, but now that there is a choice we fear that the young, eager, up and coming generation will prefer spectacle to secrecy. They will not wish to hide their light beneath the bushel of the R.T.T.C. with its plethora of rules which give the impression that every cyclist is a potential cheat.

Cyclists—By One Who Doesn't Know

THESE are the days of columnists, a stupid practice which we have copied from America. To be a successful columnist you pick on any old topic, make an Aunt Sally of it, shy verbal brickbats at it and generally show how knowledgeable and clever you are. A morning newspaper the other day allowed one of its columnists to deal with cyclists—always a good topic when there is not a fruity murder to fill the space. This particular columnist does not break forth into rhapsodic encomiums about cyclists. He thinks that they are pests apparently because they get in his way when he is motoring. Because of this he thinks that motorists should be allowed one cyclist a year. He thinks they constitute one of the major hazards on British roads, and he labels the female cyclist as the most pernicious, although he does lay tribute at the feet of the pulchritudes by referring to them as "the tasty dish with bright eyes, pink cheeks, ruby lips, and golden hair, wearing a pair of shorts and a light shirt." The Parthian shot is that they should be "banished completely, for she makes you take your eye off the road and your mind off the serious business of operating your motor vehicle."

This represents motorists as an impressionable and salacious lot. That there are cyclists worthy of criticism, as with all other types of road user, no one will dispute, but a general lambasting of the sort to which we have referred is unjustifiable.



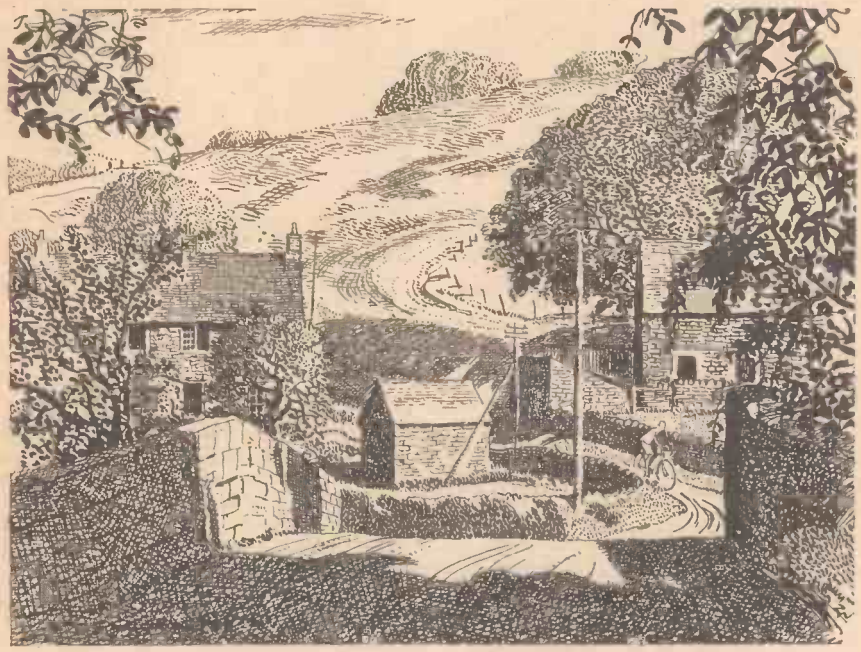
Helston, Cornwall

Looking down Coinagehall Street, main throughfare of this ancient Cornish town. Here on May 8th every year the famous Furry Dance takes place through the decorated streets.

Cycle Racing Gossip

A Monthly Summary

By W. J. MILLS



Entrance to Dovedale. The old bridge over the Dove by Thorpe Farm. The turning into the lovely dale is just past the bridge by the old Izaak Walton Hotel.

THE National Cyclists' Union's handling of international teams has come in for criticism year after year, as far back as I can remember, and this year is no exception. For the Olympic Games, all for the sake of four pounds to pay for insurance, the track team were sent out without a manager, to fend for themselves. Result—no gold medals for Britain. True, even a skilled manager may have made no difference, but the fact is that we had the raw material in the shape of riders and a good manager might have turned that into something better.

Then, in August's world's championships, the British road team were quartered 26 miles away from the racing circuit. The only time they went round the course beforehand was in a car—fine preparation for a 25-miles-an-hour world's championship race! At the finish, Brian Robinson, of Huddersfield. was convinced that he had finished eighth. British officials agreed. International officials, after studying a film of the finish, failed to mention Robinson at all.

Why no N.C.U. protest and a full enquiry?

* * *

SUCCESS of the *Daily Express* "Tour of Great Britain," the 1,470 miles road race which finished last month (September 6th) has been the last straw which has tipped the N.C.U. scales into full-out support for road racing, and, they hope, an amalgamation with the "rebel" body, the British League of Racing Cyclists.

Obviously, we cannot tolerate a "split" for ever, and all that remains is for a "face-saving" formula to be evolved so that both sides can say, "we've won."

The rank and file of cyclists are heartily fed up with the ten years' old war between the rival unions; the *Daily Express* has proved that road racing is not only safe and practical, but also, properly presented, a major attraction. The N.C.U. wants to get in on the band wagon, the B.L.R.C., having proved their case, want to stay in supreme command.

A clash of personalities does not help; after all, major officials of both bodies are not prepared to relinquish their jobs. But a solution must be found, and found this winter.

* * *

WOMEN cyclists, if we are to judge from their "chief," Mrs. Evelyn Stancer, president of the Women's International Cycling Association, are demanding international recognition.

At the present time, this is rather a cry in the wilderness. There are no women's cycling events in the Olympic Games, or in the world's championships, and, until there is a flourishing women's branch of the sport in many countries there never will be.

Here in England we have a small, but highly organised, women's section of cycle sport. We have riders of the calibre of Eileen Sheridan, the Hercules professional, who is, on time alone, not far behind the major male professionals. But, numerically, the women are very much in the minority. Japan and Russia have full strength in women's cycling, but the European countries who control the international voting, are not so interested.

The W.I.C.A., formed in England, has not yet achieved world-wide recognition. The girls have some remarkable performances to their credit, especially in long-distance road records, but as a public spectacle—well Herne Hill promoter, Johnnie Dennis, summed it up when he said, early in 1952, "No women's races at any major meeting."

* * *

OCTOBER is the month of cycling hill climbs. As you know, these are mostly dashes of a few hundred yards up a 1 in 6 slope. Does this really prove anything? Why not hill climbs of a mile or two, for example, the climb up the south western slope of Hindhead?

That enterprising club, the Charlotteville C.C. of Guildford, once tried to lay on such a hill climb, only to have it rejected by the controlling board, the Road Time Trials Council. But I maintain that a mile long climb is the real test of a cycling hill climber . . . a 400 yards dash means nothing, and when you add in the hazards of a patch of wet leaves just in the wrong place on "agony corner," winning a hill climb is just as much a matter of luck as strength.

Of course, the ideal would be a ten miles steady climb up a real mountain pass . . . but we have no such climbs in this country.

* * *

Johnnie Dennis, the ex-journalist, who took over command of Herne Hill track, on behalf of the N.C.U., is by no means satisfied with 1952 attendances. He has worked hard to build up a steady public, but the crowds just decline to come.

The season as a whole will show a profit, he thinks, but this is not enough. He wants to see a regular 10,000 crowd, instead of the usual 3,000. Solution? A mid-week meeting, he thinks, instead of the customary Saturday afternoon. This means an evening fixture, and inevitably, floodlighting. Now, artificial lighting always enhances the thrill of any sport . . . but floodlights would cost at least £3,000. Would it pay?

I agree with Dennis when he says that Saturday afternoon meetings have had their day. The average cyclist prefers to spend his week-end away from London. A first-class evening meeting, with floodlighting, would, I am sure, pull in the crowd.

With floodlighting, why not a revival of the Polytechnic 24 hours tandem paced race? This was a big draw in pre-war years. Motor racing at Goodwood, as in the recent 9 hours' race, has proved that crowds like their sport in the dark.

* * *

Japanese cyclists who came to Europe for the Olympic Games and the world's championships went back empty handed, as far as titles are concerned . . . but with brief cases packed full of detailed specifications of continental racing bicycles. M. K. Kitazawa, vice-president of the Amateur Cycling Federation of Nippon, spent more time photographing racing bicycles than he did in snapping the efforts of his team!

Jap threat to world markets is already admitted by the leading British makers, in so far as the utility cycle is concerned. If the Japs start turning out racing bikes up to a sufficient standard then we can really start getting worried!

As riders, however, the Japs were no worry to any competitor. Surprising this, because cycling is quite a major sport in Japan. Their principal races are the Japanese championships, on road and track, the University championships, and the Tokio to Osaka road race, 1,000 kilometres (620 miles) in five stages.

Their two best riders are K. Tomioka, road champion of the Asiatic Games, and T. Kato, a 17-year-old sprinter.

Expert copyists that they are, the Japs can be counted on to turn out replicas of our best racing machines. Fortunately you can't duplicate, by machinery, riders such as Reg Harris!

AROUND THE WHEELWORLD

By ICARUS

"What is a Musette?"

IT was too much to hope that my reference to the use of the word "Musette" as referring to a cycle bag would pass unnoticed. In general, I am averse to importing into the English language foreign words when there is a word in our own language which would suit. I dislike the modern tendency towards so-called "Continental" fittings and bicycles, the presumption being that they are superior to British which they certainly are not. English bicycles and English fittings are superior to any others in the world, and the fact that the "Continental" fittings may be different does not make them better.

However, several readers have written to me regarding the musette. Apparently the word is derived from the Greek Muse, the goddess of song, music and poetry. The musette by continuation became the word used to describe the container of musical sounds such as the bagpipe, if we admit that the bagpipe is a musical instrument.

A French dictionary gives several definitions, one of which is "a cloth bag which is hung on a horse's head to serve as a nose-bag for food; a cloth bag carried by soldiers to hold their provisions; a cloth or leather bag in which tools or different instruments are carried; a child's school bag."

From this it is clear that the word can be used to describe a cycle bag. But why do we wish to use it ? It has only recently crept into use over here. Is it only used by those cyclists who like gaudy bicycles, with Continental fittings ? Of course, an English word would hardly do for *them*. However, my grateful thanks to Mr. S. J. Sears, of Algiers, to Mr. Thomas A. Lewis, of the Thorne Paragon C.C., and others, for writing to me on the subject.

A Japanese Bicycle

THE photograph on this page, which has been sent to me by Mr. G. S. Campbelton, of Singapore, shows a bicycle made in Japan, and which is being sold in Singapore. It is adjustable for juniors or adults to ride, and it is also made to fold up so that it can be easily carried on bus or train or packed into a suitcase. It weighs 30lb., using 14in. wheels and 1¾in. tyres. The price is 120 dollars *less* 10 *per cent. for cash.* German junior cycles sell at 100 dollars less 10 per cent. ! Of course, the idea of the folding bicycle is not new ; it was first introduced into this country many years ago and was resuscitated by B.S.A. during the last war for military purposes. These machines will not, of course, reach the English market. Incidentally, those who are most anxious to press for higher wages in the engineering industries, of which the cycle trade forms a part, should not buy foreign goods, not even Continental fittings. They should buy British, which are higher in price because we pay proper wages in this country.

A Britisher who wants high wages and then buys foreign goods is helping himself along the road to unemployment.

Stallard Resigns from B.L.R.C.

PERCY STALLARD writes to say that in resigning as a founder and life honorary member of the B.L.R.C. some explanation is necessary. His explanation takes the form of a criticism as well as an apologia. He thought that following last year's Tour of Britain when riders ran off the course some attempt would be made to prevent a recurrence and to institute control of the following convoy. He says that his hopes have not materialised, "as complete control of everything appertaining to the event was placed in the hands of one person. He had supreme power, even to the extent of inviting foreign teams, making rules for the event, and nominating officials. It was the exercising of these powers that brought about my decision to resign. After the 'Warsaw-Berlin-Prague' I was asked by the President of the East German Cycling Body if I could obtain an invitation for them to compete in the Tour of Britain. This information was conveyed immediately upon my return to Mr. D. Peakall, promoter of the Tour, on behalf of the B.L.R.C. He informed me that an invitation had already been given to West Germany and therefore East Germany could not be entertained. I suggested that in view of the hospitality we had received

The Japanese twin-purpose bicycle.

from East Germany in the 'Warsaw-Berlin-Prague' his action was in exceedingly bad taste and detrimental to the League's interest, and to avoid political implications it would be much better to invite both or none.

"Based upon my experience of cycle racing in nine different countries, I submitted 16 recommendations for the consideration of Mr. Peakall, but not one of these was considered worthy of being adopted in the form submitted.

"Although I had already spent three and a half weeks on the 'Warsaw-Berlin-Prague,' I felt that in view of the importance of this year's Tour of Britain to the B.L.R.C. it was my duty to volunteer my services for a further two and a half weeks in an effort to prevent a recurrence of last year's Scarborough-Nottingham stage. My offer to act as Assistant Director of the Course was accepted without enthusiasm, and under these circumstances it was not surprising that instead of the two open cars and four motor-cycles which I insisted were essential to control the race efficiently, I was offered a saloon with no guarantee of motor-cyclists. As I consider it quite impossible for any person to control a race on the scale of the Tour of Britain under such conditions, I was forced to withdraw the offer of my services.

"Whilst I regret having to resign from the organisation, my resignation means nothing beside the disaster that can come to the B.L.R.C. by its refusal to use the experience available, or learn anything from last year's mistakes."

I think Stallard has made a mistake in resigning. If you believe in an organisation and feel that something is wrong with it, stay in and fight; you cannot rectify the trouble once you have resigned. Resignation merely gives unwanted publicity to grievance and achieves nothing, except to bring damage to the B.L.R.C. at a time when its differences with other bodies are likely to be resolved.

B.L.R.C.-N.C.U. Settlement Next Year?

AT the recent Congress of the Union Cycliste Internationale there was very little discussion about the B.L.R.C., but considerable concerning the position of the N.C.U. because of the admittance of unlicensed Continental riders in the recent Tour of Britain. The General Secretary of the U.C.I. stated that the president of the N.C.U. had made a personal appeal to the U.C.I. not to allow discussion on the differences between the two rival English bodies, and he expressed the view that by the next Congress there would be a final settlement between the two.

Eileen Sheridan

EILEEN SHERIDAN continues to wipe records off Marguerite Wilson's slate, and her beating of the Liverpool-Edinburgh W.R.A. Record shows her to be a superior rider. It must be remembered that Miss Wilson made or broke records at a time when there was little to beat, and so in some cases she achieved the records easily.

The Liverpool-Edinburgh route is undulating but with many steep hills. Eileen's time was 10 hrs. 9 min. Frank Southall in 1935 took 10 hrs. 12 min. over the route, so Eileen has knocked three minutes off this great rider's time. I expect Eileen to do great things within the next year, and eventually to corner all the records.

The N.C.U. and Cycle Traders

THERE are about 17,000 cycle traders in this country, and each of them has received an invitation from the N.C.U. to act as agents for their Associate Traders' enroller scheme. This scheme was originally formulated in 1931 with the object of ensuring for the utility rider the benefits of membership. It is proposed in some of the more populous areas to organise N.C.U. Centre Meetings so that local retailers can be instructed on the details of the scheme. The retailer, of course, profits from the scheme. Associates pay 4s. a year and in return receive legal and third party insurance benefits. It is hoped that once the Associate is introduced to club life that he will become a full member and take a greater interest in club affairs.

The Cycle Show

HER MAJESTY THE QUEEN has graciously consented to be Patron of the Cycle and Motor Cycle Show at Earls Court from November 15th to 22nd. The Duke of Edinburgh will open the Show on Saturday, November 15th, at 11 a.m. The exhibition once again spans two Saturdays, and all the portents are that it will be well attended. Although cycle sales in this country have in the past year shown some decline there is now evidence of a revival.

Improved Cycle Lighting

A Method of Using Accumulators in Conjunction with a Dynamo

By P. J. PULLAR-STRECKER

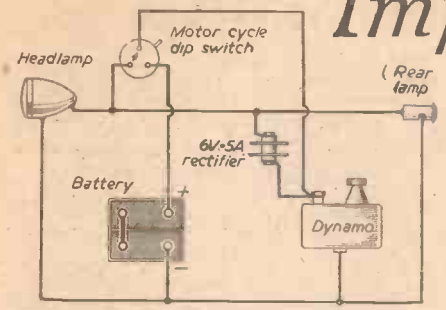


Fig. 1.—Stationary light for use with a dynamo.

THE ever-increasing cost of dry batteries is compelling the habitual night cyclist to look for some method of illumination other than the simple dry battery lamp.

The cycle dynamo is now the most generally popular method of providing the necessary power for lighting, but it also requires a small dry battery for use when stationary in towns and difficult traffic conditions where frequent stopping without lights would mean disaster.

The lighting problem is especially difficult for the motor-assisted cyclist who requires more powerful lighting than that available with the cycle dynamo on account of his higher speed and need for number-plate illumination. It is also difficult for the light-weight cyclist to whom the resistance offered by a cycle dynamo is a serious hindrance.

The use of accumulators can overcome all these drawbacks. Used in conjunction with the ordinary dynamo to give a good light for use when stationary, accumulators provide a battery which is powerful, which can be charged from the dynamo while running, and which will provide full power running lights in the event of the breakdown of the dynamo. For the motor-assisted cyclist the accumulator may be charged continuously while running, and used at night to provide more powerful lights than those possible with a dynamo alone. For the light-weight cyclist, accumulators form a battery which will provide powerful lighting without the resistance of a dynamo, and which can be maintained much more cheaply than a dry battery by occasional charging from the mains.

The Accumulator

For this kind of work the nife accumulator has overwhelming advantages over the more common lead-acid type. The most important advantages here are: 1. The nife accumulator is usually smaller and considerably lighter than the lead accumulator of the same capacity. 2. It is built to withstand vibration. 3. It is made of steel and is very robust. 4. It is not harmed by overcharging. 5. It will hold its charge for long periods when idle.

The nife accumulator is unfortunately expensive initially, although its length of life and lack of need of attention make it more economical than the lead accumulator in the long run. They can, however, be bought on the surplus market from a few dealers in surplus radio components. The most suitable ex-Service type of accumulator is a unit made up of two cells connected in series. The connection is made by means of the outer case which is provided with a rubber sheath to prevent short circuiting the cells when several units are used together. The voltage of each cell is approximately 1.3 volts, making the voltage of the unit 2.6 volts. The capacity of each unit is about 15 ampere hours. Two of these units in series, although giving only 5.2 volts, make a battery which is quite suitable for running 6-volt bulbs. The electrolyte used in nife cells consists of a 1.19 specific gravity solution of potassium hydroxide (caustic potash) in distilled water. This should be prepared accurately and exposed to the atmosphere as little as possible since it absorbs carbon dioxide which quickly makes it useless. The specific gravity of the electrolyte remains constant and gives no indication of the state of charge. It should be changed annually and each cell should be well rinsed with distilled water. The level of the electrolyte in each cell should be maintained by the addition of distilled water from time to time. As considerable gassing takes place during charging, nife cells are nearly always fitted with valves which allow gas to escape, but do not allow carbon dioxide to enter. In the type of ex-Service unit described, this valve has been made simply by drilling a few holes in the sides of the filled cap and covering them with a rubber band. The filler cap is incorporated in the terminal of each cell. It is important to see that this rubber band is seated correctly, and that no holes are left exposed to the atmosphere.

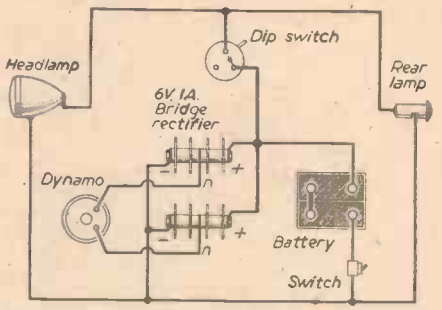


Fig. 2.—Lighting system for a motor-assisted bicycle.

A Stationary Light

The output of almost all modern cycle dynamos is alternating current. To make this suitable for charging the accumulator, a rectifier must be connected between the battery and the dynamo. This also serves the purpose of minimising the discharge of the battery through the dynamo without the use of an expensive cut-out.

The circuit is arranged so that the full power of the dynamo can be used for lighting when travelling at low speeds, and the batteries can be brought into operation at high speeds and when about about to stop, for charging and lighting respectively. This is effected by a single-pole double-throw switch (e.g. a motor-cycle dip switch) on the handlebars, which isolates the battery when not in use. The battery supplies power in place of the dynamo, i.e., to the head-lamp and the tail-lamp. Where the head-lamp is of the type designed to accommodate a dry battery, a low power 6-volt bulb may be exchanged for the existing pilot lamp, and the lead to the headlamp and the lead to the dynamo joined together at the head-lamp. The battery position of the headlamp switch now provides a dip position which is useful for saving the power of the battery during long stationary periods.

For the Motor-assisted Cyclist

For the motor-assisted cyclist, accumulators are used to augment the supply of electricity from the dynamo, permitting the use of larger bulbs in the head- and tail-lamps. Since the batteries are charged continuously while running, it is preferable to use a hub dynamo for this type of lighting.

Full-wave rectification is used as it is never necessary to supply the lamps directly from the dynamo. A switch is fitted on the handlebars to control the lights, and a second switch is included on or near the battery box to take the accumulators out of the circuit while the cycle is not in use. This is necessary because there is a slight discharge (a few milliamps) through the dynamo in spite of the fact that rectifiers are used.

For the light-weight cyclist, accumulators are simply used as a rechargeable battery to operate the lights. The lamps are controlled by a switch on the handlebars which isolates the batteries when they are not in use.

To charge the batteries from the mains, a 6.3-0-6.3-volt radio transformer may be used together with a full-wave rectifier. The filler caps should be loosened during rapid charging to allow the gases to escape freely. The rate of charging should be reduced if the temperature of the cells rises above 95° F. Charging should be continued until the voltage of each cell remains steady at 1.75-1.8 volts for at least two hours.

A battery made up of two of the ex-Service units described is used for all the above lighting arrangements. The overall measurements of the battery are 4½in. high x 3½in. wide x 3in. thick. The battery can be mounted in any convenient position, but it should normally be upright, or almost so. A good position is underneath the junction between the crossbar and the saddle post, or behind the saddle, e.g., in the saddle bag. The rectifiers used should be of the selenium metal type. These may be obtained from most dealers in radio components. For the circuit shown in Fig. 1, the stationary light first described, a 6-volt, ½ amp., half-wave rectifier is used. The black or green terminal is connected to the dynamo, and the red terminal to the lead joining the rear lamp and headlamp. For the circuit recommended for the motor-assisted cyclist (Fig. 2) a 6-volt bridge rectifier with a capacity of ½ amp. in each section should be used. The green terminals are connected to the terminals of the dynamo, and the two red terminals are joined together and connected to the battery. The two black terminals are joined to the frame. In this circuit a dynamo designed for a frame return system must *not* be used. Only a dynamo which is insulated (electrically) from the frame can be used. In the last circuit, Fig. 3, a radio heater transformer, centre tapped, is used. The secondary of this has three terminals. The outside two (marked "6.3. v.") should be connected to the two green terminals of a 6-volt full-wave rectifier. The red terminal should be connected to the positive terminal of the battery and the voltmeter. The centre terminal of the transformer (marked "O") is connected to the negative terminal of the battery and voltmeter.

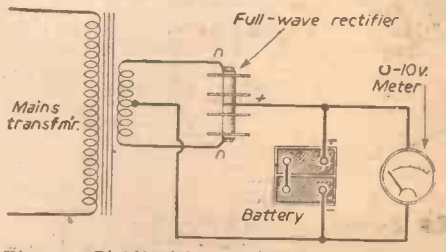


Fig. 3.—Circuit for charging the accumulator from the mains.

Wayside Thoughts

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

Claremont House, Esher, Surrey. House and gardens are open to the public.

The Old Stagers

THE other week I looked on an old bicycle with more than twenty years of riding in it, and thinking what a shame it was to neglect its excellence, I brushed the dust away, gave it a dose of oil, blew up the tyres and away we went. It is perhaps a bit old fashioned in its outline and equipment, its inherited lever brakes and patched celluloid guards, but for running quality there is nothing better in my ownership. And it is remarkable how neat it emerges from many months of neglect, due I'm sure to the all-black finish quite popular in the day of its building but now, I suppose, gone for ever. It was made for me in 1931 and went on tour to Scotland within a week, and goodness knows how far it has been since. Being curious I looked up the bill, which was £11, being a special price charged by an old trade friend of mine who has since retired. He has given up work, but one of the results of that labour still goes on, and so far as I can determine goes on as purringly as when I first pressed its pedal; and remember, I have the very best of the moderns with which to compare it. The thought has entered my head to give it to some deserving youngster, but after this further association I think selfishness will win; for after all I'm not sure a gift of such a bicycle would be appreciated as such a bicycle deserves to be. No, we yearn for plate and colour, for festoons of brake wire and flimsily built pedals with scarce a foothold to them, and if the generous mood overtakes me and the deserving case arises, I think I would rather part with a modern machine than this old mile collector that has carried me so gaily for many thousands of miles.

The Old Neglect

IT happened again in mid-May on a rough morning with rain streaking into the lap of my cape. I was on the way to work quite happily contented with my slow progress when one of my numerous car owning friends passed me, stopped until I had overtaken, and then very kindly wanted me to park the bicycle and go to town as his passenger. I assured him I was quite happy, perfectly dry, liked to feel the rain on my face, and by so progressing had a vehicle on which to return home in my good time. "You're incorrigible," he said, "but I wish I could do it." If I like to ride a bicycle far more than I like to drive a car, surely that is an individual choice with which no one should quarrel. I think many people take the line of least resistance in the first instance because car passage is more impressive and flatters their sense of importance, and it is only later in life they find out the error. Add to that notion the streak of laziness in most of us, and fundamentally you have the answer that cycling is "not the thing" among the type of folk who can, or think they can, afford a car. And yet these same folk tell me—and I know dozens of them—how lucky I am *to be able* to ride, and what a fool I should be to give it up. I agree, but *to be able* is the governing phrase, and one which ought to be in the minds of the younger generation. The certain way, perhaps the only way, is to keep on riding no matter how rich you become, and thus in preserving vitality—gently, serenely and surely—you automatically preserve health, and a kind of individual happiness that wraps you in satisfaction. Sometimes I feel it is shocking taste to give such a testimony to my own way of life, it smacks of the superior in all but the ingredients; yet how else can I promote the goodness I find in cycling? For if a man writes of his interests in finding them so excellent a way of life, he must write from conviction and often wonder why so few elderly people miss simple things that are so good. I can only tell you this is so from my own experience, and wish there were more of us to publicise the genial fascination of cycling.

A Change from Habit

WHEN I promised rather more than a year ago to take my daughter touring in Ireland, if she came on a bicycle, I had not reckoned on her enthusiasm for the different scenes and characteristics of that land and its people. She had been talking, so that at Christmas time another lady member of my family asked me why she was cut out—her words—of the pilgrimage. "All right," I said, "get cycling fit and we'll make the affair an occasion." Since then little troubles have intervened due to breakdown in bodily structure, and I was reminded in early Spring that "a promise was a promise so why not go in the car." It was certain this lassie could not ride a bicycle over the roads I wanted to travel and —well, what would you have done? So I have spent the greater part of June touring Ireland in a car because I made a promise, and the original conditions of it were altered by illness. Yet in a way I'm not altogether sorry at the upshot, for it proved to many friends that car travel for me is not so much prejudice as a means to take the lame over ways and into areas I have known as a cyclist since my first visit to Ireland in 1898. I went cheerfully, the only way to fulfil a promise, and at times tried to remember that motoring moderately may be the next best thing to cycling.

Service for the Future

ELDERLY cycling means the kind of travel that makes for ease without any undue effort and is in no hurry to roll away the hours. We are not all built this way or the crowded cyclists on the road would be a still greater "trouble" to other users thereof; but there must be many hundreds of thousands who could be like this, if they would, and be the happier and healthier for it. Many don't want to now; they are content to look on and be wheeled around under power, but the day will come to such when they will regret their loss of genial activity and be sorry. Some won't ride a bicycle because "it isn't done"—they are the snobs with too much money and too little sense; but there are thousands of others with a good bicycle and the ability to ride it quietly for 60 miles, who just do not take the trouble to make a discovery for themselves and use it for their joy.

Let us persuade the older folk at a loose end to take up cycling, and urge the present young people never to give up their grip on the pastime that can serve them so well when the glory of winning or losing has departed.

The Right Bicycle

IF an individual decides to take to cycling as an expression of genial travel undertaken easily, then let him or her select a bicycle for that purpose. Not a great unwieldly thing hung about with gearcase and odd gadgets, but a lightweight mount modified to fit the rider. Eschew narrow tyres for 1⅜in. size, but let them be open-sided and see they are fully inflated. Don't despise a slightly dropped bar, it gives you a restful position against a wind or on long slopes; and be sure the saddle is comfortable by being big enough to really lean on. Those skimpy seats the lads revel in, mainly for lightness, are not for the like of us who need comfort as the first consideration. As for gears, let the hub or derailleur be a four-change with a normal ratio of 60in.—yes, 60in.—with a 75in. and a couple of lower ones at about 51in. or 39in., and then you will discover how delightful it is to stroll uphill. The art of cycling is greatly concerned with pedalling, and if you can get 12 an hour out of a 60in. gear and be comfortable you have gone a very long way towards easy cycling. Twelve an hour is all you need, except down hill, while if you average nine to ten an hour on a riding day it is remarkable how the miles pile up without wearying and what you can see on the way. Cycling properly practised is not the joy of the first hour, but the conservation of that joy at the sixth or seventh hour of riding, and when that is attained—and it can be done by anyone of normal powers—you are a cyclist, a freeman of the road, a surveyor of the finest countryside under heaven, and the owner of an enjoyment unsurpassed.

CYCLORAMA

By H. W. ELEY

October Charm

MOST out-of-doors men love this mellow month of October. It is often grand and lovely, and my records show that I have had, in the past, some great rides during this month, when the blackberries gleam in the hedgerows and the woodland trees are at their lovely best. What tints and hues greet one in the English countryside now that October is here! Tawny browns, and golds, and russets . . . all making a matchless panorama on the hillside, and reminding us that Mother Nature is still supreme with her palette and brush.

In the silent wood there is a carpet of brown leaves; the grey squirrels slip quickly up the smooth trunks of the beeches and, as I enter a quiet glade, a gaudy jay darts by, squawking with raucous note. And in the warren over by Great Oaks Farm the rabbits are at their best.

"The Cyclist" in California

RECENTLY I had a long and most interesting letter from a gentleman in far-off California. He is a regular reader of *The Cyclist*—and tells me that he is a "pen pal" of veteran F. J. Urry. My correspondent, whose forefathers sprang from English soil, plans to come to the "old country" this "fall"—and plans also to buy a bicycle so that he can travel the roads of England and *see* some of the scenes and places I have from time to time tried to describe in these notes. If and when he comes to Derbyshire he is assured of a warm welcome, and I will do my best to show him some of the beauties of this shire where the stone walls intersect the fields and where the gentle River Dove, most exquisite of English rivers, flows amid the fern-covered rocks and boulders. Maybe, in some old church register, the "Man from California" will discover traces of his English ancestors!

"The Good Old Days"

IN these times of shortages and rationing complications it is not infrequent that one hears sighs for what are usually called "the good old days." Well, I suppose that in many ways they *were* good, but not, I am afraid, in every respect! Along with the plenteous food (those noble sirloins of beef are often quoted!) there was dire poverty, and cheek-by-jowl with opulence in our big cities there was acute distress and suffering. The punishments inflicted in the good old days were grim indeed, and I was reminded of this fact when I saw the ancient "whipping post" at Havering-atte-Bower, in Essex, recently. Still preserved in some of our villages are the "ducking stools" of yore—reserved for poor wretches suspected of "casting the evil eye" and other mysterious forms of witchcraft; and do not forget the "Gallow Trees"—there is one still to be seen at Inkpen Beacon in Berkshire. These grim reminders of the past indicate that the "good old days" were not all so happy and carefree as some would have us believe.

The Big Bell

I WAS much intrigued recently to read of the success of a Birmingham manufacturer of bicycle bells in America. It appears that this manufacturer is a great believer in visiting export markets in person to ascertain the precise requirements. It is an excellent idea, and I suspect that in the past far too many British firms have adopted the attitude that the man overseas should be satisfied with what the home manufacturer thinks he should have and like. This Birmingham industrialist found that in the matter of cycle bells our American cousins liked a *big* bell and a *loud* bell. He set out to make such, and the result has been a big volume of orders to the benefit of export trade and to the benefit of all the employees in this Birmingham factory. It is good to know that the small accessories in the British cycle trade are as welcome as the complete bike! May more British firms succeed in "ringing the bell"!

It's not ALL Black!

EVERYONE has heard of England's "Black Country"—that scarred industrial belt of South Staffordshire where the grime of coal-getting spreads like a dismal pall over the land, and where places like Tipton, and Wednesbury, and Darlaston, and Tividale, tend to repel because of their murky grim faces. Yet all of South Staffordshire is not black and ugly, and quite near to the pits and slag heaps there are bits of pleasant verdant land as green and inviting as any in England. Kinver Edge, near Stourbridge, is still lovely, and there are other spots which I know have been left unspoiled by the scarring hand of industry. It may seem strange to suggest a "Black Country" tour . . . but why not? He knows not England who only knows sunny Devon and leafy Warwickshire, and the glories of the Lakes; and these places in the "Black Country" have a character all their own. Tradition and craftsmanship are woven into all the "trades," and it is quite fascinating, for instance, to visit the chain-making industry at Cradley Heath. Yes! In the very shadow of the red forges there is green beauty and loveliness, and it is a libel on South Staffordshire to say that it is all grim and repellant. Ancient history is there, too, for Dudley Castle still stands as a reminder of days before coal was found in this part of our land.

Road Safety

THIS year has seen all sorts of activities launched in connection with road safety, and I see that the Pedal Club at one of its meetings invited five cycling M.P.s to attend and enter into a discussion about ways and means of promoting safer road travel. I note that Miss Elaine Burton, who is the Member for Coventry South, had something to say about women's cycling garb, and advocated the universal wearing of shorts, and condemned skirts. Well, I do not myself see many women riders in skirts these days and, in fact, one of the good things about modern cycling is the freedom achieved in connection with clothes. I look back a long way and see again those irksome cycling clothes of the '90s, and contrast the styles then with the easy, free and attractive garb affected by the woman rider of to-day. Mr. Tom Fraser, the Member for Hamilton, suggested that big lorries should be banned from roads from 25 to 28ft. wide, the goods going by train instead of lorry. A somewhat shattering remark came from Mr. G. H. R. Rogers, North Kensington's Member, who admitted that when he got into a car he became "a fiend in human form"! This is strong language, but we cyclists have always had a sneaking idea that "something happens" to a man when he becomes a motorist! The pedestrian and the cyclist become "nuisances"—to be hooted at as if they possessed no "road rights"! Road safety is still one of the vital issues facing this country, and much has still to be done before we can be complacent about accidents on the rolling roads of old England.

Holiday Memories

DURING the summer I was happy to receive several cards from cyclists away on holiday tours. It was good to be remembered in this way. Some of my "pen friends" had selected sunny southern rides and I received views of notable spots in Devon and Cornwall, and Dorset and Sussex. Other riders sent me views of northern beauty spots, and quite a few had chosen to tour in Yorkshire and Northumberland. All the brief comments indicated happy hours in the saddle, and the charm and freedom of the open road. Thanks to all—who, at some wayside inn, took the trouble to mail me a card of greeting!

Published about the 30th of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, Strand, London, W.C.2, and Printed in England by W. Speaight & Sons, Ltd., Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand—Gordon & Gotch (A/sia), Ltd. Sole Agents for South Africa—Central News Agency, Ltd. Subscription Rate (including postage): For one year, Inland and Abroad 14s. (Canada 13s.). Registered at the G.P.O. for transmission by Canadian Magazine Post.

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