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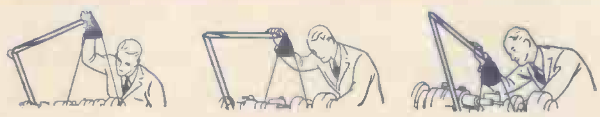
EDITOR: F. J. CAMM

NOVEMBER 1954



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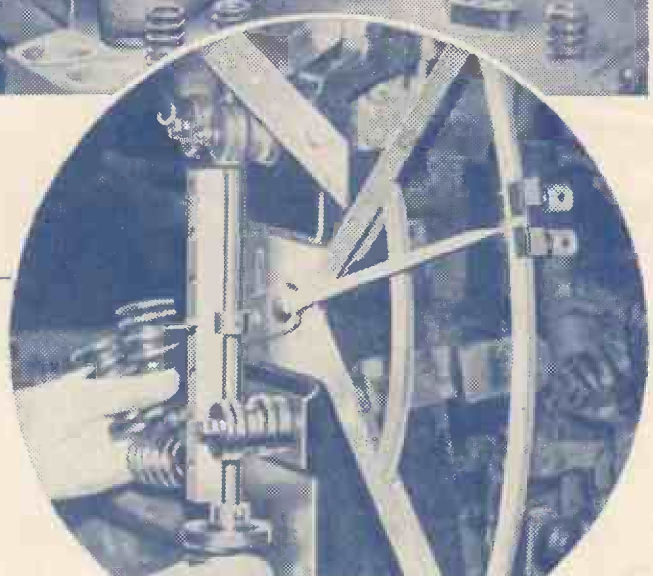

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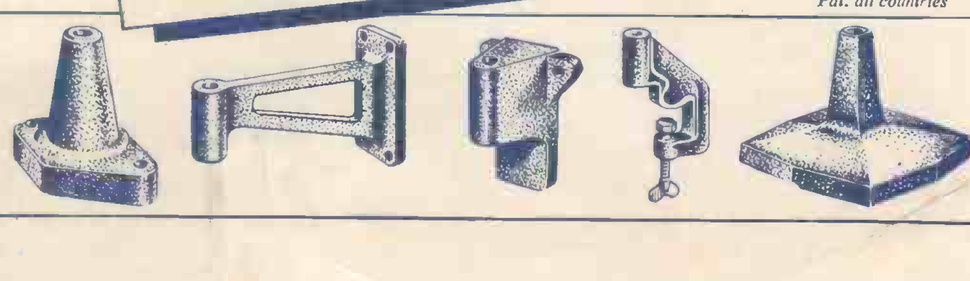

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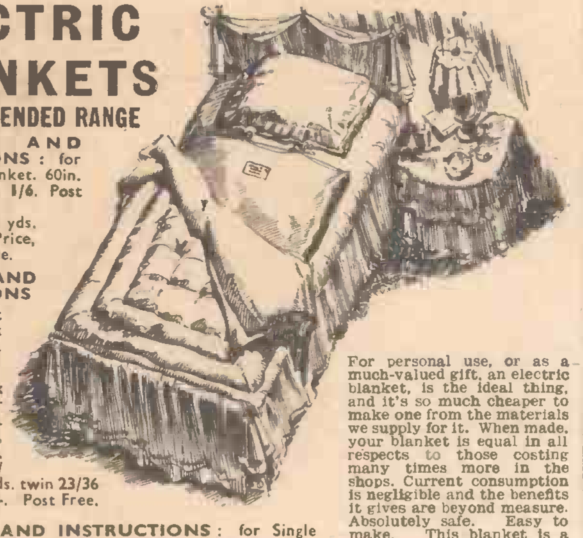

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PRACTICAL MECHANICS

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

VOL. XXII. No. 251 Editor: F. J. CAMM NOVEMBER, 1954

FAIR COMMENT

By

The Editor

The Flying Bedstead

THE information recently released by the Ministry of Supply concerning the Flying Bedstead, experimentally produced by Rolls-Royce, Ltd., indicates the trend in jet engine performance towards higher thrust-weight ratio, and the possibility it offers for the eventual development of aircraft capable of taking off and landing in a near-vertical flight path. The practicability of this has long been recognised and this test vehicle was built to examine the basic control problems. No attempt was made to develop special engines for engine development is a lengthy business. Instead, the simplest and lightest framework was built which could use existing engines. The choice was limited by the engines available and by the need to have sufficient reserve thrust to carry a pilot and adequate fuel for a reasonable running time. The machine is powered by two Rolls-Royce Nene engines set horizontally in opposition, one on either end of the framework. The jets from these engines are ducted through 90 deg. so that both engines discharge vertically downwards under the centre of gravity. This is a favourable arrangement for balancing the device and eliminates gyroscopic effects. The pilot sits on a platform above the two engines. The control moments which he needs to balance the machine are supplied by compressed air jets, which are discharged through nozzles at the ends of cross-arms. The air for these nozzles is bled from both engines, and the pilot, using a conventional control column and rudder bar, regulates the flow through the nozzles. In this way he provides the pitching, rolling and yawing moments which he requires.

In the initial tests, in order to safeguard the machine and the pilot, the "flying bedstead" was tethered to allow it only the limited freedom of a few feet of movement. With increasing experience and confidence the freedom permitted was increased. On August 3rd, all check wires were removed and the machine, piloted by Captain Shepherd, took off at Hucknall for the first time in free flight. It remained airborne for nearly ten minutes and during this time it moved about over the ground under the pilot's control at heights of from 5 to 10ft., returning finally to alight at its starting point. For subsequent flights it has been flown free at heights up to 25ft.

A great deal of investigation and development remains to be done. For example, the problems of heat, noise, safety and the design of the most efficient engines and an airframe to employ this principle have all to be tackled and solved.

Selenium

THE ability of selenium to rectify alternating current is used in radio communications, broadcasting, domestic radio and television receivers, electrolytic processes and radar equipment, and in a variety of photo-electric cells. It is also used as a decolouriser in glass-making and, strangely enough, as a colouring agent in the plastics industry. The expansion of the electronics industry during and since the war has resulted in a shortage of selenium. There is no known deposit of selenium which is worth mining.

The element occurs with sulphide ores and most of it is obtained as a by-product of copper refining. In the electrolytic refining of copper a slime (anode slime) is formed which contains a fairly high proportion of selenium. The U.S.A. is the biggest producer of selenium, all of it from this process, but its supplies are still not enough for its own industry and it has to import more of it. Most of Great Britain's supplies of selenium come from Canada, again from copper-refining plant. There are small quantities of selenium on the market which come from Sweden and Japan, but these are high-priced.

There is a possible source of selenium in this country which is now being investigated by the Chemical Research Laboratories, and as far as can be seen at present the potential yield from this source will run into tons, a valuable addition to present supplies.

Iron sulphide, or pyrites, is used in Great Britain in the manufacture of sulphuric acid. Like copper sulphide it contains selenium. Flash roasting of pyrites is one of the processes which is used to avoid using sulphur as a raw material. The process is fairly new, but its use is expanding and it may produce quantities of selenium which would be worth recovering. The selenium is concentrated in the wastes, dusts and muds from the roasting plant. Little is yet known of the economics of recovery, but waste materials from three plants have been examined at the Chemical Research Laboratories. The materials from one plant contain sufficient selenium to justify the hope that recovery would be worth while.

Index for Volume 21

THE September issue concluded Volume 21 and the index for it will shortly be available, price 1s. 1d. post paid.

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WEATHER MECHANICS

1—THE AERIAL OCEAN

1st of a New Series: Sun and Earth Relationship. Movement of Air Over Planetary Surface

By WILLIAM ELLWOOD

THE basic cause of the phenomenon which we call *weather* is, naturally enough, the sun. This phenomenon is modified continually as the earth flashes along its orbit at a mean speed of 18½ miles per second. The seasonal change in weather is due fundamentally to the inclined axis of our planet relative to the ecliptic, and the position of the earth in its orbit. Further modification of the weather is brought about by the disposition of land masses and oceans. This first article deals with the earth as a whole; its atmosphere—the chief medium in which the phenomena of weather occur; and the sun.

In Fig. 1 the three main zones of the earth's surface are shown; also their origin. North of the tropic of Cancer or south of the tropic of Capricorn the sun can never appear immediately overhead. Within these two lines

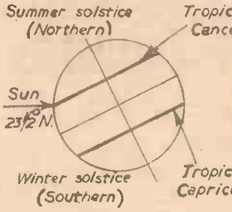


Fig. 2.—Northern limit of the sun.

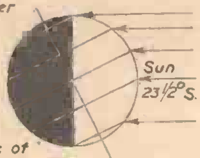


Fig. 3.—Oblique approach of the sun's rays in winter.

lies the torrid zone. To an observer stationed on the line of Cancer (Fig. 2) the sun achieves a zenithal position at the summer solstice (northern hemisphere), whilst the same applies to an observer on the line of Capricorn when we are at winter solstice in the northern hemisphere. *Solstice* means an apparent "standing still of the sun" before turning back towards the equator. It is of Latin origin. *Tropic* is from the Greek "to turn." Twice a year at the spring or summer equinox (equal night) the sun occupies a zenithal position at noon, to an observer situated on the equator.

It will be seen that when the sun is over the line of Cancer, the north frigid zone has continuous daylight, whilst the south frigid zone is shrouded in darkness. The converse

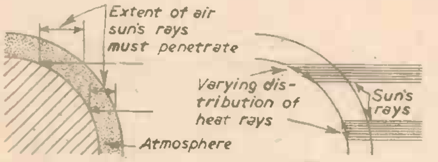
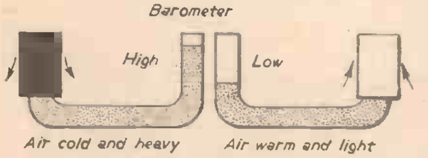


Fig. 4.—Absorption and distribution of heat energy.

is the case when the sun is over Capricorn. This cyclic relationship of sun and planet must be clearly grasped and made the basis of our meteorological discussion.

Composition of the Atmosphere

The earth's atmosphere may be described as an aerial ocean enveloping the planet.



The Metric Unit of Air Pressure and a Column of Mercury.
1 Bar 29.53 inches
1 „ 750.1 mm.
1 „ 1,000 millibars
Average pressure at ground level 1,012 Millibars.

Fig. 5.—Working principle of the mercury barometer.

Its composition up to about 100 kilometres is 78 per cent. nitrogen, 20 per cent. oxygen, whilst the remaining percentage includes carbon dioxide, argon, ozone and other rarer gases. These proportions are by volume or pressure. They constitute the 100 per cent. dry air. A varying amount of water vapour is also found in the lower layers of the atmosphere. Beyond the 100 km. altitude the proportions of nitrogen and oxygen quickly decrease and hydrogen is encountered. Helium is also present and other rare gases

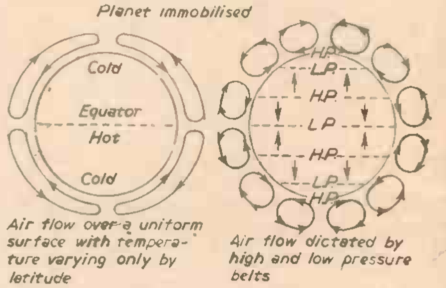


Fig. 6.—Fundamentals of air circulation.

not yet fully identified. It is, however, very likely that the atmosphere, in one form or another, extends to an altitude of at least 800 km. above the earth's surface.

Winds

Turbulence in the atmosphere, which we describe as winds, is the indirect action of the sun. It is a direct reaction to the surface temperature of the earth which is continually changing, whether over land or sea. In Fig. 3 it is mid-winter in the northern hemisphere and the sun's rays are striking the north temperate zone obliquely. All land and sea in the far north is clothed in the long arctic night. There are two reasons why the oblique rays of the sun are less effective than direct rays, as may be demonstrated in Fig. 4. First, the rays must journey a greater distance through the atmospheric shell before contacting the earth's surface. This results in a larger amount of heat energy being absorbed by the atmosphere than is the case in summer. Secondly, the greater the angle of incidence becomes, the greater the area of planetary surface which must be heated by any particular band of the sun's rays. The cumulative effect is one of *low temperature* at the surface and a cold, heavy atmosphere above it. This atmosphere possesses what is termed *high pressure*. The exact pressure may be ascertained by reference to the barometer (Fig. 5). *Low pressure* as indicated by the barometer infers that the surrounding air is warm and light. As warm light air tends to rise and cold heavy air tends to sink and remain near the surface, it follows quite logically that the air of a high pressure centre will move in any direction across the planet's surface which leads to a low pressure area. Thus *winds* are created.

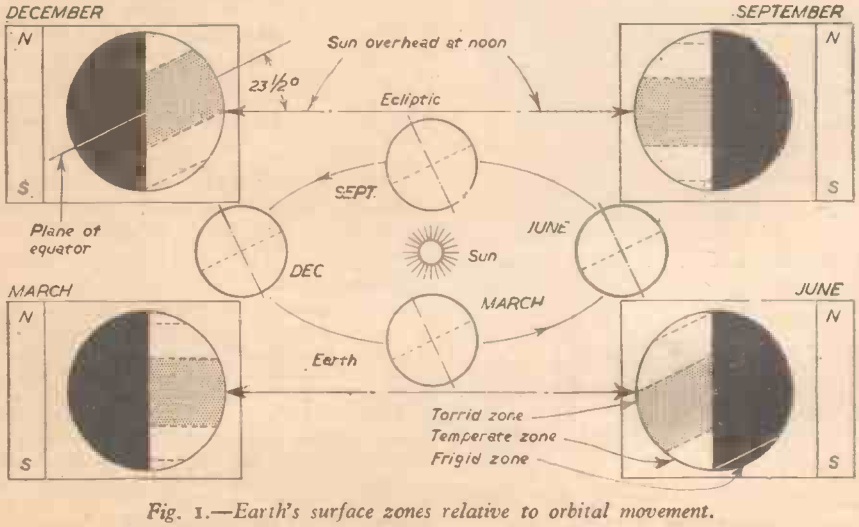


Fig. 1.—Earth's surface zones relative to orbital movement.

If temperature distribution was governed solely by latitude we should have a general circulation of air, to and from the equatorial belt, as shown in Fig. 6. This condition, however, is drastically modified by the relative temperatures of land and water. Land heats more quickly than water but it also cools more quickly. This fact can be proved locally, at least, by any person living on the coast. On a sunny day he experiences a sea breeze, but in the evening a land breeze springs up. This is a simple transposition of high and low pressure areas occurring after sundown.

A further modification of air flow is induced by the earth's axial rotation. In Fig. 6 we have immobilised the planet, but in Fig. 7 the diurnal motion is restored, with the result that the winds no longer blow from due north or south. As the earth revolves eastwards, so does the atmosphere, but with a deviation towards north or south as influenced by the relative high and low pressure bands. Another point of vital importance must be explained here. The easterly component of these winds is approximately the same as the surface speed of the earth at that particular latitude where the wind originates. A point on an equatorial latitude travels nearly 25,000 miles, relative to the earth's centre, in a period of 24 hours; whereas a point situated on a line of latitude near either pole, covers only a minute fraction of 25,000 miles in the same period.

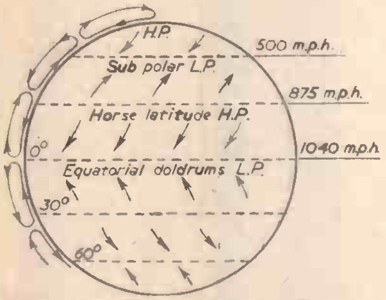


Fig. 7.—Air flow modified by axial rotation.

The "Trades" and the "Westerlies"

Due to the extreme cold, the arctic region is covered by a disc of high pressure. Air from this area flows south towards the sub-polar or relatively low pressure region. Initially it also has a slow eastward movement; but as the sub-polar surface is moving faster than the arctic surface, an observer on a sub-polar latitude catches up, or runs into, the air drifting slowly south-eastwards, and experiences what he terms a *north-east* wind. The slower this southward drift is the more easterly becomes the wind to the observer, and the stronger it seems to blow. Meanwhile, at approximately 30 deg. north and south, high pressure bands are formed. This is due primarily to the heated air rising at the equator, cooling in the stratosphere or above, then descending again at the latitudes mentioned. Here a splitting up, as it were, of the air current takes place; half of it returning towards the equator as north-east trade winds in the northern hemisphere and as south-east trade winds in the southern hemisphere. The other half of the current flows towards the sub-polar regions of low pressure, being termed the westerlies in both hemispheres. The easterly component contained in these two latter winds is due to the earth's surface at the latitude of their birth travelling faster than the latitudes over which the winds blow. Thus, these winds "catch up with" and pass an observer situated, say, on latitude 45 deg. north or south. As the wind possesses a component acting at right-angles away from the equator, the same observer experiences a south-westerly wind in the north or a north-westerly one in the southern hemisphere. The north-east and south-east trade winds—so named because of their great consistency and therefore immense value in the sailing ship era—are influenced by the axial rotation of the planet in the same way as the winds blowing from the poles to the sub-polar regions. Vector diagrams (Fig. 8) will help to explain the experienced wind directions.

Areas of Calm

At the latitudes where the air flow divides, whether ascending or descending, calms are the usual order of the day. It is true that cyclones roam the planetary surface beyond the latitudes of 10 deg. north or south—of which we shall deal with in due course—but winds experienced either on the equator or in the *horse latitudes* are of gusty and uncertain nature, usually accompanied by torrential rains and electrical disturbances. We may mention here that the "horse latitudes" presumably derived their name from the conditions of long calm suffered by mariners in sailing ships. Horses were quite often included in the ship's cargo and when drought and disease stalked the ship, these horses often died.

The equatorial zone of low pressure is named the *doldrums* and weather conditions are similar to those just outlined. Ships crossing from one hemisphere to the other, ran the danger of being becalmed for days—and in some cases for weeks!

These regions or zones of calm, shift north or south through about 8 to 12 deg., this being caused by the permanently inclined axis of the earth and the latter's changing orbital position.

Most of the phenomena we have discussed are readily demonstrated over a vast area of the Pacific Ocean. This ocean occupies a considerably larger area of the earth's surface than that of all land areas added together.

(*To be continued*)

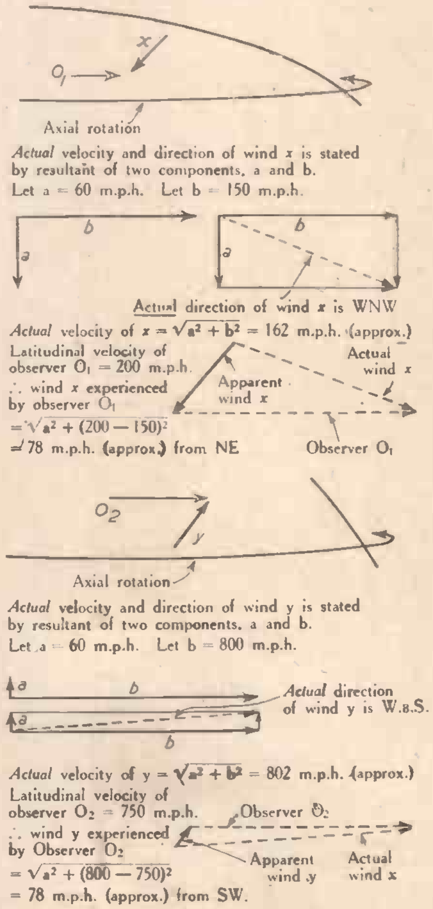


Fig. 8.—Wind velocity and direction relative to a moving observer.

New Etching Process

A RECENTLY developed chemical method for making magnesium printing plates will result in producing high quality plates much more rapidly and economically than by conventional means.

Specifically, it is in the etching process that the improvements have been made. The developments consist of the application of a unique etching solution to a magnesium alloy plate in a specially designed machine. The plates which are prepared by the new process are etched cleanly and sharply in as little as one-tenth of the time formerly required.

Operator removes plate from machine after chemical treatment.

New Lightweight Steam Engine

THIS engine has been designed to be mass-produced for about £100 to supply power in undeveloped areas. It is composed of three separate parts: the boiler measuring about 1ft. x 18in., the furnace 2ft. x 2ft. and the engine just over 1ft. each way. The engine is easy to work and assemble and has only four controls. It is designed to work off the land and may be carried by six men, two to each section. At a recent display one of the units, fed on peat, supplied power simultaneously to a lathe, a saw, a grinder and six other devices.

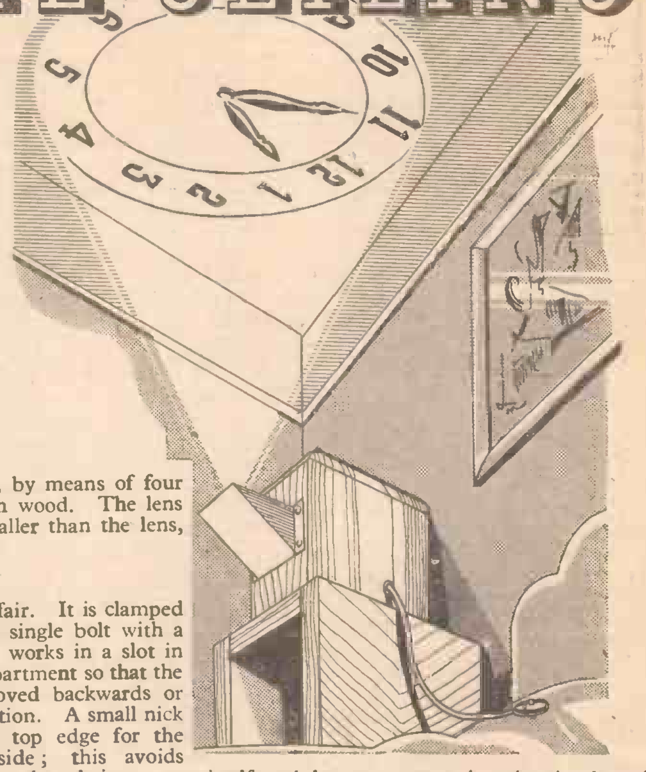
Electronic Weather Forecasting

IN the future, electronic brains may eliminate some of the guesswork in weather forecasting. This was mentioned by Dr. C. G. Rossby, Professor of Stockholm University, when he was speaking about experiments being carried out in Sweden. The "brain" digests thousands of factors, assesses their relative importance and meaning and then produces information from which the weather map can be drawn.

A Wingless Plane

RESEMBLING a flying saucer, this 20ft. diameter, 3½ ton machine has flown for 10 minutes at the Rolls-Royce Experimental Station, Hucknall, Nottinghamshire. It was lifted by downward facing jet streams which can be deflected to control the angle and direction of flight. The pilot sits in a cockpit slung between the two Avon jet engines. When perfected it may result in air liners being able to take off straight up, thus solving the long runway problem. The "flying saucer" is still on the secret list.

TIME ON THE CEILING



An Ingenious Watch Stand Which Throws an Enlarged Illuminated Image of the Watch and Time on the Ceiling

THE object of this contrivance is to throw an illuminated image of your watch, much enlarged, on to the ceiling, so that as you lie in bed, wondering whether it is time to get up, you can see the time with the minimum of inconvenience simply by pressing a pear switch which may be kept under the pillow. This switch is connected by means of a yard or so of "flex" to the apparatus (shown in Fig. 1), which stands upon a bedside table. The watch is simply hung up on its hook, and when the button of the pear switch is pressed, two small lamp bulbs, worked from an ordinary flashlamp battery, shine on to the watch.

A lens fixed exactly in front of the watch face focuses a picture of the dial and hands on to the ceiling, the light being bent upwards by means of a mirror. Focusing is achieved by sliding the watch support to and fro until a sharp image is thrown on to the ceiling; once this is done, the focus is always correct, unless a watch of different thickness is used, or unless the distance to the ceiling is altered by placing the apparatus on a higher or lower table.

Construction

The body of the apparatus should first be made of ⅜in. wood to the dimensions given in Fig. 1. If wood of a different thickness is used, be careful to modify the dimensions where necessary to allow for this. The sliding cover for the battery compartment works in a groove formed by tacking ⅛in. wood on to the side walls, the space between two pieces of the ⅜in. wood forming the groove. Most amateurs will find this easier than cutting a groove in a single piece of wood.

For the lens use a small reading glass, about 1¾in. diameter and about 4in. focus. Such a glass in a celluloid holder can often be obtained from a chemist's shop. If one of these is used, the holder should be discarded and the plain glass fitted into place, as shown in Fig. 1, by means of four small clips of brass or thin wood. The lens hole should be slightly smaller than the lens, of course.

The Watch Support

This is quite a simple affair. It is clamped in position by means of a single bolt with a knurled nut, and this bolt works in a slot in the floor of the watch compartment so that the watch support can be moved backwards or forwards to its correct location. A small nick should be cut across the top edge for the chain, which hangs outside; this avoids detaching the watch from the chain every night. Care should be taken when fixing the hook that the centre of the watch comes right opposite the centre of the lens.

Two ordinary flashlamp bulbs are used for illumination, one on each side. They should be about half-way between the lens and the watch; if too close to the watch the illumination will be uneven, while if the lamps are too far away the light may not be bright enough.

You may either buy two suitable screw lampholders or you can fix the lamps as shown in Fig. 2. This sketch explains itself, and the arrangement is quite simple and effective. A flat piece of bright tin screwed to each side of the watch compartment as shown in Fig. 1 will make a good reflector and improve the illumination.

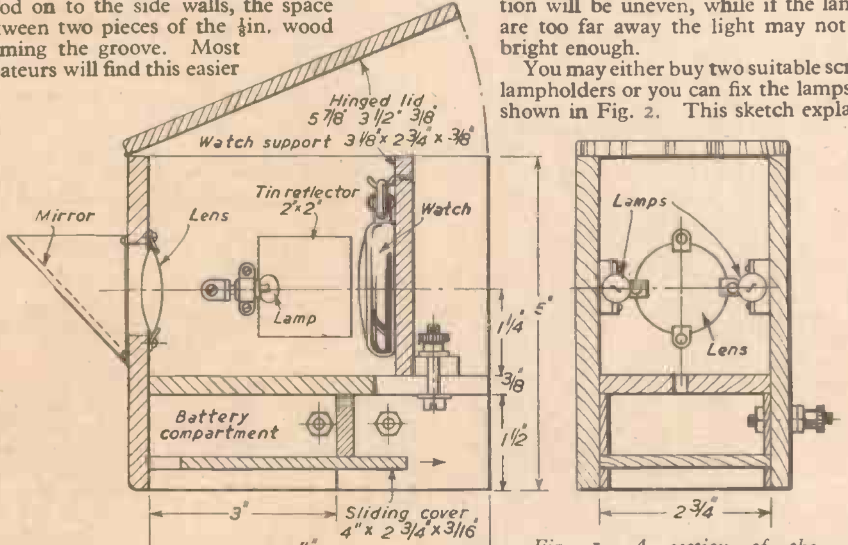
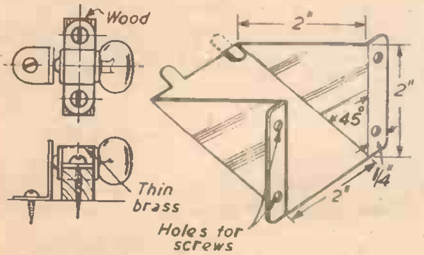


Fig. 1.—A section of the complete apparatus.



Figs. 2 and 3.—The lamp fixings and the bracket for holding mirror.

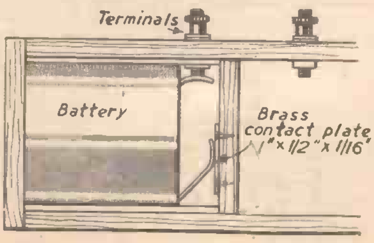


Fig. 4.—The battery connections.

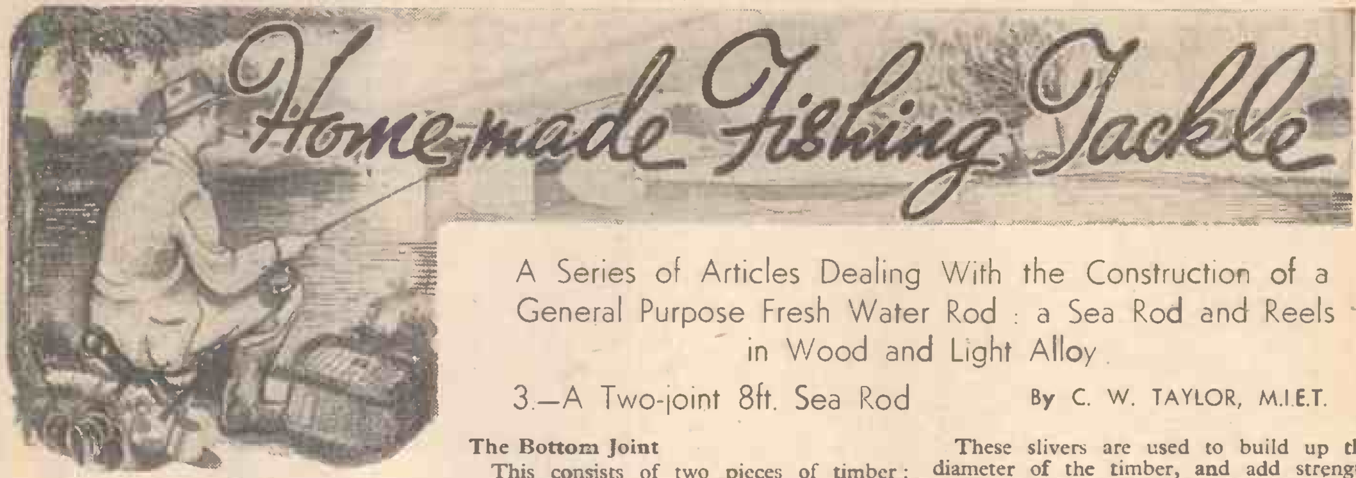
The Mirror

The mirror is arranged opposite to the lens on the outside and is held in position by means of the support shown in Fig. 3. This is cut out of thin sheet metal bent to shape and screwed into the required position. The mirror itself should be cut to the correct size by means of a wheel cutter or a diamond after the support is screwed into place. It should be held in position by means of the two lugs shown in Fig. 3, which are bent over the edge of the mirror as indicated. The mirror should be of good quality flat glass, for some cheap mirrors have a more or less undulating surface, which in this case would spoil the sharpness of the picture on the ceiling.

Two terminals are required, and these should be fitted into the position shown in Fig. 1. Fig. 4 is a part-sectional plan showing how the battery connections are arranged. The short brass strip from the battery is bent so as to press directly on to one terminal, while the other battery strip is bent over to press against a special contact plate.

The Wiring

Wiring up is the final operation. Use insulated wire of about 22 gauge, and be careful to scrape off the insulation at the connections so that a good metal-to-metal contact is obtained. Connect a wire to each of the brass angle pieces which press against the central connections of the lamps, run these wires neatly through holes in the bottom of the watch compartment, and connect the other two ends to the contact plate shown in Fig. 4. The connections may be made simply by pushing the bare ends of the wire under the plate and screwing the latter down tightly. Now connect a wire to each of the strips which clamp the lamps in place (Fig. 2), and run both of these wires to the terminal (outside the battery compartment).



Home-made Fishing Tackle

A Series of Articles Dealing With the Construction of a General Purpose Fresh Water Rod : a Sea Rod and Reels in Wood and Light Alloy

3.—A Two-joint 8ft. Sea Rod

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

THE jig or former, the description of which was given in the first article, will again be employed to make the built cane, which is the timber used for the two joints.

For those who do not wish to make the joint timber by the process described in Article 1, two lengths of built cane of the required dimensions may be purchased from many tackle stockists.

As regards design, a sea rod for general use has little in common with a fresh water rod. A sea rod is usually required to cast lead and tackle of considerable weight, and must, therefore, be made with the emphasis on strength and rigidity.

The bamboo required for making the built cane joints should be of as large a diameter as it is possible to obtain and should be first-class material.

Bamboo poles, about 1¾in. diameter or larger, can be obtained from rod material specialists, and can sometimes be acquired in the form of old tent poles. The wall thickness should not be less than 5/16in.

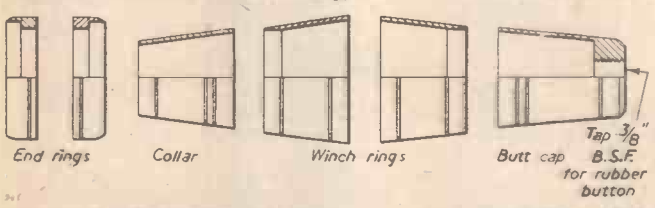


Fig. 3.—Handle fittings, half sectioned. Scale half full size. Made from brass, coloured and lacquered or plated.

The Top Joint

This joint is 48in. long and measures approximately 5/16in. across the flats of the hexagon at the small end, and 17/32in. across the flats of the hexagon at the large end.

To produce this joint by means of the process described in Article 1, the flat, which must be planed on the jig or former (see Article No. 1) tapers from 3/16in. wide to 19/64in. in a length of 48in.

The Bottom Joint

This consists of two pieces of timber: a short piece of built cane spliced into a piece of turned hardwood, which forms the foundation for the handle.

Consider first the short piece of built cane, which is 26½in. long. To make this piece, the flat, which must be planed on the former, tapers from 5/16in. wide to 23/64in. in a length of 26½in. This produces a piece of built cane approximately 9/16in. across the flats of the hexagon at the small end, and ⅝in. across the flats of the hexagon at the large end.

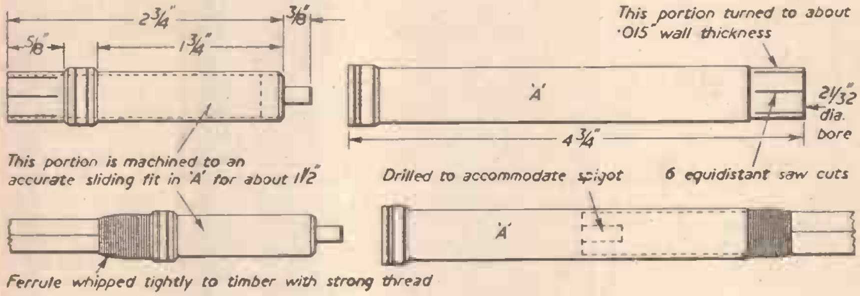


Fig. 1.—Constructing the joint ferrules.

The other piece of timber for the bottom joint will be considered later.

Building up the Ends of the Timber

When the two pieces of built cane have been made or purchased, 18 thin strips or slivers of bamboo are split from short pieces of ⅝in. diameter bamboo.

Six slivers 2½in. long are glued to the flats at *each end* of the 26½in.-long piece of built cane, and six slivers 2⅝in. long are glued to the *large end only* of the 48in.-long top joint.

These slivers are used to build up the diameter of the timber, and add strength where it is most required. The slivers are made the same width as the flats of the joint timber where they are to be glued, and are bound in position while the glue dries. "Casco" powder glue is used.

The other piece of timber for the bottom joint is a piece of hardwood, free from knots, 24in. long, which is next turned between centres to 1 1/16in. diameter. One end is then turned to 1in. diameter for a length of 2½in.

Having turned the hardwood, a temporary whipping of string is put tightly on the portion which has been turned to 1in. diameter, to avoid splitting this end of the wood while it is being drilled or bored to 11/16in. diameter. The wood should be bored to a depth of 2½in. Care must be taken to keep the hole central and straight, and it can be carefully opened out by using a series of drills.

The bamboo slivers at the *large end* of the 26½in. piece of built cane are next filed to 11/16in. diameter—a push fit in the hole drilled in the hardwood, and the built cane and hardwood are glued together. The temporary whipping is left on until the glue hardens.

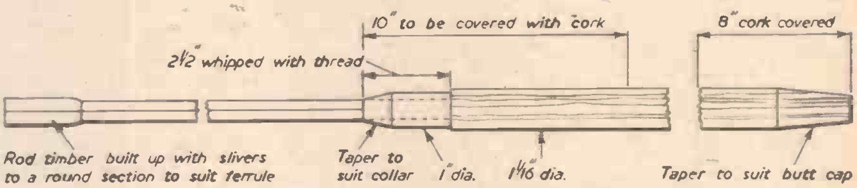


Fig. 2.—Tapering off the wood to the built cane.

Those who do not possess a lathe to turn the hardwood can cut a length out of a hardwood tool handle.

The Joint Ferrules

A strong metal joint should be turned from two pieces of high tensile brass tubing. The bore of the larger piece of tube should be 21/32in. diameter, and the smaller piece of tube should have its outside diameter turned so that the two pieces go together with an accurate push fit. The end of each ferrule is turned down, for a length of ⅝in. to about .015in. wall thickness, and on this portion six equidistant saw cuts are made. This portion is whipped down on the joint timber with strong thread (see Fig. 1).

Such a joint may be purchased at tackle stockists.

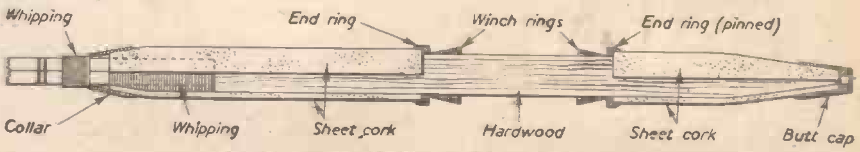


Fig. 4.—How the collar is glued in place.

Fittings for the Handle

A set of fittings should be made for the handle consisting of a collar, winch rings, and butt cap (to which can be fitted a standard rubber button), as shown in Fig. 3. Those who do not possess a lathe will be able to purchase standard fittings.

The winch rings should be turned to an easy sliding fit on the hardwood.

The Handle

The temporary whipping is removed from

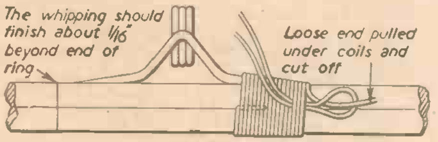


Fig. 6.—The method of whipping.

the hardwood when the glue has set, and the end of the wood is tapered off to the built cane (see Fig. 2). The taper should be filed on the wood so that an accurate fit is obtained with the tapered bore of the collar.

A permanent whipping of thread is next put on the wood. This starts at the bottom of the taper and continues along the wood for 2½in.

Sheet cork 1/16in. thick is next obtained: a piece 1ft. square is sufficient. This material can be obtained from rod material suppliers, but the kind which is used at garages for jointing is quite suitable.

Two pieces of cork are required for the handle, one piece 10in. long, the other piece 8in. long. Both pieces must be accurately cut in width, so that when they are wrapped round the hardwood and bound tightly with tape, about ½in. wide, the two longitudinal edges of the cork butt closely together, and the joint will be practically invisible.

The cork is wrapped round the tapered end of the hardwood to cover the whipping, and obviously care must be taken to get the cork to the correct shape so that the edges will butt together. Bend the cork round the wood until it completely covers the wood, then with a knife make a cut as shown in Fig. 7. Allow an extra 3/64in. for the increase in diameter, due to the glue which will coat the wood. A similar knife cut at the other end of the cork when it is wrapped round the tapered portion of the wood will then give a good indication how the cork must be cut. For most of its length the cork will be cut parallel.

The hardwood and whipping are next coated with glue where the cork is to go. The cork is then bent round the glue-coated portion of the wood and one end of the cork temporarily held by rolling a thick elastic band along the wood and on to the cork.

The opposite end is then gripped tightly round the wood, and a spiral binding of tape, about ½in. wide, is started. The tape binding should completely cover the cork, and should be pulled as tight as possible. The end of the tape can be held by forming two half hitches. The binding remains in position until the glue has set.

If, due to error in cutting the cork, any gap exists between the edges of the cork, this may be filled up by working into the gap a stiff mixture of cork dust and glue, finishing with dry cork dust.

The collar is glued on the tapered portion of the cork and at the other end the ring is pinned through to the hardwood (see Fig. 4).

The winch rings are next slid into position on the hardwood (which should be polished), followed by the short ring (for the cork). The lower 8in. length of sheet cork is then glued to the hardwood to form the remaining part of the handle. On to this cork should be glued the butt cap, and the short ring at the other end should be pinned to the hardwood.

Having finished work on the handle, the bamboo slivers at the ends of the joints should be warmed several times, and at intervals, to dry out the bamboo and shrink it to a more stable condition. The slivers are next carefully filed round to an accurate light-driving-fit in the ferrules.

A block of wood is used when tapping the ferrules into position on the joint timber. The reduced portion of each ferrule is whipped tightly to the timber with strong thread. The

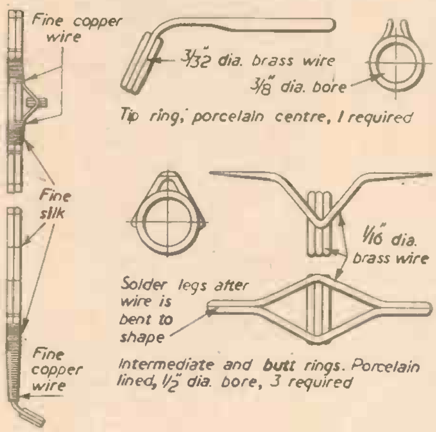


Fig. 5 (Above).—Rod rings, half full size.

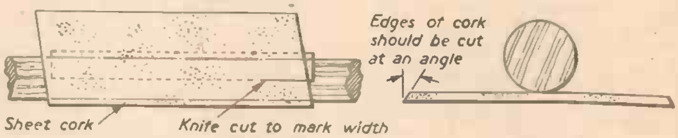


Fig. 7 (Right).—Method of fixing cork sheet.

final alignment of the joints will depend on how straight the ferrules are mounted!

Rod Rings

Rings on sea rods should always be lined with a hard, corrosion-resistant material. Heavy casting and running of the line through the rings quickly wears grooves in the softer metals. In view of this, porcelain or some other hard material should form the centres of the rings. It should also be remembered, that sea water is very corrosive to certain metals, including some grades of brass. If such metals are used, they must be given some degree of protection by lacquering or varnishing, or better still, by plating.

When the joints have been cleaned up, by scraping and sandpapering, the rings may be whipped on to the timber by using first, fine plated copper wire, or ordinary fine copper wire, having regard to the remarks above. This is followed by the usual fine silk or cord whipping (see Fig. 5). The suggested spacing of the four rod rings, starting at the tip ring, is: 17in., 20in. and 23in.

Whipping

Fine silk or No. 40 gauge "Sylko" will be used for most of the whippings. Red, green and black are the usual colours, and the method of whipping is shown in Fig. 6.

After the loose end has been pulled under the coils, it should be trimmed off closely with a knife.

The fine hairs which stand up from the silk should be laid, and the whipping made smooth by applying a little french polish or clear cellulose varnish, after which the finger is placed on the whipping and the rod is rotated.

The rod is finished by applying two or three coats of copal varnish. Dust soon settles on wet varnish and spoils the appearance, so a room which is seldom used and in which the windows are closed is necessary to obtain a good finish. Clean brushes and a thorough wiping down of the joints are also necessary if a professional finish is to be obtained. *(To be continued)*

Transistorised Telephone Set

THE use of junction transistors to enable telephones to be operated in extremely noisy situations such as workshops, aircraft hangars and engine-testing sheds was demonstrated by Mullard at the S.B.A.C. Exhibition at Farnborough. A telephone (shown in the photograph) had a special noise-cancelling microphone substituted for its normal microphone. These microphones respond only to sound which originates very close to the mouthpiece, and not to background noise, but their output is much too small to permit their use in ordinary telephone systems. In the demonstration, the output from the noise-cancelling microphone was amplified in a tiny two-stage transistor amplifier to bring it up to normal level. A further stage was used to supply the telephone earpiece at the other end of the line, since the distant telephone was also in a noisy situation.

A four-wire circuit was used, with amplifiers in each pair. All the amplifiers (six stages in all) were assembled on the small component panel near the left-hand terminal strip, see photograph. The necessary batteries (of hearing-aid type) can be seen in a plastic tube to the right of the amplifier panel, and next to the right-hand terminal strip.

The transistor amplifier is so small that it could be built into the handset of a standard telephone and it could be powered by the low-voltage supply which is provided in all normal telephones to operate their carbon microphones. Thus no external fittings would be required for the modification.

The transistorised telephone set.

THE S.B.A.C.

The Hawker Hunter

FARNBOROUGH SHOW

A Brief On-the-spot Account of the Flying Display and Under-cover Exhibition

By THE MARQUIS OF DONEGALL

FARNBOROUGH '54 (Exhibition and Display, No. 15) was more noteworthy for the consolidation and development of types already seen in the years just past than for brand new civil and military aircraft. There were, however, several such as the Folland Aircraft Midge, the Comet 3 and the Hawker Hunter 6 which were to be seen for the first time.

The flying display started with the Bristol Aeroplane Company's green-nosed, silver Proteus-Ambassador. This is one of the engine test-beds flown at the display which had not been seen before. Two others were the Soar-Meteor, which flew past powered only by its minute-looking wing-tip units, and the Eland-Varsity. The Ambassador was followed by the Hunting Percival Pembroke which is a transport 'plane and in full production for the R.A.F. It cruises at 172 m.p.h. at 8,000ft. and has a civil version carrying 10-12 passengers known as the New Prince Series 5.

Britain's newest jet fighter, the 600 m.p.h. Folland Midge.

Four Gipsy Queens power the de Havilland Heron 2, developed from the ubiquitously popular twin-engined Dove. A retractable undercarriage has been incorporated and a Heron 2 which the Duke of Edinburgh will sometimes fly is to be added to the Queen's Flight in replacement of one of the Vikings. Last in this group came the turboprop Eland-Varsity of D. Napier and Son, already mentioned.

The next group started with de Havilland's Beaver 2, a Canadian-bred utility aircraft of a half-ton payload, which handles almost like a helicopter. This was followed by the Hunting Percival Provost with Leonides engine, the standard R.A.F. basic trainer which is also making its way to Southern Rhodesia, Burma and Eire. Some Jet Provosts are also on the way. Auster Aircraft next showed their A.O.P.9, powered by 180-h.p. Cirrus Bombardier. It has split flaps and the size of wheels and tyres has been increased. The Scottish Aviation Pioneer 2 communications aircraft took off in about 75 yards and landed in considerably less. This aircraft has done excellent work in Malaya and is powered by Alvis Leonides.

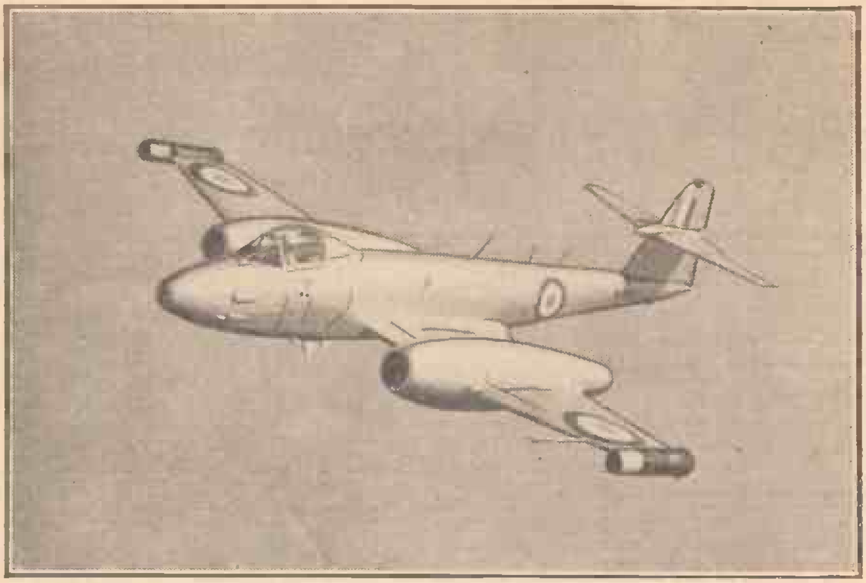
Group 3 started with the Fairey Aviation anti-submarine Gannet A.S.1. Fairey's are concentrating their main production on this aircraft, which is a three-seat mid-wing monoplane powered by an Armstrong Siddeley Double Mamba—two Mamba engines each driving co-axial contra-rotating airscrews. Either can, of course, be feathered at will for economy of fuel. Then came Boulton Paul's two-seater trainer, the Balliol Mark 2, the 1948 prototype of which is believed to have been the first aircraft powered by only a turboprop. After the Soar-Meteor of Rolls-Royce, already mentioned, we saw some sensational flying by the Hawker Hunter F.1, the Armstrong Whitworth Sea Hawk F.B.3 and the three Canberras. First we saw the Canberra P.R.7, a photographic reconnaissance aircraft, next the Canberra powered with Bristol Olympus engines that sneaked up on us silently at 50ft. and suddenly roared into an almost vertical climb; to be followed by the Armstrong Siddeley Sapphire Canberra, thus giving us a triple opportunity of admiring the lines and amazing display of these great bombers, with performance more usually associated with fighters.

"Fun with the helicopters" would be my heading for the next group. First the little Bristol Sycamore 4 buzzed about like a house-fly, flying forwards, backwards and sideways, as did also, in a more dignified manner, its big brother, the two-rotor Bristol 173, with Leonides engines and provision for 10-13 passengers. A Mark 3 is scheduled to carry

Unloading a mobile workshop from the Blackburn Beverley freighter which was part of the ground exhibition.

16 passengers and these are being built for experimental service with B.E.A. The remaining helicopters were the blue Skeeter 5 and the red Skeeter 6 of Saunders-Roe, Ltd., the smallest British helicopters. The fact that everybody laughs when this bulbous-cabined two-seater insect appears over the airfield is no reflection on its technical composition.

Individual demonstrations then began with the Armstrong-Whitworth Meteor Night-fighter 14. This aircraft dates from late in 1953 and has a sharply raked windscreen and a new two-piece blown canopy. This two-seater radar-equipped machine was developed logically from the basic Gloster Meteor. As a sequel to the anti-submarine Gannet, we saw the Gannet T.2, a trainer whose first flight we heard of only three weeks ago. It is likewise powered by a Double Mamba and has folding wings. Short Brothers presented the Sherpa research aircraft, followed by two of their Seamews. Whereas the Sherpa is an experimental aircraft built to demonstrate the potentialities of the aero-isoclinic wing with wing-tip controllers instead of trailing ailerons, the Seamew, a carrier-borne anti-submarine aircraft, is of conventional design. It is designed for cheapness, lightness and simplicity and first flew in August of last year.



A Gloster Meteor fitted with two Rolls-Royce Soar engines on the wing tips.

Enormous interest was created by the new, green, 20ft. wing-span Folland Midge. It seemed to me to have a very long take-off but, once in the air, it hurtled about looking more like a V.1 than was reminiscently comfortable. Although the Fairey delta fighter, probably because it is fatter, looked larger than the Midge, it has a wing-span of over a foot less and it was followed by the Vickers Supermarine fighter Swift 4. The Avon-powered Swift has flown from London to Paris at an average speed of 669 m.p.h.

The giant Vickers-Armstrong's Valiant B.2 majestically followed the succession of little fighters. It has a high-mounted, swept-back wing and is powered by four Rolls-Royce Avon turbojets.

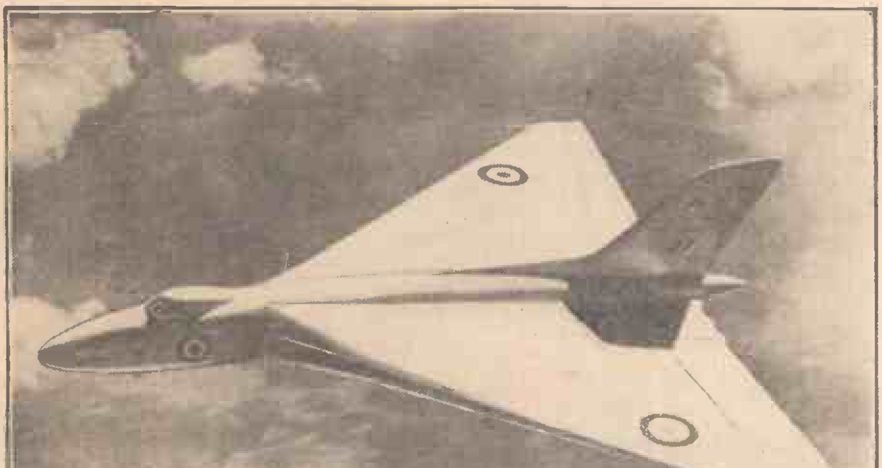
As an illustration of the Valiant's range, readers will remember that it was scheduled to do the England-New Zealand race in only three hops, the longest of which was 5,000 miles.

The supersonic bangs started when the Vickers-Armstrong Supermarine 525 carrier-borne interceptor hurtled across the airfield. A more advanced type is to be produced in considerable numbers for the Fleet Air Arm. It is powered by two Rolls-Royce Avon turbojets and has no afterburners. This was followed by two Hunters, the second of which contained Neville Duke who, in common with Lithgow in the 525, produced the inevitable bangs in the fastest low-level crossing of the airfield of that afternoon's display. This F.6 had come over and returned to Dunsfold, Hawker's test airfield. Although still secret, the Hunter F.6 is rumoured to have a Rolls-Royce Avon engine of increased power.

The organisers were evidently determined that audience enthusiasm should not lag as the show neared its close. Indeed, the next item was the de Havilland Aircraft Co.'s Comets 2 and 3. The announcer made it quite clear that the Comet 3, which in outward appearance differs imperceptibly from a Comet 2, is not destined to replace it. The Comet 2 caters for 44 first-class passengers and has four Rolls-Royce Avon 503 turbojets, whereas the Comet 1 and 1A only carried 36 and 40 passengers, respectively. Some thirty-five Comet 2s have been bought by operators as far apart as Japan, Venezuela and France. The Comet 3 first took off in the middle of July and, though you would hardly notice it, it has a fuselage 15ft. longer than that of the Comet 2. The wing area and fuel capacity have been increased and the windows are square. If used for tourist class, the Comet 3 would seat 76 passengers sitting five abreast with a 15in. gangway, and it may be decided to operate a two-class service across the Atlantic catering for 58 or 62 passengers, four abreast.

The last de Havilland to be flown was the D.H.110 twin-jet, two-seater fighter. This fighter has exceeded the speed of sound and was, in fact, the first two-seater fighter in the world to do so. It is powered by twin Rolls-Royce turbojets, side by side, and it performed some thrilling aerobatics in the ideal evening conditions.

Lastly, the Gloster delta-wing Javelin two-seater fighter which, owing to weather, had merely taxied the day before, was able to show its paces. There were more bangs, for it is by no means new to exceeding the speed of sound. This will probably be the first British aircraft to carry air-to-air guided missiles. At present the Javelin has two Armstrong Siddeley turbojets without afterburners, but it is being developed all the time and allowances are being made for increases in engine power and for afterburners. Other features are that it has an incredibly short take-off for this type of machine and has done a lot of flying at over 50,000ft.



The beautifully shaped Delta bomber, the Avro 698, in flight.

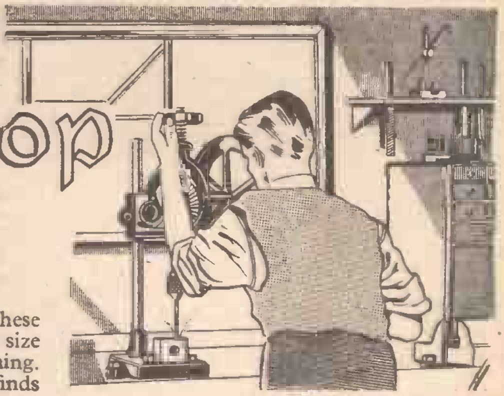
The Ground Exhibition

Let us pass for a moment to the static exhibition. So much interest was being shown at the Rolls-Royce stand that it required patience to get a glimpse of the new, diminutive Soar axial-flow turbojet engine for Meteor wing-tips. It has a diameter of less than 16in. and a thrust of 1,810lb. ! This was said to be the biggest static exhibition that Farnborough has ever had and there were, in fact, some forty more stands than last year.

There was a good deal of emphasis on the various parts that go to make guided missiles. Again, increased efforts at achieving lightness were to be seen from the little Soar down to the tiniest parts. New apparatus for recording tests and measuring apparatus for wind-tunnels was to be seen.

There were some fascinating models, including a Blackburn Beverley with two Gnat fighters inside it.

Small Tools in the Home Workshop



Making and Using Small Special-purpose Tools

By "TOOL DESIGNER"

THE most expensive problem which faces the amateur engineer once the lathe and drilling machine have been installed, is the provision of small tools for the various operations. The tools and cutters which actually carry out the process are very important. Poorly designed and blunt cutters can never work efficiently and this is particularly noticeable when long deep holes are bored. The professionally made cutter—whether this is a boring tool, pin cutter, or end mill—is always an expensive item, and to rely solely on this source of supply removes much of the interest which the hobby provides.

In all large engineering workshops, the fitter, turner, miller, or borer, is continually devising some small cutter to allow him to carry out the work easily; thus in a very short while he accumulates many different tools, which he can usually apply to other work as it arrives. Similarly then this practice can be applied to the amateur workshop, because the cutters are not difficult to make and, with average care, the hardening and tempering operations are easily performed over the domestic gas flame.

Spot Face Cutters

Spot facing is an operation whereby the surface of a casting, forging or rough bar material is locally cleaned to provide a seating for the nut or screw head. In a number of cases this work is possible while the milling of some other face is taking place, the milling cutter is lowered in the appropriate manner and merely passed over the boss or sunk for a short distance into the rough bar surface.

However, this is not strictly spotfacing because the engineer usually associates this operation with a drilling machine—the tool being fed down on to the boss.

There are several ways of making these cutters, the design depending on the size of the boss which requires machining. Fig. 1 (a) illustrates a two-lip tool which finds favour with the amateur fraternity because it does not take long to make and is easy to sharpen. A length of silver steel about 2 or 3in. long has a pilot turned on one end about .002in. smaller than the drilled hole, and this is followed by filing or milling the flats as shown. Next the teeth are "backed off" as we say in the tool room, and this for the tyro's benefit means the edge which does the cutting is made, and any tendency for the flat area behind the edge to rub is removed. A word of warning at this point may save newcomers work and annoyance because a mistake is so easily made.

Remember, the drilling machine rotates Right Hand—thus the cutter teeth must also cut in that direction. Examine these drawings closely and you will see that each example turns one particular way—the curved arrows and notes will assist those not well acquainted with engineering drawings in understanding these remarks.

When the filing or milling has been satisfactorily accomplished, the tool requires hardening and tempering, to enable the reader to hold the tool properly a pair of fairly long tongs are useful. Have a bucket of clean cold water ready near where the heating process takes place, light the gas flame and hold the tool over it. It will soon change colour and in a matter of five minutes it becomes a bright cherry shade. Remove it from the flame and plunge it into a bucket of water, whirling it round and round, to disperse the heat thoroughly.

A tool in this condition is too brittle, due to internal stresses, and it usually snaps like the proverbial carrot when put to use. Tempering is then carried out, and this means another reheat is necessary until the cutting end assumed the colour of pale straw. Care is essential at this stage because the tool needs watching closely, preferably without daylight striking directly on it, as this can create a false impression. A small gas jet turned fairly low heats the tool slowly and will give every opportunity to study the colour. When the light straw colour is reached drop the tool in the water and leave it there for a few minutes.

Clean up the faces with a piece of smooth emery cloth, but never allow the latter to rub on the cutting edges otherwise they soon become dull; the cutter is now ready for use.

The remaining sketches at Fig. 1 show larger versions which the amateur will seldom encounter, though for work larger than $\frac{5}{8}$in. diameter, the loose cutter is useful. These have 4 or 6 teeth and are filed as shown to provide the cutting edges, hardening and tempering again being performed as described. The shank is reduced to allow it to enter the drill chuck, say 1/16in. smaller than the maximum opening of this accessory; or the reader may prefer to make a Morse taper, to suit the machine spindle. Finally, the pilot is driven into the shank or is made integral with it.

At "C" a blade tool is sketched, but again this is rarely seen outside the full-size workshop—it does however, make a useful item if the reader is periodically meeting large facings or counterbores deep down a box shaped casting. The cutters are easily changed, only these being heat treated.

Counterbores

Counterboring is nothing more than deep spot facing but whereas the diameter of the latter tools was not important and merely required to be sufficiently large to cover a boss or to make a facing on a rough bar to clear the corners of a nut, counterboring on the other hand usually requires the holes at least

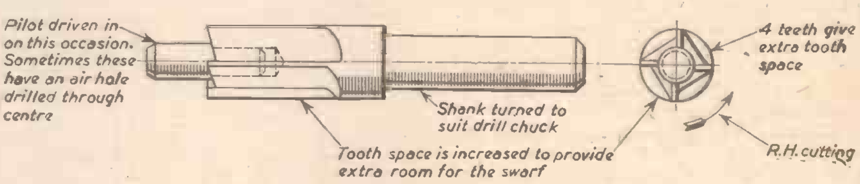


Fig. 2.—A typical counterboring cutter.

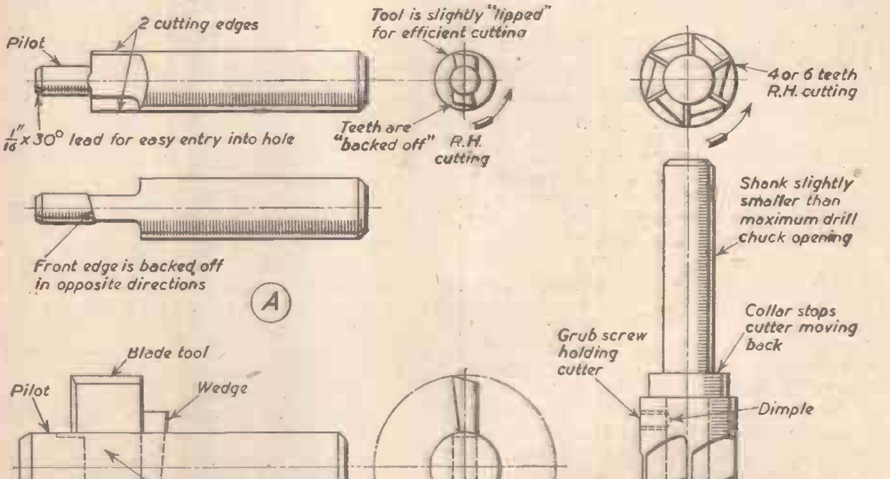


Fig. 1.—Various tools for spotfacing operations.

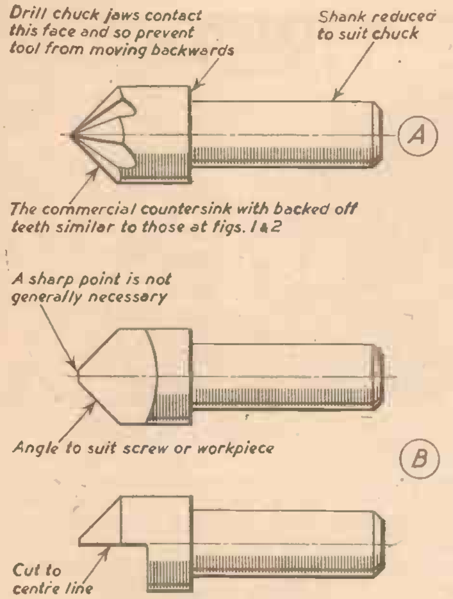


Fig. 3.—The commercial type of countersink and the simple home workshop articles.

closely approximating to the size of the part which assembles in it.

A typical example of this work and one which comprises 95 per cent. of all holes, is seen when cheese head and socket head screws are sunk below the surface. This latter practice gives a cleaner appearance to the design of any piece of machinery or model and does much to prevent cuts and abrasions through knuckles coming into contact with the sharp edges.

Both the two-lip or multiple tooth versions lend themselves to this operation, but blade cutters unless very small are not suitable. Counterboring, of course, requires the removal of a considerable amount of material from a previously drilled hole, and because of this the tooth space is increased as shown in Fig. 2. Failure to apply this rule will lead to the material packing tightly and the first indication is probably a broken pilot; if the tool is lifted once or twice and the swarf blown from the hole, quite long holes are counterbored successfully.

The two-lip tools are also known by the name of pin drills, but this latter title is, to a newcomer, a little misleading because he visualises drilling being performed with the twisted variety. Pin drilling is a term which is employed far too loosely and would cause less confusion if it fell into disuse. Tool designers rarely use this term when describing their cutters.

Countersinks

Throughout the engineering design offices and workshops the countersink screw is regarded as rather a menace, and is regulated to such simple tasks as holding a nameplate to a machine or for other work of similar slight importance. The reason for this is not difficult to understand, and if consideration is given to the fact that the hole is tapered, tightening the screw will tend to pull the top plate until the countersink aligns with the screw head; and thus a faulty position is secured. Dowelling the parts obviates this disadvantage, but then another emerges—the countersink cannot then line up correctly, consequently the screw head only makes partial contact, hence vibrations can cause loose screws. A cheesehead screw is much more effective for holding parts together and tyros will do well always to remember this fact.

The countersink angle may vary from 90 to 120 deg., but 90 deg. is the usual figure and the examples in Fig. 3 are made to that dimension. A commercial tool is illustrated at "A," and though the reader can attempt the making of a similar accessory, it is not necessary to take so much trouble for the few holes which are encountered. The angle tool at "B" is simple and follows closely in this direction those cutters previously discussed. As the holes are drilled before the countersink is used there is no advantage in bringing the angle to a sharp point; in fact this is a serious disadvantage because there is every possibility of the latter being burnt in heat treatment through it becoming literally white hot. A small flat, much smaller of course than the hole size is left, as this eliminates this condition.

One exasperating difficulty which even skilled mechanics experience when countersinking is the chatter which occurs and produces a series of small flats around the angular portion. This indicates the speed is either too fast, the work is not securely held, or a combination of both factors. The reader can thus apply the necessary cure—commencing with a speed reduction if the work appears properly clamped, and so remove these unsightly marks.

"D" Bits

Whereas the previous tools are applied for operations which do not require accuracy, the "D" bit is a precision tool, for they are used instead of reamers for the correction and finishing of comparatively deep holes. The name is derived from the actual cross-section where cutting takes place—one-half of a round piece of steel is filed or milled away, leaving a "D," the top face being the cutting surface.

Silver steel is the usual material for these tools, and as this steel does vary a matter of a few tenths of a thousandth, the reader is well advised to measure each piece carefully to see that the outside diameter is not small.

Fig. 4 shows a typical "D" bit, and this is made sufficiently long to enable a drill chuck to grip it with enough protruding to reach the bottom of a hole. The crux of this design is the ability of the user to make the cutting edge exactly on the centre line—failure to do this will cause it to cut undersize. Micrometer readings should ensure accuracy at this point, but about .0016-.002in. is left on this face for final stoning after hardening. Any subsequent resharpening is done on the front face, and never on the top surface.

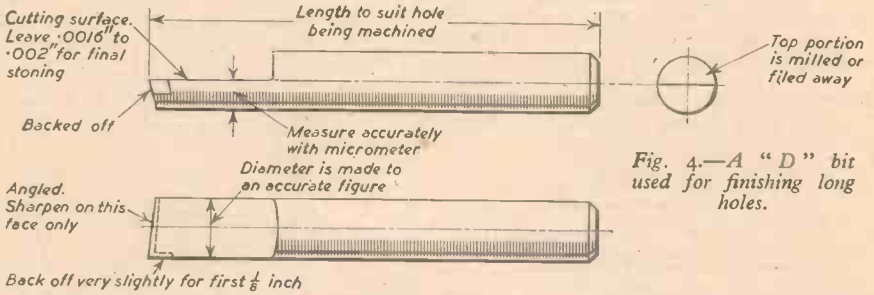


Fig. 4.—A "D" bit used for finishing long holes.

A good start is another important feature, and after the twist drill has passed through the component to remove the maximum amount of material, a single-point boring tool is applied to just open out the bore to the desired figure and so provide a proper bearing for the "D" bit. The latter tool is then carefully offered to the hole and gently passed through—a generous application of cutting oil will assist in obtaining a high degree of finish. As most of the metal has already been drilled away, and the flat portion on the bit is not too small, there is usually room for the swarf without fear it will pack solid and so cause scoring. This latter condition only occurs when the hole is blind, because there is enough room in a plain hole for the chips to fall away as the machine rotates.

Incidentally, as a matter of interest, rifle barrels are drilled with a tool similar to the one shown in this drawing; the chief difference is that a hole is provided to enable the coolant to reach the cutting edges under pressure and so wash back the swarf.

General Notes

The facilities for making tools in the engineering workshops are obviously greater than those which the amateur has at his disposal, but with reasonable care there is no reason why by milling away the surplus to form the teeth and perhaps finally touching the faces with a smooth file to remove burrs and marks, the reader cannot make good serviceable tools.

Remember, concentricity is another important factor, and if the shank is reduced to allow it to enter a drill chuck, then the cutting diameter and shank must rotate truly.

Loose pilots are a matter of opinion and many readers consider it unnecessary to go to so much trouble. Besides turning the pilot, the cutter requires boring to an accurate diameter to receive it, but this method is often preferable when the number of parts is large. Small pilots are renowned for "twisting off," as a mechanic terms it, due to either a tight fit in the drilled hole or swarf packing in the flutes, and most tool designers arrange their drawings to incorporate separate pilots.

When this is carried out the user can leave them soft; silver steel is an admirable metal for this purpose and they do not break so easily. Secondly, any that do need replacing are fairly easily drilled out if the cutter is held in a collet.

One further point. The tyro reader should appreciate that most of these details are small delicate pieces of steel, consequently they require treating with a certain degree of care. To try to force them into a piece of material as one does to a 1/2in. drill when machining a piece of tough steel, is certain to lead to broken cutting edges and the finish is always poor. Try to achieve a certain delicacy of touch when manipulating the tailstock of the lathe or the spindle of a drilling machine, and then few broken cutters will need replacing.

The next article will deal with various milling cutters which the reader can make in his home workshop.

(To be continued)

STEREOSCOPIC PICTURES

Notes on Stereo Technique Using a Single Lens : Variation of Taking Point Separation and Mounting Prints for Viewing

By H. A. ROBINSON

SINCE the coming of the photographic stereogram (stereoscopic slide), popular interest in the plastic art has flowed and ebbed with remarkable regularity. At present it is in full flood and in view of the better understanding given by the "3-D" film and press anaglyph it may remain so for some time. In the scientific world, three-dimensional work has steered a more even course.

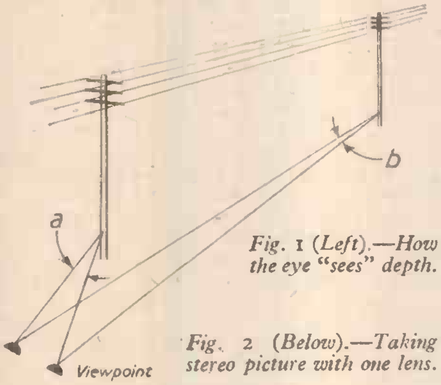
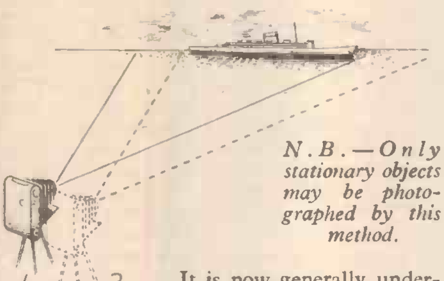


Fig. 1 (*Left*).—*How the eye "sees" depth.*

Fig. 2 (*Below*).—*Taking stereo picture with one lens.*



N.B.—Only stationary objects may be photographed by this method.

It is now generally understood that to get a stereoscopic pair of pictures a "stereoscopic camera" incorporating twin lenses and shutters is normally used, but it does not seem so widely appreciated that the ordinary, single-lensed camera can be employed for static subjects—indeed, in some cases, with distinct advantage.

The amount of relief that we see in any given item depends entirely on the angles subtended by the optical axes at the subject as it is scanned; the variations that come about being translated by the brain into range.

Thus the angle subtended at a close-in telegraph pole is different from that at a pole located 200yds. away, so there is no difficulty in "seeing" that the first pole is much nearer than the second, see Fig. 1. The angles subtended, however, on, say, two items on a distant hill are, through the distance, virtually the same despite the fact that one may stand 200yds. behind the other. Hence, while the poles are seen in relief, the hill items appear to be on a flat frieze.

We see depth in stereoscopic pictures because the twin camera copies the axis angles and so forces the eyes when viewing the slide to go through the same evolutions as they would in nature. The brain, therefore, receives the same impulses and so the final picture seems to have all the roundness and depth of nature.

The optical angles as copied by the camera are conditioned entirely by the range, but with single-lens taking the angle can readily be adjusted by altering the distance apart that the two pictures are taken, and there are times when to be able to increase or decrease the subtended angles is very useful. Such adjustment *could* be made with a stereoscopic camera by capping first one lens and then the other, but the whole process is easier when working with a single lens.

Single-lens Procedure

The general procedure of obtaining stereo pictures with the ordinary single-lensed camera is to set the instrument on some level surface, sight the subject, and make exposure number one. Then move the camera 2½in. to 3in. to one side, wind on the film and take the second picture, giving the same exposure, see Fig. 2. Even if the exposure were a little different it would not matter a great deal, for although the resulting prints would be of a somewhat differing character they would merge to one solid picture in the stereoscope. For this kind of work the popular 2¼in. x 2¼in. format is little short of ideal. The shape is highly satisfactory and six stereo pairs on a 120 film are obtained.

Models respond particularly well to single-lens taking as they are normally photographed at about six to eight feet, a range which seems to give exceptionally happy stereoscopic results.

Varying Taking Point Separation

The effect of *widening* the distance between the taking points is to give the appearance of greater relief. As well as boosting near-in items the increase also brings relief into distant objects that otherwise would appear flat, and it is in the latter that the principle can be of particular use. The reason for the illusion of greater depth is that enlarging the subtended angles is equivalent to viewing the subject from a much shorter range which, as shown with the poles, produces a greater sense of depth.

Outdoor pictures can be taken with two individual exposures provided there is no movement in the subject, as is the case with architectural items and the like. As the photographer will be standing well back from such subjects, the distance between the view-points can be increased with advantage, provided there are no marked features in the very near foreground. A general rule is that the base can always be one-fiftieth of the range.

Keeping the camera level is important for easy mounting later. If a direct finder is used, there will be no trouble in this, but if taking at waist level, the camera should be held level with some particular button on the photographer's coat. A handy gate top or wall solves the problem at once.

This wider-than-nature principle comes quite a lot into scientific stereoscopy; the aerial photographer makes use of the principle to get relief into features thousands of feet below, while one classic stereoscopic picture of the moon was taken with the view-points several continents apart. Officially this way of taking is called "hyperstereoscopy."

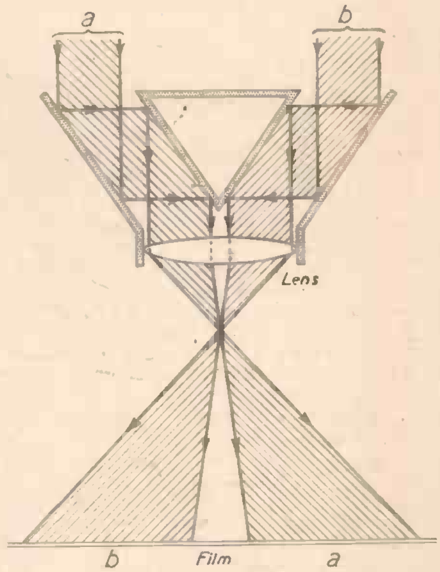


Fig. 4.—*Split beam attachment showing how two separate groups of rays (a and b) are brought together and passed through the same lens.*

At times it is an advantage to take the twin pictures with slightly *less* than eye-separation, as when some very small item is being taken only a short distance from the lens. Relief at eye separation under these circumstances can be exaggerated and fusion not too easy. The reduced base eliminates both troubles. Taking 2½in. at 10ft. as correct, the separation for any nearer range can be worked out by simple ratio, or on the "fiftieth of the range" assumption.

Single-lens work, it should be noted, has the advantage that the single picture can be reverted to at any time. Thus it becomes

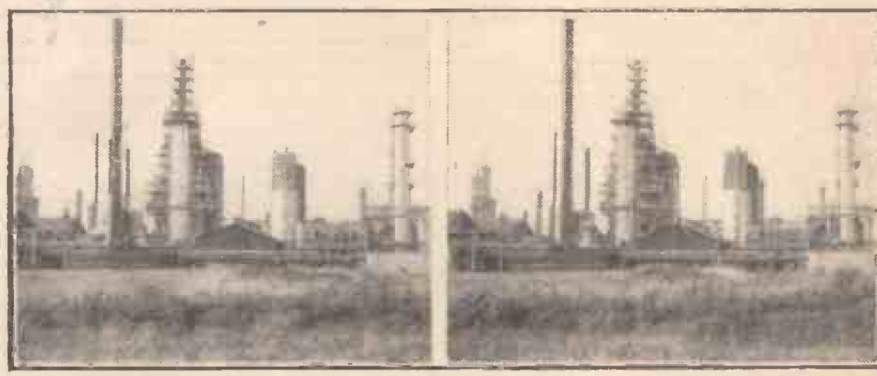


Fig. 3.—*The above stereo pictures were taken with an ordinary* 2¼*in. x* 3¼*in. single-lens roll-film camera with taking points* 8*ft. apart. When viewed through a stereoscope, the increased relief should be apparent.*

possible to mix stereo pairs and single pictures on the same film while only carrying the weight and having the bulk and expense of the usual one-lens camera.

For the technically minded, who wish to take engineering subjects like bridges, buildings, etc., the stereoscopic picture is ideal, for the result is a detailed and interpretable rendering that it would be quite impossible to produce with the single print. Areas of shade which in the single print mean nothing now become definite recesses, while points of highlight stand out as projections and items in general take up their correct relative planes. The difference between the flat print and stereo rendering in such usually confused subjects as factory plant and steel framework under construction is truly remarkable, the clarifying effect having to be seen to be believed. The picture of oil plant (Fig. 3) if looked at with a viewer gives some idea of what happens. And these excellent results can be got with an ordinary non-stereo camera and roll film, the oil plant pair being obtained in this way.

Prints for Viewing

To view the pictures a stereoscope is needed. The prints as obtained from the roll have to be transposed before mounting, otherwise inversion will take place and holes appear as projections.

Some care is needed to get the prints level on the mount so that they will merge comfortably, and to this end it is best to wedge the viewer somewhere so that the hands are free and then placing the card for the slide in the runners move the prints about till they merge nicely. Then mark the positions and mount with a photo paste.

As a point of technique the prints should be on the soft side, having detail everywhere, which, of course, is possible when printing with a soft grade of paper. Harsh prints do not give such good results though they look quite well when looked at in the hand. The softness of the stereo prints disappears in the stereoscope.

Any notes on single-lens taking would not be complete without some reference to the split beam attachments like the Leica "Stereoly," which allows the rays from the two eye aspects to pass through a single lens. There are several of these on the market.

These are clipped on to the front of the camera and the path of the rays diverted either by prisms or mirrors. This is shown in Fig. 4. The advantage of this system is that the two pictures are obtained on a single picture area thus constituting a considerable saving in material. Also with the attachment moving subjects can be taken.

Disadvantages are that the picture shape is often unsatisfactory and there is danger of slight deterioration in the image through multiple refractions or reflections. However, the split beam stereo attachment is a very workable proposition.

Making a Lightweight Camping Trailer

A Simply-made Vehicle Using a Motor-car Front Axle

By H. M. CHALMERS

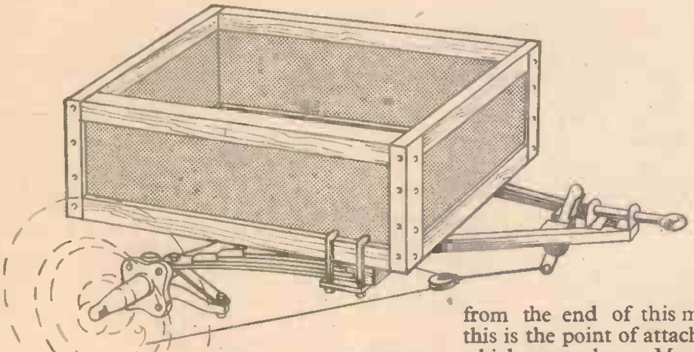


Fig. 1.—A perspective view of the completed trailer.

ALTHOUGH the trailer is designed for use with a pre-1938 Ford 8, inasmuch as a similar front axle is used to ensure an available spare wheel in the case of a puncture, owners of other makes of vehicles may be interested in the method of construction.

Basis of the structure is a rectangle 4ft. x 2ft. 9in. outside dimensions, of 3in. x 2in. hardwood. Before this is halve jointed and bolted at each corner, a groove ⅛in. wide and ½in. deep is ploughed along the middle of each member. Tongued and grooved flooring is now nailed down up to the edge of this groove, making sure that the rectangle remains true while this is being done.

The Springs

Springing is by two ex-Austin 7 rear quarter elliptics, the original coil for the shackle pin having been cut off and a ½in. hole drilled at this end. With the work upside down the springs are positioned on the side members so that this hole is directly above a point 1ft. from the end of this member. Incidentally, this is the point of attachment of the drawbar, which comes later. Meanwhile the springs are clamped down, each by two U-bolts approximately 15in. long. A short piece of hardwood with steps cut out makes a steadying block for

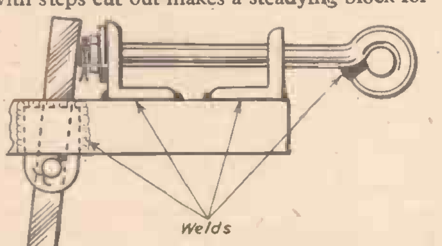


Fig. 2.—The towbar construction.

the unequal lengths of the leaves of the spring. The axle is now bolted on, and on the same bolt is fixed the short iron bar which immobilises the swivel axle arm so that the wheel rotates parallel to the path of eventual motion.

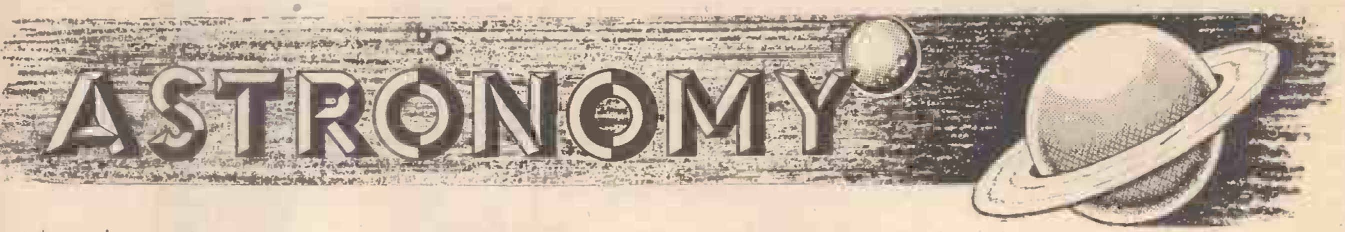
The Towbar

The drawbar, 10½ft. long with a ½in. diam. hole in each end, is folded to a V shape with the holes 27in. apart. With a piece of wire maintaining this distance the work can easily be taken to have the towing and brake operating parts welded on. The accompanying diagram makes the construction clear. Half-inch bar is used. The brake shoe operating levers on the wheels are joined by cable and a pulley wheel acts as a compensating device. This is attached to the over-run brake lever by a single cable.

With the work right way up again the sides and ends of ⅛in. hardboard are glued and pressed into the grooves. Top rails of 1½in. square section with similar grooves are hammered down on top, and the corners are completed by bolting on four angular distance pieces reinforced by strips of thin 3in. wide angle iron or aluminium.

Mudguards are simply made of 7in. wide strips of hardboard held to the contour of the wheels by three stays.

The trailer as described above towed perfectly with loads up to 4 cwt. For our summer holiday I bolted on a single skin hardboard shell, 6ft. x 5ft. 3in. x 4ft., and this provided sleeping accommodation for two and a child on a tour covering 1,000 miles. There were no snags, but it is suggested that experiments with two coil springs on the drawbar might eliminate the metal-to-metal click which occurred when starting up after slowing down in traffic, etc.



3.—The Planet Saturn

By E. W. TWINING *(Illustrated with drawings by the author)*

ALTHOUGH the ancient astronomers believed that all of the movable heavenly bodies revolved around the Earth, Saturn was recognised by them to be a planet and, as they thought, the planet farthest removed from the centre of the system. Very little was known about it, however, until the year 1610, when Galileo first turned his newly invented telescope upon it; the instrument by means of which, from that year onwards, we were destined to learn so much. Galileo found by the aid of his invention that the object which had always been thought to be just a simple round globe was not such a sphere as was the Moon or the Sun. What Galileo thought he saw was that this planet was a normal globe with two globular appendages, one on either side; in fact he thought he saw three globes, all in line, the middle one being the largest. It does not say much for the optical perfection of his telescope nor for its magnifying power, but at least a start had been made.

In the course of the movement of the planet a time arrived when, much to the astonishment of Galileo, the appendages disappeared. Then they grew again, and grew to such an extent that the planet appeared to have taken an enormous ellipsoidal form.

Discovery of Saturn's Rings

Forty-five years were to elapse before the enigma was made clear and then Professor Huyghens, the inventor of the telescope eyepiece—which is still the most useful eyepiece which we have to-day—by a combination of acute observation with sound logical reasoning, demonstrated the fact of the existence of a ring, or rings, which surrounded and were completely detached from the body of the planet.

From that time onward the number of observers and mathematicians grew. Optical equipment developed in number, size, perfection and magnifying power. Micrometers have measured the planet and its rings and mathematicians have weighed it, so that we now have all details of its size, weight, mass, movements and periodicities. The only thing we do not yet know is its structure and composition.

After the light thrown on the problem by Huyghens the next advance was made by Cassini who, in 1675, announced his discovery of a division in the ring, the now well-known dark line which divides the formation into an inner and an outer ring. Beside this division

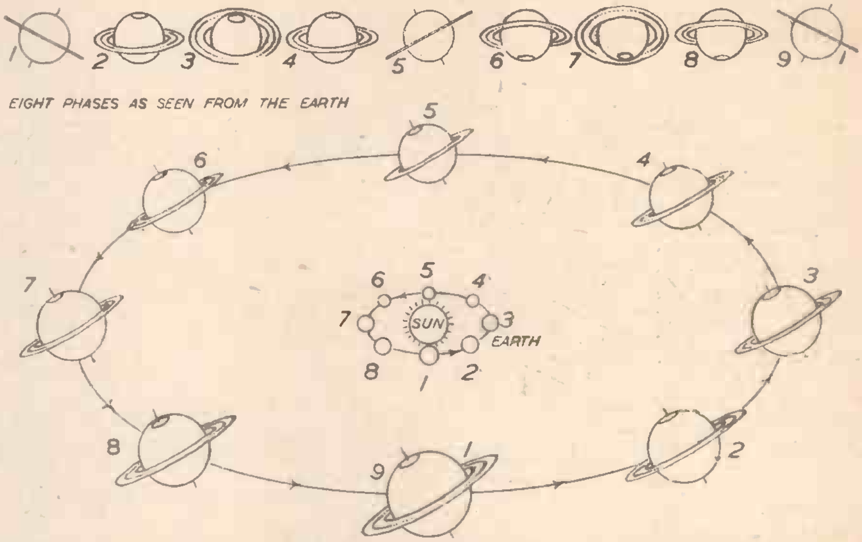


Fig. 2.—The phases of Saturn.

there is a much finer line, almost dividing the outer ring into two parts, though the division is often barely visible. This outer ring is not so bright as the broad inner ring. The last important discovery was made simultaneously in 1850 by an English astronomer Professor Dawes and by Professor Bond of Harvard College Observatory, Cambridge, Mass., both of whom announced the discovery of an innermost ring, to which was given the name the "Crape" ring, the width of which is about equal to the diameter of the Earth, that is to say, 8,000 miles. It seems strange that 240 years had to elapse after the first telescope was directed to Saturn before this crape ring was seen; not even the penetrating sights of either Huyghens or Herschel detected it. This was not due to its insufficiency of size but to the fact that it is very thin and misty and is overpowered by the brilliancy of the second, or bright, ring which the crape ring adjoins. Even on some photographs of Saturn it is not visible. The chief value of the crape ring to us is that it throws light upon the constitution of all the rings. Mathematicians, and our knowledge of mechanics, tell us that none of the rings can be solid, they must be flexible and in their different parts and distances from the planet they must revolve at different speeds. It has been suggested that changes are in progress in the structure of the rings and that these changes are of great magnitude and are taking place rapidly, but there does not appear to be any grounds for this supposition; Saturn looks to-day just as it must have done 100 years ago, and the discovery of the crape ring is no evidence that it was new in 1850. It is well known that hundreds of observers may look at an object and if they do not know that a certain feature exists, they do not see it, but immediately someone who is more observant or has keener sight and instrumental power, discovers that feature and announces his observation, the same thing may be seen by anyone, even with lower telescopic magnification. Fig. 1 shows the planet and its rings, including the crape ring, as it appears in a good telescope.

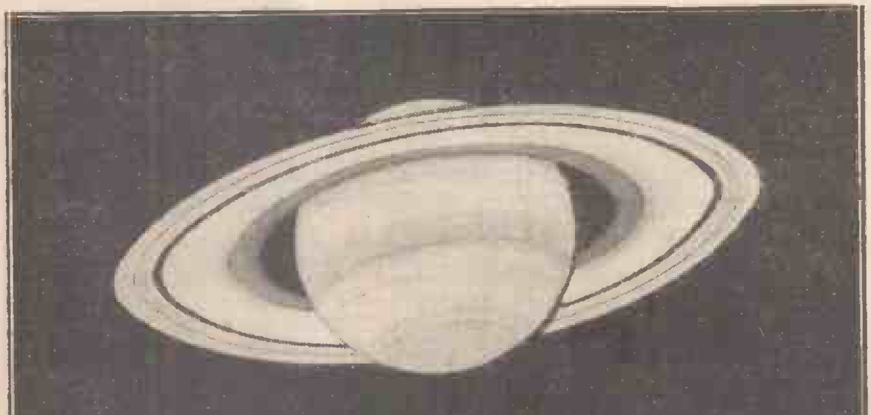
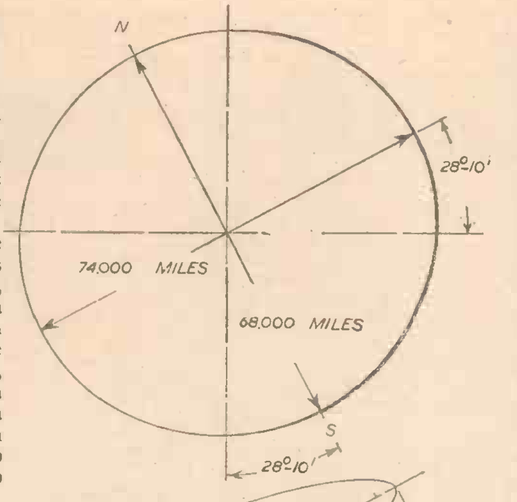


Fig. 1.—The planet Saturn and its rings.

The Phases of Saturn

Saturn takes about 30 years or a little less to traverse its orbit around the Sun and twice during that time the rings become invisible, as was first observed by Galileo. The reason for this is explained by Fig. 2, where the upper row of drawings show the phases of the planet, as seen from the Earth, in eight positions as it makes one complete revolution around its orbit. It presents its rings edgewise to us every 15 years, and also every 15 years we see the rings spread to their fullest extent. We see the rings alternately above and underneath ; first the North Pole turned towards us and then the South. The second drawing in Fig. 2 is a perspective view of the orbits of Saturn and the Earth with the Sun in the centre. This view shows the axis of Saturn inclined to the ecliptic, the angle being 28 degrees 10 minutes, and so we have the reasons why we see all the phases shown in the uppermost figure.

Sometimes we see the shadow of the planet cast upon the rings and of the rings cast upon the planet, as we do in Fig. 1, which is a view taken of the planet when it was situated almost mid-way between Nos. 6 and 7 in Fig. 2. This matter of the shadows is very interesting to observe, for were we looking directly from the Sun we should see no shadows, but the Earth is 92,000,000 miles from the Sun and when we are at this distance at right-angles to the line of light rays from the Sun to Saturn the shadow cast by the body of the planet upon the rings becomes visible. Thus, suppose in the lower diagram Fig. 2, the Earth is in position 5 and Saturn at 7 we should see the shadow of the rings on the upper right-hand side of the body of the planet and of the body on the lower right-hand side of the rings. So, too, when Saturn has nearly reached the quarter of its orbit, that is to say nearly to position 5, with the rings turned edgewise, if the Earth were at 7 we should see the shadow of the rings beneath them although the rings themselves may be invisible.



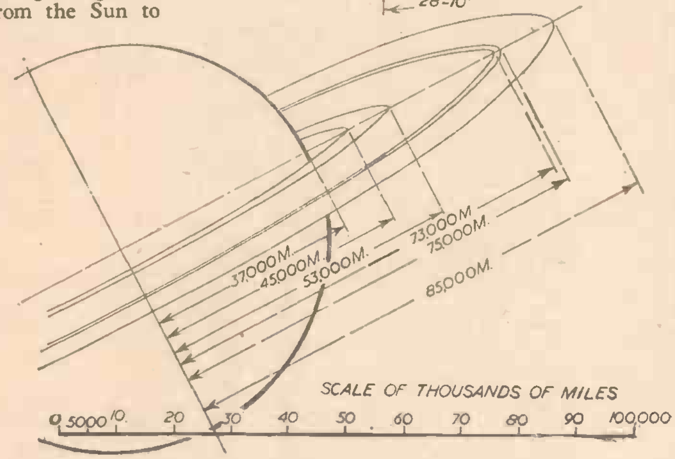


Fig. 3.—Details and dimensions of Saturn and its rings.

In Fig. 3 are given all the dimensions of the body of the planet and of each and all of its rings. Now it will be noted that the full diameter of the outermost ring is no less than 170,000 miles, yet when it is turned edgewise to us we cannot see it, only its shadow. What can the thickness of the rings be and what is their composition ? We can only make surmises. It has been said as regards thickness that it cannot be more than a few hundreds of miles, but I think that were it as much as only 300 they, the rings, would be seen as a thin line of light ; not only is there no light but, when there is no shadow, they are absolutely invisible. Yet if the rings have any thickness at all the edge of the outermost ring must be illuminated. Therefore, I give it as my opinion that the densest ring, the bright ring, may have a thickness of no more than 10 or 20 miles. Of course, much depends upon the density and size of the particles of which the rings are made up if they are composed of particles, and it is generally accepted that they are. These particles must vary greatly in size in the several rings and probably in the bright ring itself, but each zone of a ring has particles which are all of the same size and each one pursues its own orbit, the rotation speed of each zone being constant. It has been suggested that the particles are no larger than grains of sand. This may be in the case of the crape ring, though I think that they are larger, but I certainly believe that in the bright ring they are very much bigger. It may be they are a mile or more in diameter, that probably they are globular and each surrounded and carry with them cloud envelopes, which would account for their whiteness ; for the brilliancy of the bright ring is equal to that of the body of the planet which we know has a very deep and dense cloudy atmosphere.

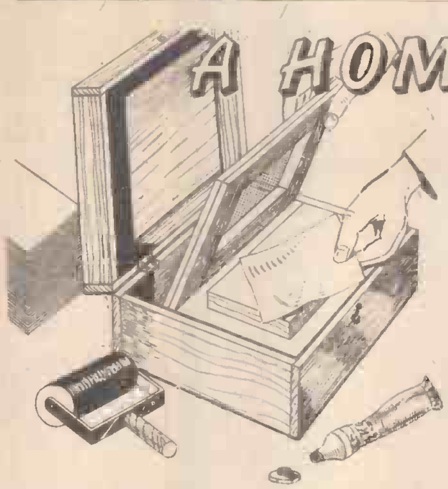
Saturn's Physical Condition

We have no knowledge of the physical condition of the body of Saturn, nor do we know the dimensions of the solid body inside the cloudy atmospheric envelope, if there is any part of it solid. By means of observations and calculations on the satellites, their movements and the attractive power exerted on them, the weight of the planet has been calculated, but its density is quite unknown because we do not know and have no means of finding out the depth and density of the cloudy envelope. That this depth must be enormous there can be no doubt, but I see no reason why the nature of the materials of which the planet is composed should differ greatly in kind and proportions from those which make up our Earth. Sir Robert Ball wrote, more than half a century ago : "The specially remarkable circumstance with regard to the globe of Saturn is, that the materials of which it is made are very much lighter than the materials of the Earth. The planet is so vast that it would take six hundred globes as large as our earth, agglomerated into one, to equal the ball of Saturn." This is not sound argument, because he included in the vastness of the planet the volume of the surrounding atmosphere and clouds. However, he put it right in his later writing by excluding the atmospheric volume. As a matter of fact I think there is some evidence that the weight of Saturn is much less than one hundred times that of the Earth and if this is so its approximate size can be calculated. In considering this matter one is bound to dissociate the dimensions of the exterior size of the planet from the core inside of the cloud envelope. We have got to remember that Saturn is in the same condition now as that in which the Earth once was, at some remote epoch when all water in the seas was suspended as vapour in a dense atmosphere, and the core was only cool enough to begin the formation of a solid crust. Possibly the Earth would then have appeared, to a hypothetical outsider, say on Mars, nearly as large as Saturn does to us and yet its weight would have been the same as it is to-day. It may well be that as Saturn further cools, in the course of millions of years, that the clouds will collapse and form oceans, seas and rivers. Land will be uncovered and, eventually, vegetation and life will appear.

The Satellites

Saturn has nine Satellites revolving around it, each of which has a name. The largest is Titan and this has a diameter a little greater than our Moon. It revolves around the planet at a distance of approximately 770,000 miles ; it has therefore an orbital diameter of more than three times that of our Moon.

A few more figures may be of interest although these figures are representative of dimensions which are staggering in their immensity. Saturn revolves around the Sun at a mean distance of 883,000,000 miles. The diameter of its orbit is 1,776,000,000 miles and it travels 5,548,065,000 miles, once around its orbit, in 30 years, which is 184,933,500 miles in each year, or a little over 350 miles per minute.



A HOME MADE DUPLICATOR

A Useful and Easily Made Device for the Handyman

By FREDERICK GILLSON

FOR many years I have used a duplicator chiefly for printing handbills. I have also found it invaluable for producing circular letters, concert tickets, programmes, copies of music and drawings. Moreover, it has proved a paying concern, for I have used it to print over 800 copies of a book, which brought in nearly £60.

It is not an elaborate or expensive article of the rotary type, but one of the flat variety. Anyone can make a similar machine, for it is simple to construct, and costs little for the material. It will print on paper size 8½in. x 6in., or smaller if required. If a larger machine is desired, the measurements of the frame must, of course, be increased. The same applies to the box that is to hold the frame.

Too large a duplicator is, however, cumbersome and uneconomical, for it tends to encourage waste of ink and stencils.

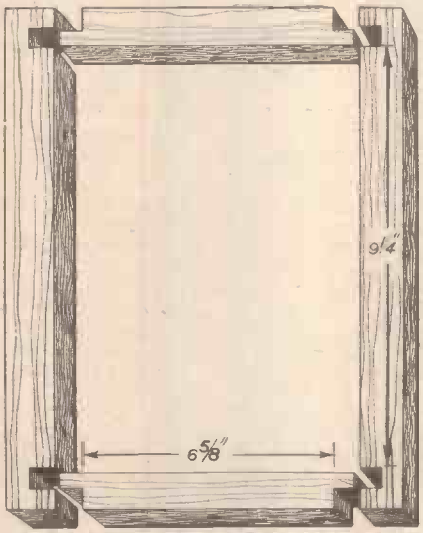


Fig. 1.—The construction of the frame.

The Frame

This is the most important part, and care must be taken to see that the measurements are correct, otherwise it will not work easily. Four pieces of ⅜in. wood are required, two of which are 7⅝in. x ⅞in., and two 11in. x ⅞in. Cut the ends of each of the shorter pieces ⅜in. to form tenons, with mortises in the longer sections (see Fig. 1). Fix with glue and thin cabinet nails.

A raised inner frame of ¼in. wood is now required, and for this you will need two lengths 9¼in. and two 6⅛in. Nail these securely at the bottom to the outer frame (Fig. 2).

Now carefully stretch a piece of duplicating silk over the raised inner frame (Fig. 2 *A*) and glue the silk to the sides of *A*. Let the edges of the silk rest on the top sides of *B* (Fig. 2) for trimming later. It is most important that the silk should be taut, otherwise it will ruin the stencils.

The silk that I used in building my machine was very cheap. I asked at a typewriter shop for a "silk backing sheet," of the kind that used to be employed for obtaining clearer carbon copies of typewritten letters. Immediately they found one, for which I paid one shilling. A proper duplicating silk may readily be had from firms that sell duplicators. Ask for one quarto-size.

Another wooden frame is now required. Make it the same size and shape as the one you have already made (Fig. 1). Then place it over the raised portion of the frame that holds the silk. (See *A*, Fig. 2). Screw it to the lower frame.

Next construct a raised table, on which to place the paper that is to be printed. Using ⅜in. wood, make a base 11⅝in. x 9⅝in. and on this mount a ⅞in. wooden block, 8½in. x 6in. Note particularly the size of the clearance at the sides before securing the block in position from underneath (see Fig. 3).

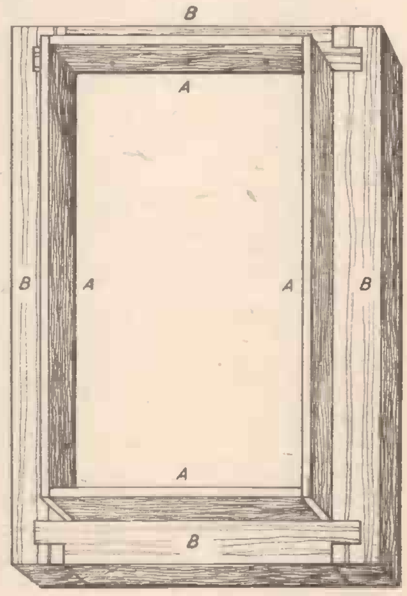


Fig. 2.—Details of the inner frame.

On top of this wooden block place a piece of sheet metal (steel or zinc). It should measure 8½in. x 6in. Be very careful to see that it is quite flat. Fix it to the block with four small screws countersunk in the corners.

Now place the frame containing the silk over the raised block and screw two hinges on the left-hand side. Make sure the frame lifts easily. If the block needs raising a little, unscrew it and place a layer or two of thin cardboard underneath it. Then screw it into position again.

The Box

All that now remains is to make a suitable box in which to keep the silk diaphragm. Use ⅜in. wood throughout, and consult Fig. 4 for the layout. Make the lower part of the box first. Two of the sides measure 13in. x 3in. and the other two 10in. x 3in. For the bottom a piece 13in. x 10¾in. is required.

The wooden partition *A* (Fig. 4) is 12in. x 2¼in., and is placed 2in. from the long side. Into this small section the tube of duplicating ink is to be kept, while the larger area is for a roller that will need to be purchased. To prevent the roller moving about, fasten it with a small clip.

Next make four supports of ⅝in. square wood, length 1¾in., and place these at each corner of the larger area (see *B*, Fig. 4). On these supports lay a piece of ⅜in. wood, 11⅝in. x 7in., and use it as an inking board. Keep the inky side downwards. Cut a V-shaped opening at the centre of each of the 7in. sides, so that a finger can be inserted for lifting out the board.

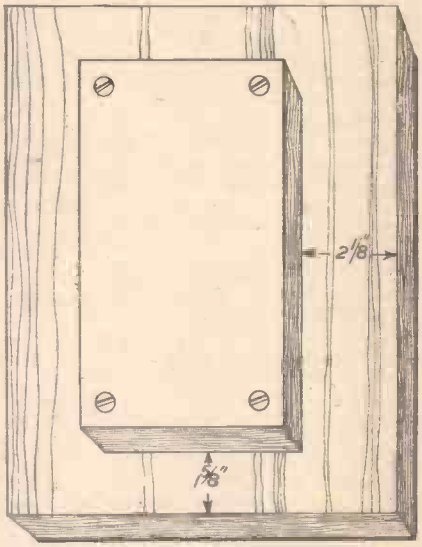


Fig. 3.—Securing the block in position.

The lid is made with four side pieces, two of which are 13in. x 1¼in., and two 10in. x 1¼in., and the top which is 13in. x 10¾in.

The hinged lid is fastened at the front with a brass clasp. A leather handle can be added, if it is necessary to carry the duplicator frequently.

If desired, stencils may be kept inside the lid by means of small clips.

Quite a pleasing finish is obtained if all the woodwork is given a coat of medium oak varnish stain.

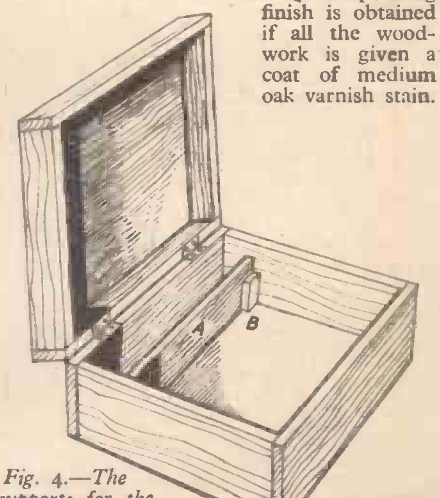


Fig. 4.—The supports for the inking board.

Useful Hints

When duplicating, to ensure satisfactory results, bear the following points in mind:

1. Lift up the top frame, and place a piece of thick blotting-paper on the raised block. Cut it the same size as the block. Clearer copies will result.
2. Lay on top of the blotting-paper the paper, or card, to be printed.
3. Place the prepared stencil (viz.: one cut on the typewriter, or cut by hand with a stylo pen) on this paper. (*N.B.*—Type must be clean in order to secure a good stencil.)
4. Bring down the raised frame gently.
5. Squeeze about an inch of the stencil ink from the tube and roll it in all directions on the inking-board.
6. Pass the inked roller over the silk and be sure that the silk is entirely inked. Always work from top to bottom and *never* from side to side, or you will damage the stencil. The pressure will cause the stencil to adhere to the underside of the silk.
7. Lift the frame and remove the duplicated copy.
8. Place more paper, or cards, in position until you obtain the desired number of copies.

A Simple High-level Liquid Alarm

A Useful Liquid-level Warning Device

By A. R. MYHILL, F.R.I.C., M.Inst.Gas.E.

OCCASIONS often arise where it is desirable to have audible or visible warning that the level of a liquid, usually water, in a tank or well has risen to a definite height. This is often dealt with by some sort of float system, a vertical rod or cable operating an electric contact at a given position in its travel. There are occasions, however, where floats are inconvenient on account of their size or shape or for other reasons, and the arrangement described below has been designed to avoid the use of floats. It can also be made portable so that one may, if desirable, use the whole outfit at short notice on any tank.

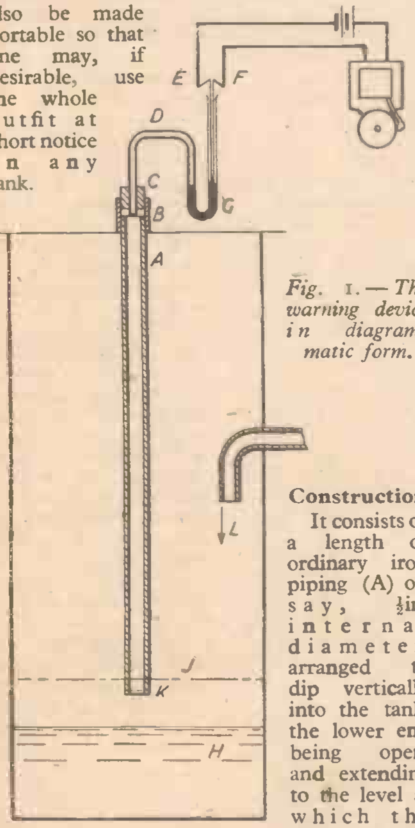


Fig. 1.—The warning device in diagrammatic form.

Construction

It consists of a length of ordinary iron piping (A) of, say, ½in. internal diameter, arranged to dip vertically into the tank, the lower end being open, and extending to the level at which the alarm is intended to operate. The top end is fitted with a screwed socket (B), the lower edge of which serves to support the pipe on the lid of the tank or on a cross member. The top of the socket carries a rubber bung (C) screwed into the internal thread to make a tight joint, and having a central hole, about ⅛in. diameter, through which a glass tube (D) passes. This tube is bent to the shape shown, and has a U-bend at (G) containing a small amount of mercury. Beyond (G) the tube extends vertically for a few inches and is open at the top.

Two vertical thin wires extend downwards from the open end to within, say, ¼in. from the upper surface of the mercury. A battery circuit is then arranged as shown to ring the alarm bell when contact is established by the rising of the mercury so that it bridges across the two wires.

Operation

Suppose liquid is entering the tank at (L), and the level is at (H). It is desired to have warning when the level reaches (J). When this occurs the open end of the pipe becomes sealed, the contained air becomes slightly compressed, with the result that the mercury level in the open limb of (G) rises, making contact with the wires (E and F). The liquid level in the pipe also becomes slightly lower than (J) as shown at (K). The alarm, therefore, does not operate until the liquid has risen to a level slightly higher than the bottom of the pipe, and, if desired, allowance can be made for this, although in most cases such refinement of control is unnecessary.

The Wires

The material of the wires (E and F) is of some importance. Many metals, particularly copper, brass, lead and their alloys, are attacked by mercury, which dissolves them, and would rapidly fail in action. Even if the wires were not completely destroyed, the products of attack are likely to build up on their surface and would eventually lead to a short circuit. The ideal metal is, of course, platinum, but this, except for scientific instruments, is generally unnecessarily expensive, and other metals can often be used. Iron wire is not attacked and may be employed for the purpose, but it should not be galvanised or tinned. It has the disadvantage that in a moist atmosphere it may rust and, therefore, if thin, may eventually disintegrate. Short lengths of nickel-chromium alloys of the type used for electric heating elements are quite satisfactory for the job and have a very long working life.

Making a Surf Board

Fig. 1.—The board in use.

THOSE who delight in bathing may have some first-class fun with a surf board. A sandy beach with a gradual slope over which the foaming waves break is the spot where the sport may be enjoyed at its best. The support which the board offers makes bathing safer for those who cannot swim and often proves a great help in learning to do so. It is simple to make and costs little.

Types of Boards

The simplest kinds of boards are shown in Fig. 2; they are quite plain affairs measuring from 4ft. to 6ft. long by 1ft. 6in. wide tapering to 1ft. The best results are obtained with a wide piece of hardwood 1in. thick, as this need not be strengthened in any way. If deal or similar wood is used in narrow plank widths it will have to be joined and strengthened with battens and these, unless they are carefully prepared and fixed, may make the board uncomfortable and retard its speed. The battens should be fixed on the upper face with brass screws, and they should be neatly rounded over. Some may prefer to prepare their board with hand holes at each side; they are certainly a great convenience and enable the board to be held more firmly and with greater ease. The holes should be cut about half way along the board, about 1in. from the edges. They may be 6in. long and all the edges should be rounded. Boards of two shapes are shown, but the type with a pointed front end is the speedier.

Another form of surf riding which is being largely indulged in all round our coasts requires the assistance of a motor-boat. A towing board is rectangular shaped and measures 6ft. by 3ft. It is made with stout planks joined with battens at each end; ring bolts for the towing rope are bolted on to the front two corners.

A bright coat of paint will improve the appearance.

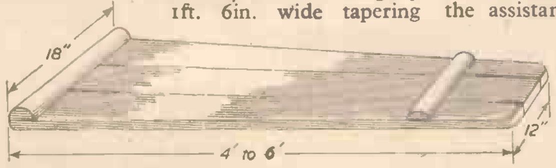


Fig. 2.—Two types of board.

Making a Dumb Piano

A Device for Practising Piano Exercises in Silence

By M. PEARSON

MANY lovers of music regret that they never learnt to play the piano when they were young. They hesitate to make a belated attempt to do so now, because they shrink from compelling their relatives to listen to them while they murder childish exercises with exasperating incompetence. Some of them, who have a slight acquaintance with printed music, feel sure that if they could be spared this humiliation they would willingly tackle the inevitable drudgery.

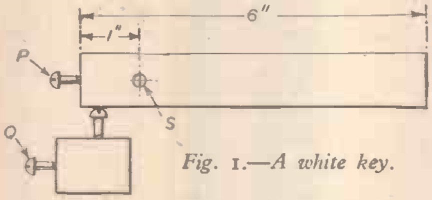


Fig. 1.—A white key.

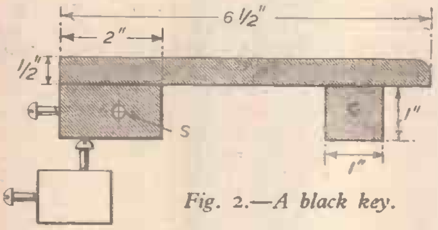


Fig. 2.—A black key.

The following notes explain the construction of a contrivance, scarcely larger than a violin, on which a passage of piano music could be played a thousand times without a sound being heard. This silent keyboard offers a solution to the difficulty.

How it is Used

A person who desires to take advantage of its possibilities should obtain an instruction book for the piano, which contains a simple arrangement of a song, the melody of which is well known to him. In the book the appropriate fingering will have been marked by an expert; this is fundamental.

Using the right hand only, the student should play the first half-dozen notes of the treble portion, repeating the action several times. Then a few more notes. After a short passage has been practised he should play it without looking at the keyboard, satisfying himself that he is using right notes and correct fingering. Later, the left hand will tackle the bass section in a similar, piecemeal fashion. After that will come the playing of the opening bar by both hands, simultaneously, very slowly, accurately and repeatedly. Finally, an attempt will be made on a real piano, and with a bit of luck the student should not feel unduly mortified by his performance.

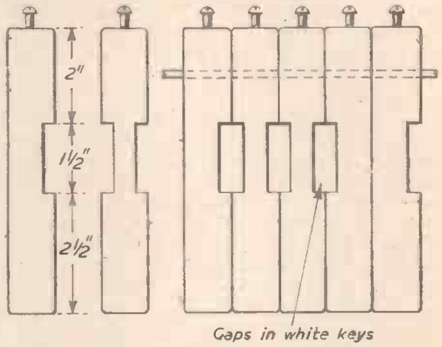
Throughout the practising the aspirant should hum the melody; this will tend to consolidate his experiences. He should be courageous enough to make haste slowly and to avoid all slap-dash work. He is out to conquer something, and for most of us mastery calls for much patient repetition. The process is tedious, but worth while.

Construction

The instrument consists of (a) black and white keys of special design, and (b) a supporting structure.

Fig. 1 illustrates a white key. It is fashioned from a length of wood with a cross section of 1in. square. A hole " S " is drilled through it, and all the white keys are threaded on to a metal tube-axle 26½in. long and ¼in. thick. The tip of the under side rests on an adjustable screw inserted in the wood immediately underneath. From this supporting wood projects a horizontal screw " Q " which matches a similar screw " P " protruding from the key. When P and Q are joined by a rubber band, " power " is supplied for making the key return to a horizontal position after being depressed.

A black key is shown in Fig. 2. It is made of white wood (subsequently inked) of ½in. square section. One end is screwed to a piece of the material used for the white keys. Here, again, a hole " S " is bored through. All black keys are threaded on to a separate length of the metal tube. The arrangements for " power " and " key-levelling " are as before. Hanging from the key is a piece of ⅜in. thick wood " G," which is to be called a guide.



Figs. 3 and 4.—Keys cut away for black key guides.

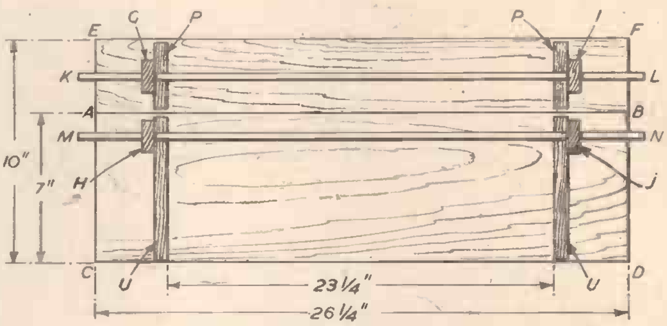


Fig. 5.—The baseboard layout.

This is fastened by glue and by one screw passing through the key.

Each white key has a piece cut out of its side as shown in Fig. 3. In some cases a key is cut on both sides. As a result there are gaps between the white keys as shown in Fig. 4. The " guides " of the black keys drop into these gaps. The exact position for the gaps should be obtained from a real piano.

The Baseboard

Shown in Fig. 5, this is in two parts, both composed of ½in. plywood; one is ACDB and the other EABF. Underneath the whole, at each end, is a piece of the same wood 10in. by 3in. ACDB is screwed to these bearers. EABF is loose; later it will be fastened to the bearers by easily detachable bolts.

The larger piece of the base supports the white keys; the narrow one the blacks. The black keys and their supporting structure form a complete, separate, detachable unit.

On the upper surface of the large baseboard are two pieces of wood, shown as " U " in Fig. 5, of the same material as white keys. The length of base between these cross pieces allows 25 white keys to be accommodated, beginning at F natural. Pencil marks should be made on the baseboard, at right angles to the front edge, to allot the space available for each key. Seven keys occupy 6½in.

On the upper surface of the narrow baseboard are two similar cross pieces; these are marked P in the diagram.

Fig. 6 illustrates one of four pieces of plywood which operate as bearings for the tube-axles. The two for the white keys are shown in Fig. 5 as " H " and " J." Those for the black keys as " G " and " I." They are vertical, and are screwed to the cross pieces. In addition, it is desirable to support the axles near the middle point by a similar-shaped bearing cut from a piece of thin metal, with a bent-over foot.

The two axles should be parallel to each other. The one carrying white keys should be 5in. from front edge of base. The position of the other will best be ascertained by experiment, matching the guides on the black keys with the gaps.

A strip of felt should be fastened to the upper surface of the baseboard, near the front edge.

Fig. 7 shows the device for achieving " power " and " key-levelling." Four of these will be required and they will be of different sizes. The central support of the axles will not be in the exact middle, so the device on one side will differ slightly from that on the other. And there is a difference between requirements for white keys and black. But all will be obvious to the constructor.

The basic idea is this. ABCD is a piece of thin ply or hardboard. Fixed to it is a piece of the material used for white keys. When the keys have been placed in working positions this new piece of wood can be marked with the points appropriate for the screws. When they have been fixed the gadget can be fastened to the baseboard at G and H.

In order that the keys may retain their proper positions on the axles spacing washers will be needed at appropriate points. Quite a number will be required between the black keys.

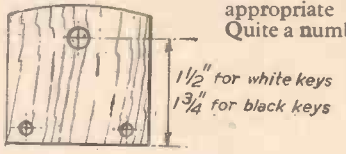


Fig. 6.—A plywood bearing.

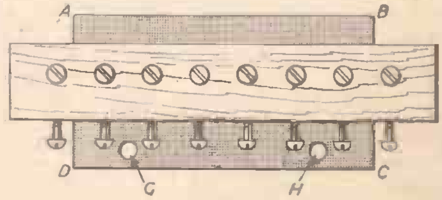


Fig. 7.—Device for achieving " power " and " key levelling."

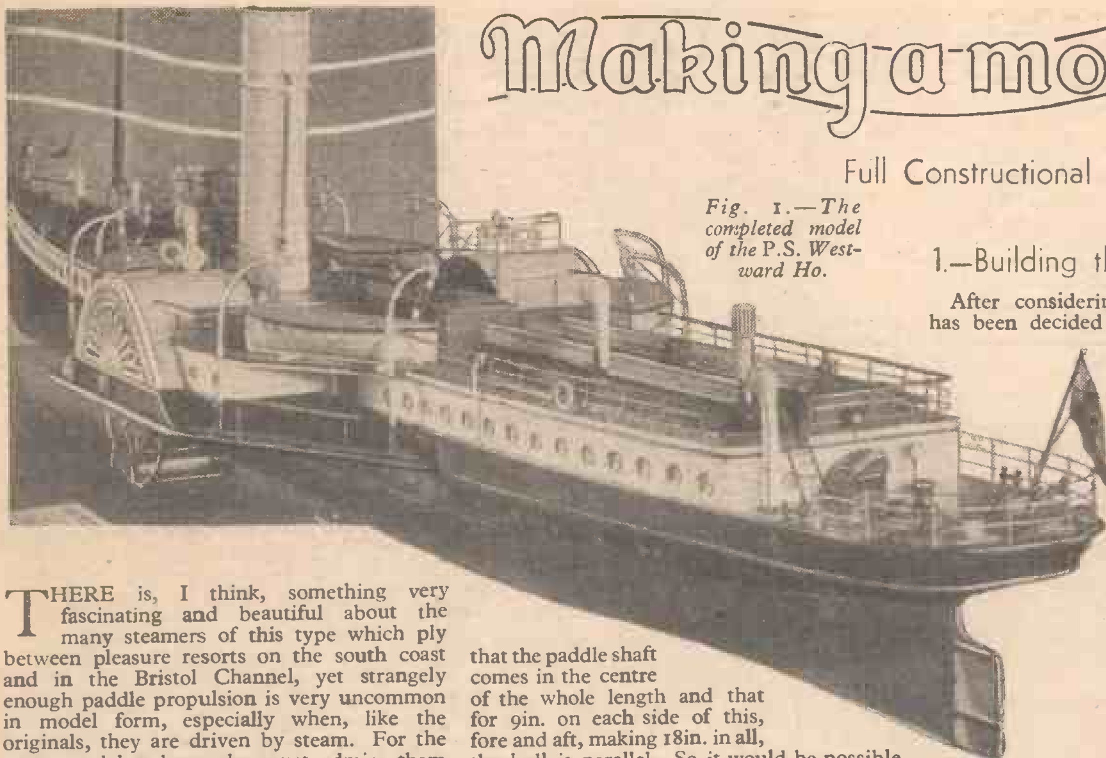


Fig. 1.—The completed model of the P.S. Westward Ho.

Making a model of t

Full Constructional Details of a 4ft. Long
Diagonal

1.—Building the Hull

THERE is, I think, something very fascinating and beautiful about the many steamers of this type which ply between pleasure resorts on the south coast and in the Bristol Channel, yet strangely enough paddle propulsion is very uncommon in model form, especially when, like the originals, they are driven by steam. For the many model makers who must admire them this article describes a working model and gives drawings showing its design and construction.

The particular prototype chosen is one of the famous white funnel fleet of Messrs. P. and A. Campbell, Ltd., of Bristol. Some of these vessels are stationed in south coast ports, but the newest and largest are at Bristol and work cruises to Ilfracombe and occasionally to Lundy Island. The newest vessels are the *Bristol Queen* and the *Cardiff Queen*, both having two funnels and triple expansion engines. The paddle boxes are not nearly so ornate as those of some of the older vessels; in fact, these, and some of the old boats, have paddle boxes which are so severely plain that they appear as large bulges in the sides of the vessel and in elevation there is nothing to indicate the outline of the paddles.

Several of the others have been given two funnels and the same plain form of paddle box and thus the subject of this article is one of the older steamers with a single white funnel and paddle boxes which follow the shape of the paddles and are highly ornamental. The vessel chosen is the *Westward Ho.*

Fig. 1 is a general view of the port side of a model of the *Westward Ho* and Fig. 2 shows an amidship portion of the starboard side and gives a close-up view of the paddle box, funnel, lifeboats and fittings. This model is complete in all details, including the feathering of the floats of the paddles. But such refinements are not necessary for the working of the vessel.

In the drawings which will illustrate this article everything in the nature of fine detail is omitted, but the main features, which are needed to give correct appearance, are shown in Fig. 3. This is a complete sheer plan (side elevation) and deck plan of the model which will now be dealt with. The length overall is 48in., the beam of the bare hull 6in. and the draught 2¾in. The height from keel to deck line is 5½in. and the overall width or extreme beam over the sponsons of the paddle boxes 11½in.

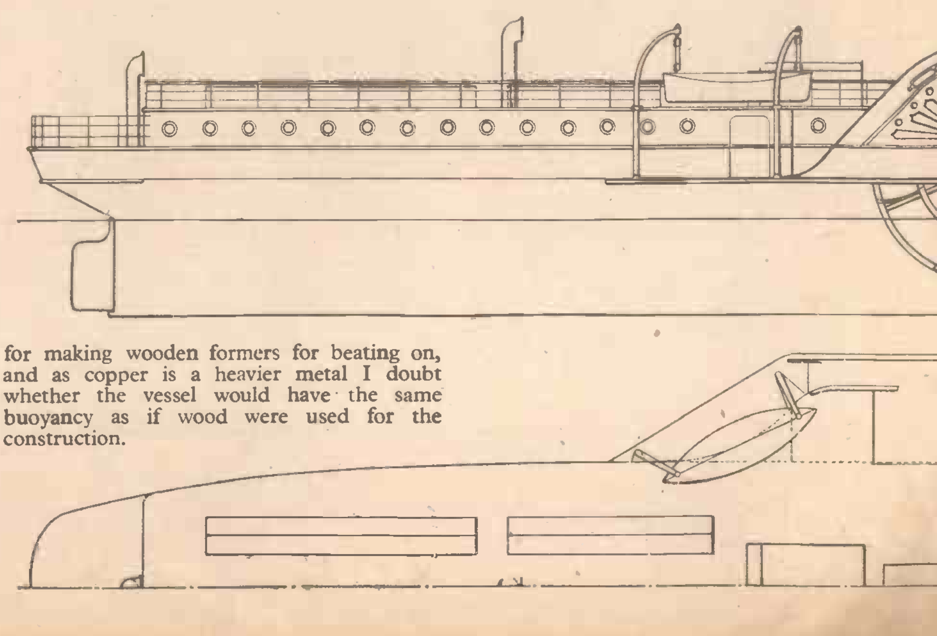
Building the Hull

The construction of the hull will be the first work to be taken in hand. Now it will be seen from the lines, which are given in Fig. 4, that the paddle shaft comes in the centre of the whole length and that for 9in. on each side of this, fore and aft, making 18in. in all, the hull is parallel. So it would be possible to make the whole hull of sheet aluminium of five pieces, one for the 18in. centre section, two for the bows and two for the stern. Each of the two pieces for the bows and the two for the stern would have to be accurately beaten to shape, joined together by longitudinal straps riveted on each side of the centre-line and joined to the amidship section by cross or semi-circumferential straps, all on the inside of the hull. Such a hull would make a fine job, but it would involve more work and difficulty than building in wood; especially the beating of the four pieces for bows and stern, which would need curved hollows carved out of wood for finishing. Besides this it would not be possible to maintain good painted surfaces on the outside of the hull. Especially when water is present paint on aluminium seems to have a tendency to flake off, due to oxidation of the metal underneath, and this applies to all kinds of paint and lacquers. Copper might be used, and copper could have the jointing straps soldered instead of riveted, but there is the same necessity for making wooden formers for beating on, and as copper is a heavier metal I doubt whether the vessel would have the same buoyancy as if wood were used for the construction.

After considering the matter carefully it has been decided to advocate wood and to build in the bread-and-butter fashion, using boards of 1in. thickness above the bottom waterline, the bottom being made up of two ½in. boards. By adopting these thicknesses to make up the thickness of the hull the inside can be cut out almost entirely on a jigsaw to outside and inside outlines drawn in pencil on each board. Fig. 5 is in two parts. The central parallel portion, 18in. long, is drawn in cross section and is divided between these. In one part is drawn half-sections of the bows at every 3in. longitudinally and in the other half-sections of the stern, also at every 3in. As may be seen the total depth of the hull, without the deck, is 5in., i.e., four 1in. boards and two ½in. On all the sections which are the bodylines are figured in the inside width to be sawn away and the widths from the centre-line to which the boards are to be cut for the outside. A few moments' study of Fig. 5 will show that this method and these thicknesses of board will leave practically no work to be done with gouges on the inside of the hull when it is assembled and all the cutting and hollowing out inside and all carving outside can be done with the paring chisel, and very little of that will be necessary. In the drawing the grain of the wood which is to remain is shown, as usual, by cross hatching, whilst the parts to be pared away are indicated by stipple.

The Wood Used

With regard to the wood to be used: the best, of course, is yellow pine; next comes



the P.S. WESTWARD HO

g Scale Model of a Paddle Steamer Powered by Steam Engines

By "DESIGNER"

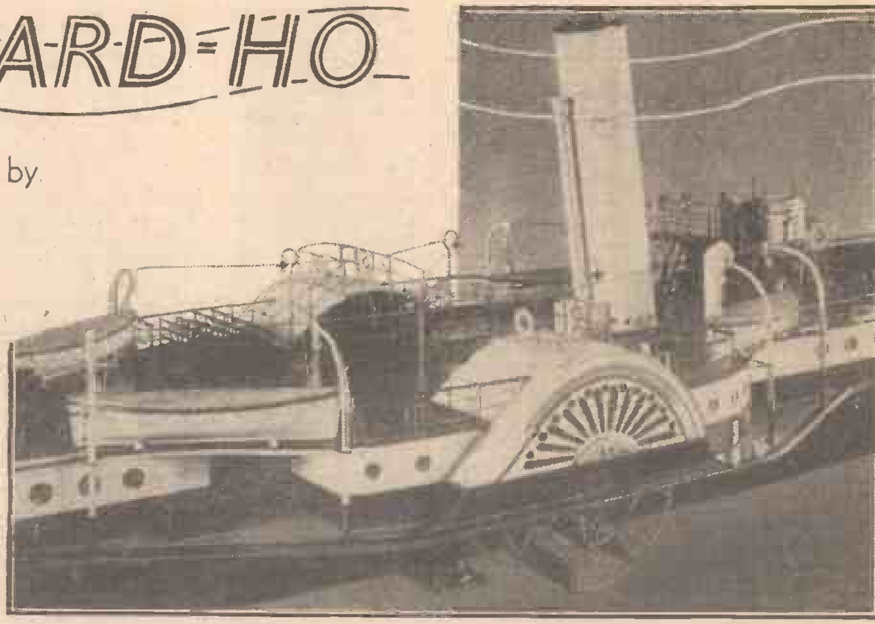


Fig. 2.—*The amidship section of the model.*

white or Siberian pine and then Obechi. This last has an excellent straight grain; in appearance it is very like Spanish mahogany, but is almost white in colour. It carves nicely, takes a smooth finish and is light in weight, though not so light as the two pines mentioned. To obtain yellow pine try a firm of engineers' pattern makers and if he or they cannot spare from their own stock as much as you want, they will doubtless give you the name and address of the timber merchants from whom their own supplies are obtained. Failing one or other of the soft pines, fall back on Obechi—most dealers in hardwoods will stock this. Get it sawn, thicknessed and surface planed into four planks 1in. thickness and two of $\frac{1}{2}$in. thick, all 6in. wide and 48in. long. Just to make sure that it is dead true on all surfaces pass a smoothing plane set to the finest of fine cuts over both sides of each plank.

Now draw a centre-line truly and exactly down the middle of each plank and with a joiner's square draw across each board, at 3in. spaces, all the bodylines: 3in., 6in., 9in., 12in. and so on up to 48in. Mark all these bodylines on all the boards with their correct numbers from 3in. to 45in. Take the top 1in. board and starting on line 3in. mark off on each side of the centre-line $1\frac{7}{16}$in. and 1in. for the outside and inside respectively. On line 6in. mark off $2\frac{1}{8}$in. (full) and $1\frac{3}{4}$in. On line 9in. mark $2\frac{3}{8}$in. and $2\frac{1}{4}$in. On 12in. mark $2\frac{15}{16}$in. and $2\frac{5}{8}$in. On line 15in. mark 3in. (here you can actually make no outside mark because you are at the edge of the board) and for the inside mark $2\frac{3}{4}$in. These last marks will be the same from 15in. to 33in. since the hull between these lines is parallel. Abaft the bodyline 33in. the dimensions for cross marking can all be taken off the drawing Fig. 5, the last pair of marks at 45in. being $2\frac{1}{4}$in. and $1\frac{7}{8}$in. The points of intersection of all the marks with the bodylines must now be connected up by longitudinal curved lines from the stem, through 3in. and all other bodylines to line 15in., and from 33in. to 45in., with a continuation past 45in. around the stern. Appropriate draughtsmen's celluloid curves are the best for this purpose, but failing these it can be done with a spline of hardwood; that is to say, a slender rod, rectangular in cross section bent to a bow, the camber of which can be adjusted by a taut cord. For our present purpose the rod should have a length of about 18in. and be about $\frac{1}{4}$in. by $\frac{1}{8}$in. section. The cord should be tied with a slip knot at one end so that the camber of the curve can be varied.

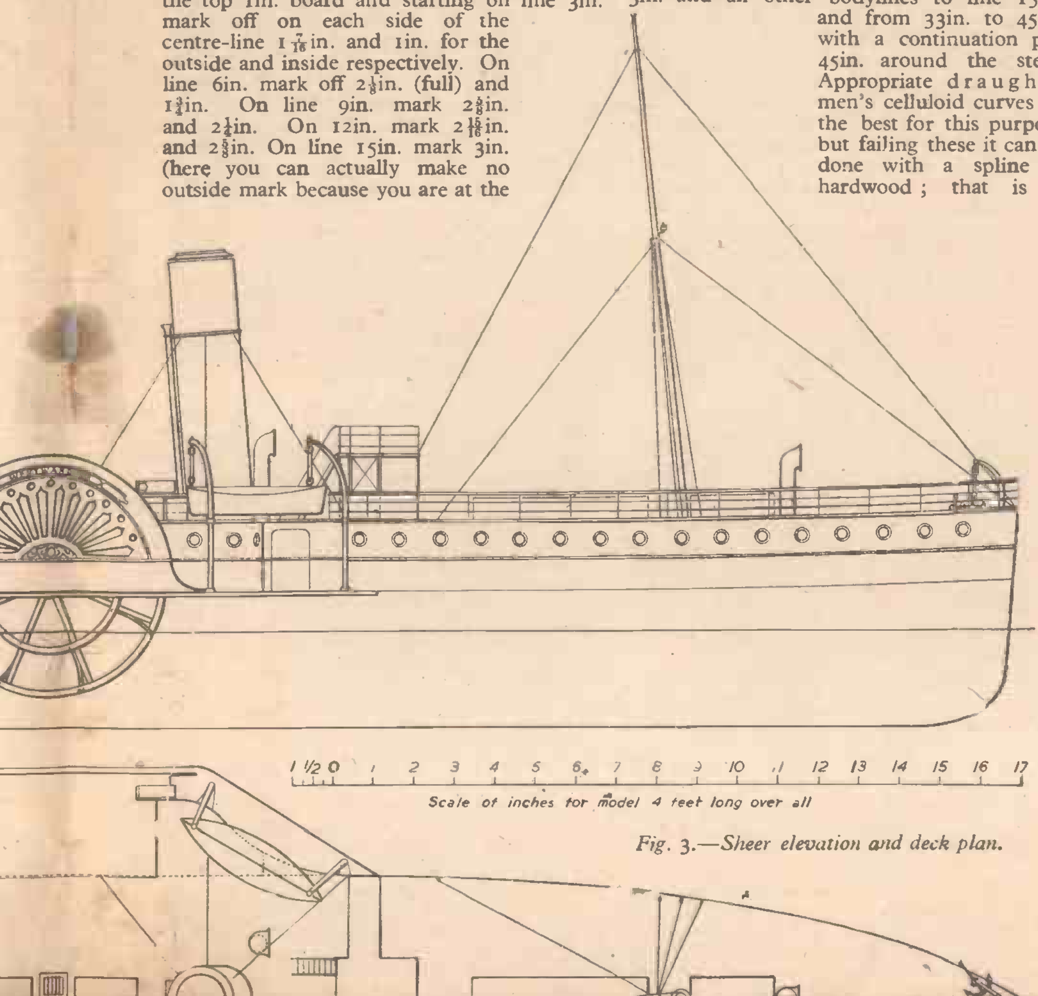


Fig. 3.—*Sheer elevation and deck plan.*

Cutting Out the Centre

Having drawn all the curved lines the next thing to do will be to cut out the centre of the plank. Unfortunately, a bandsaw cannot be used, and it must be done with a jigsaw or a heavy power-driven fretsaw. It might be possible to saw by hand, using a bowsaw or a hacksaw, but the cut must everywhere be dead square with the board, and this it may possibly not be if there is no certainty of keeping the saw always cutting at right angles to the surface. If no other cutting means are available it *must* be done by hand, and in that case at about every 2in. or so of the cut, try the saw for angle by offering up a small steel square between the saw blade and the surface of the board. At the same time it might be as well to cut just a little inside of the pencil line and not on it. Everything depends upon the operator's skill in using the saw.

When all the boards are marked out in accordance with Fig. 5 and are sawn and finished, the bottom $\frac{1}{2}$in. one should be recessed to a depth of $\frac{3}{16}$in. to lighten it; this recess should extend from bodyline 12in. to line 36in. or slightly beyond each of these. The maximum width of the recess, between lines 15in. and 33in., should be $3\frac{5}{8}$in. and be parallel.

There is a small amount of sheer, or rise, to the forward part of the bows, which extends back to bodyline 12in. (see Fig. 4). The extreme height of this, above waterline 5in., is $\frac{3}{16}$in., and I think it will be advisable to add this on after the rest of the hull is glued up, so that the hull can be placed, bottom up, on a true flat board or bench when and after gluing.

Type of Glue

The glue to be used must be capable of making strong and perfect joints and be absolutely waterproof. Ordinary glue can be made insoluble with bichromate of potash, but there is only one glue which fulfils the conditions to the full, and that is Casein. It is manufactured by Casein (Industries) Ltd.,

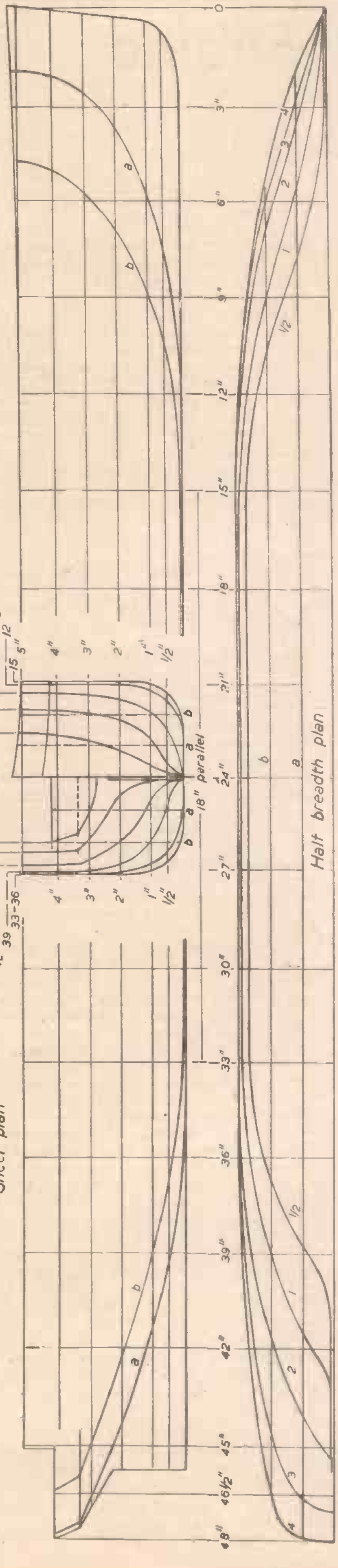


Fig. 4.—The lines of the hull.

of Sheepcote Lane, Battersea, London, S.W.11, and is sold quite cheaply by the pound. The particular brand is "Laitzo XXX." Instructions for using are supplied; it is in powder form and only requires mixing with cold water before applying to the wood.

The Glueing Operation

Start with the top board 4in. to 5in., and glue 3in. to 4in. down upon it. Lay strips of wood across, and either make a number of clamps to put pressure on the joint or place heavy weights on the wood strips. Leave to dry for about 24 hours. Then glue the next waterline section 2in. to 3in. and again

Preliminary Coating

Even though the hull is not yet ready for painting, it would be advisable to give it some preliminary protective treatment. There are three mediums which are available: it can be given a priming coat of oil paint, three or four coats of shellac lacquer or two coats of cellulose dope or cellulose lacquer. I recommend thin shellac lacquer. This is made by dissolving brown shellac flakes in methylated spirit. For the first coat the spirit should have only sufficient of the lac in it to render it a pale amber-brown colour, still more or less transparent. Thus it will soak well into the grain of the wood. With a large mop brush give the hull a coat of this, putting it on

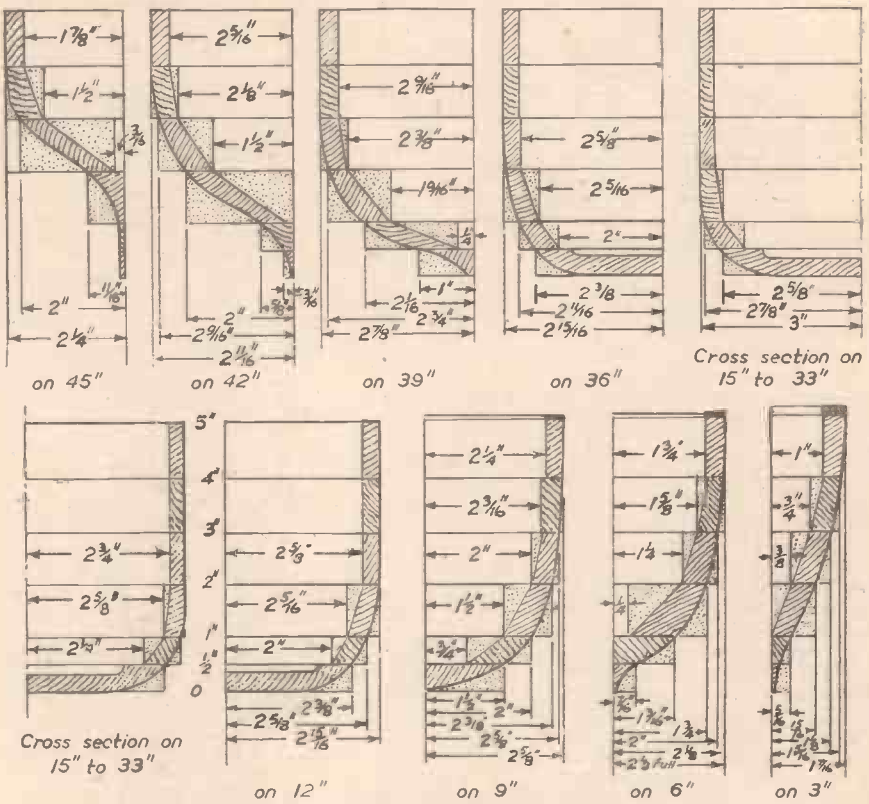


Fig. 5.—The bread-and-butter construction of the hull.

clamp and leave to dry, and so on, section by section, until the bottom ½in. waterline section is on. In placing each section down glue both of the surfaces to be joined, and be careful to see that all drawn pencil lines come into alignment, including the centre-lines on each board. Then the hull will be built up true. Next comes the paring away on the inside and afterwards on the outside. In doing the outside paring use, say, a ½in. bevel-edged chisel on bows and stem, and a small iron plane on the parallel portion between body-lines 15in. and 33in. I do not think a spokeshave will be needed, but it can be used if desired. In paring it will be found best not to make straight, longitudinal cuts, but to finish with cuts made diagonally across between the glued joints, for better and truer curves can be obtained in this way, and one is enabled better to feel the direction of the grain.

Last of all, glue on strips of wood for the $\frac{5}{16}$in. sheer, pare this to shape and finish the shaping of the hull by glasspapering using No. 1 grade first and lastly No. 0.

For the information of the novice who is unfamiliar with hull designs, I would refer again to Fig. 4, and say that the horizontal lines ½in. to 5in. are known as *waterlines*. The longitudinal lines "a" and "b" are *buttock lines*, and cross or circumferential lines 3in. to 45in. are *bodylines*.

plentifully and freely both outside and inside. Allow it to dry for about three hours and apply a second coat, having a little more lac in it. In another few hours give still another coat. When this is dry, lightly rub down with No. 0 glasspaper, preferably slightly worn paper, and apply a fourth coat of shellac. The hull can remain in this state until it is finished and ready for painting.

To a great extent the nature of the final painting can decide which preliminary shall be used; if it is to be ordinary oil paint or enamel, then an oil priming or the shellac can be used, but if the finish is to be a cellulose paint let the first coats be cellulose also. Whatever the preliminary treatment is, the parts which will have to receive the sponsons of the paddle boxes had better be left in the bare wood because these will have to be glued on later, when they are made, and this applies to the paddle boxes as well.

In the Next Issue

Next month it is proposed to deal with the power plant, which will consist of diagonal steam engines having a pair of single expansion double acting cylinders, driving a cranked shaft direct coupled to a paddle shaft on each side. In this respect the model will follow the design of the prototype, except for the fact that the full-size engines are two cylinder compound.

(*To be continued.*)

Converting a Petrol Engine to Run on Paraffin

Full Working Details, Including Vaporiser Construction

By M. F. LEVETT

THE function of the vaporiser on an engine that is designed to run on paraffin is to convert the paraffin into a vapour that will ignite (in the cylinder) as easily as the petrol vapour does in the normal engine.

This is effected by passing the " atomised " paraffin/air mixture emanating from the carburetter through the " vaporiser," which is maintained at a very high temperature—almost always by the exhaust gases, suitably directed. The vaporiser may be a simple plate, or a complex arrangement of tubes. Whichever layout is adopted, the principle remains the same, viz., on one side the heating medium, on the other the paraffin/air mixture.

Vaporiser Construction

In any conversion the most important item, of course, is the vaporiser ; it is on this that the overall efficiency of the engine depends. The main constructional details of a suitable vaporiser are shown in the diagram. The making of this item should not prove too difficult.

Mild steel sheet, of at least 10 gauge, is the best material to use, it being easily manipulated. The top and bottom plates should be of about 3/16in. steel plate in order to provide a rigid surface which will not easily distort when the unit is bolted in position and the carburetter attached. The carburetter-securing studs pass through the top plate—to which they are welded—on to the top of the vaporiser body, where welding ensures a firm fixing.

The bottom plate has two holes drilled in it to accommodate the studs securing it to the manifold. A small gap is allowed between this plate and the body of the vaporiser to allow the nuts to be placed upon the studs and tightened. The gap between the top plate and the vaporiser is to prevent excessive heat from reaching the carburetter ; about ⅛in. is usually adequate.

For the vaporiser tube, a piece of drawn steel tubing should be used. This tube has to carry the entire weight of vaporiser and carburetter, so it is important that it is of good quality.

The exhaust inlet and outlet stubs, on to which flexible pipes are later to be fixed, may be fabricated or cut from standard steel tubing. This will depend on the internal diameter of the flexible pipe, which size will in turn depend on the measurement of the exhaust pipe at the point where it joins the manifold ; it is from this point that the hot gases are tapped off and led to the vaporiser.

These flexible pipes are securely fastened at each end, plus any intermediate supports that may be required. The outlet side of the vaporiser is connected to the silencing system in a similar manner.

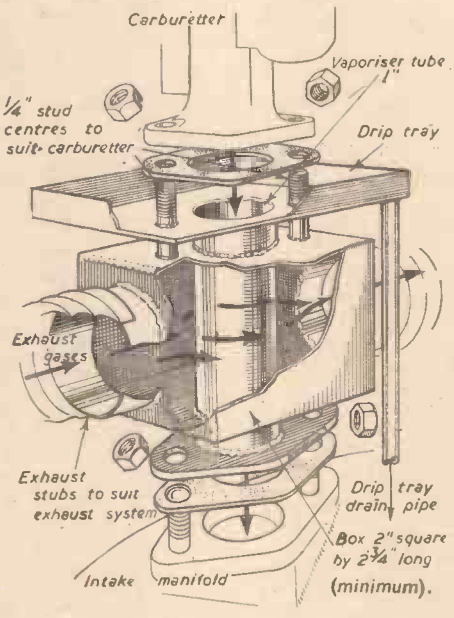
A copper-asbestos gasket is fitted between the top plate and the carburetter, and between the bottom plate and inlet manifold.

The drip tray shown in the diagram is desirable from the safety angle ; it is easily made up from tinplate. Use ¼in. bore tube for the " drain pipe," leading this to a covered container which can be emptied when full.

A drain tap must be fitted to the bottom of the float chamber of the carburetter in order to drain same of paraffin prior to starting.

For starting, a petrol tank of a reasonable size is fitted in an accessible position. What was formerly the main petrol tank now becomes the paraffin tank, and should be clearly marked.

A two-way tap, suitable for the size of fuel piping used, is fitted close to the engine, and adjacent to this tap fit a glass bowl type of filter. Run a pipe from the outlet side of this filter to the carburetter inlet union ; flexible fuel piping is advised here. The inlet side of the filter is connected to the outlet side of the two-way tap. One of the inlets on the two-way tap is connected to the starting petrol tank, the other to the paraffin tank. It need hardly be mentioned that a good " head " must be allowed between the fuel tanks and the carburetter.



Construction of the vaporiser

Where a fuel lift pump is used, place this between the outlet of the two-way tap and the carburetter inlet union.

The operating temperature of a paraffin engine is around 180 deg. F. ; fit a thermometer in the cooling water outlet to keep a check on this. To maintain the temperature, fit a blind to the radiator, if used for cooling, or, where sea-water cooling is employed, place a screw-down valve in the outlet pipe.

The lubrication of a paraffin engine should present no difficulties, but a reduction of the change period of the oil by about 20 or 30 hours is advised.

The ignition system, if it is in good order, requires little attention ; a slight retarding of the timing will usually suffice. Set the spark plug gaps to about .020in., and if persistent "sooting-up " is experienced, try the effect of slightly hotter running plugs ; any large garage will help out here.

With a mechanically sound engine it may be only necessary to reduce the compression ratio by the addition of an extra gasket under each cylinder head.

Actual operation of the engine is little different from that of a similar petrol engine. To ensure easy starting, the following is the best method to employ.

Starting

Ensure that tanks contain the correct fuels, engine oil is at correct level and radiator full. Turn on petrol at two-way tap, open drain tap on carburetter until petrol flows freely, use primer on pump, if fitted. Close drain tap, set throttle slightly open, pull out choke control, when a few sharp turns should start engine. Allow to run on petrol until properly warm, turning over to paraffin at about 140 deg. F. Adjust radiator blind, or sea-water valve, to allow engine to operate at the correct temperature.

Stopping

Turn the two-way tap to the petrol position about five minutes before it is desired to stop the engine. Stop the engine finally by turning the fuel off. Only use the ignition switch in an emergency.

Should the engine be inadvertently stopped whilst running on paraffin it may, if the temperature of the vaporiser is fairly high, be restarted by liberal use of the choke control. This practice is not advised, however—it tends to cause neat paraffin to be drawn into the cylinders.

A paraffin engine gives of its best when working hard ; under such conditions—if the operating temperature is correct—the exhaust gas should be colourless. Black smoke will accompany " pinking." This should only occur at infrequent intervals if the engine is momentarily overloaded. If pinking is persistent, however, serious damage will occur to the engine, and steps must be taken to cure this.

Excessive smoke in the exhaust, usually blue in colour, indicates wear in the engine permitting oil to get into the combustion chambers, or that too much fuel is being supplied to the engine. The former can be cured by suitable attention to the worn parts, the latter by alteration to the jets in the carburetter. A good carburetter text book will indicate the best method to employ when trying the effects of jet alteration.

White smoke, accompanied by " spitting-back " in the carburetter intake, is a sure sign of faulty vaporisation. This can be cured by an increase in the heating area of the vaporiser. It is fortunate that such a fault is rare.

Although the vaporiser, etc., described here is intended for use with a downdraught carburetter, by changing the relative positions of carburetter and intake manifolds the same basic layout can be used equally well with an updraught carburetter. In fact, with suitable modifications the whole methods outlined here can be applied to the conversion of *any* type of petrol engine.

A final warning, make sure that alterations to engines, particularly when installed in boats, do not affect any insurance that may be in force.

Electric Clock, Slave, and Synchro Motors

Notes on Slave Control, and Pendulum and Synchronous Movements

By F. G. RAYER

THE operation and construction of motors of these special types are in some ways of particular interest, and the principles employed may be put to use in the actual building of various timekeeping mechanisms, clocks, or other equipment. Some movements of this type are not always included in the more familiar classification of motors, but since they furnish motive power for the rotation of hands or other units there is some justification for including them. All " motors " of this type are, almost without exception, of extremely low current consumption, and have extremely small driving power. They are, however, arranged to run within close speed limits, thereby serving the purpose of timekeepers. Speed regulation may be achieved by the use of a swinging pendulum, the oscillations of which are maintained by a suitable magnet. Or the speed of rotation of the driving member may be synchronised with alternating current mains, thereby achieving an almost exact degree of accuracy. Or, in the case of slave clocks, impulses may be obtained from an existing clock, which will then control the speed at which the slave clock runs.

Such mechanisms do not usually present any undue mechanical difficulty in construction, and small gears, etc., may readily be purchased, if not already available in some suitable form. Except for the actual working members, the construction of such timekeeping motors can be on almost any lines desired. The whole mechanism may be left visible in a suitable glass case, or everything may be concealed, as with most ordinary clocks

Pendulum Movements

Two types are most generally seen. In one, the energising current is very small and is applied with each oscillation of the bob, while in the second type the magnet is only energised when the bob falls below a certain pre-arranged swing. A popular form of the first type is shown in Fig. 1, and is usually operated from a small dry battery. The pendulum is suspended from a thin, flat spring, in the usual way, and terminates in an iron core or permanent magnet, which swings freely inside a solenoid coil. The electrical circuit is completed each time the core is passing into the solenoid, and broken when the core is swinging outwards. The swing of the pendulum is thus maintained as long as current is available. The drain on the battery may be a few milliamps only, and several months' operation is possible before replacement is required.

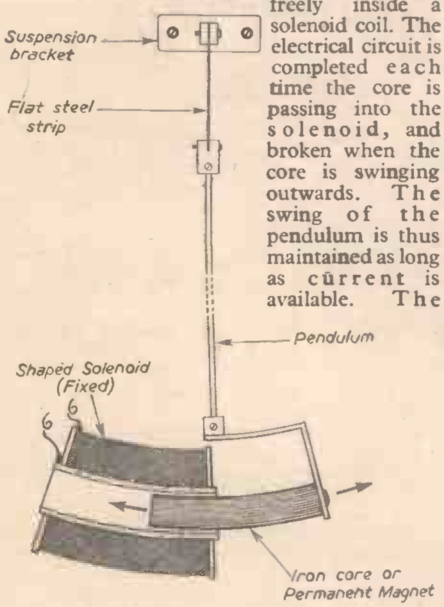
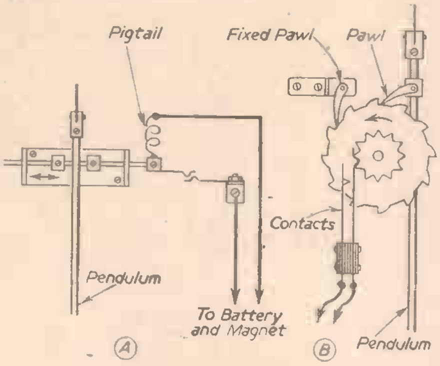


Fig. 1.—Pendulum movement with low consumption coil.

One method of arranging for the energising of the magnet at the correct instant is shown at " A " in Fig. 2. Here, the pendulum rod hangs between two collars on a rod able to move laterally. When the bob reaches the limit of its swing to the right, the right-hand collar is struck, and the contacts closed. The solenoid is thus energised while the core swings to the left. At the limit of its travel in this direction the left-hand collar is struck, opening the circuit, so that the bob is free to swing again to the right. This sequence is repeated continuously.



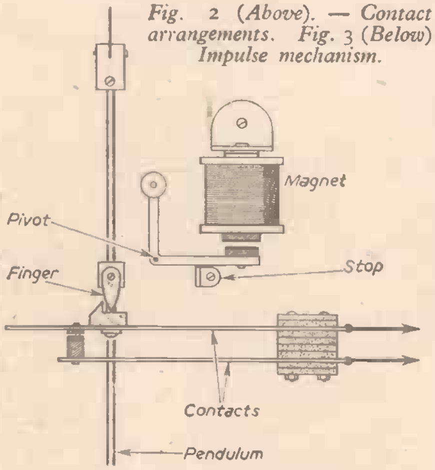


Fig. 2 (Above). — Contact arrangements. Fig. 3 (Below) Impulse mechanism.

The movement of the pendulum is made to rotate a spindle as shown at " B " in Fig. 2, a fixed pawl preventing backward movement of the ratchet wheel. This rotating movement drives the clock second hand direct, or through gearing. In Fig. 2 a 5:1 reduction ratio would be required between ratchet wheel and hand if the pendulum has a one-second swing. If the wheel had 60 teeth no such gearing would be required. This also shows another method of energising the solenoid, a small toothed wheel opening and closing the contacts illustrated at the correct instant.

Mechanisms of this kind are not difficult to make up, but friction must be kept low, or an increased operating current will become necessary. For economical running, the operating coil should have as high a resistance as possible, and be energised for no longer than is necessary to maintain oscillations of the bob. To avoid the difficulty of using very fine wires a low operating voltage may be adopted by using dry-cells in parallel. About ¼lb. of 34 s.w.g. wire can then be used.

A further type of contact and energising mechanism is shown in Fig. 3. Here, the contacts are normally open, and the small finger trails backwards and forwards across the shaped steel piece fixed to the top contact. When, however, the swing of the pendulum falls below a pre-arranged level, the finger fails to escape; as the pendulum swings back, the finger then depresses the top contact upon the lower, energising the magnet. Though the latter may take the form shown in Fig. 1, or consist of a horseshoe electrical magnet attracting an iron piece on the pendulum, alternative arrangements are sometimes seen. That in Fig. 3 operates by the small roller striking upon the pendulum rod, and is found in some large commercial clocks.

With such a mechanism, energising may only take place once in 30 or more swings of the pendulum, becoming more frequent as the power of the battery falls. The magnet requires to be of a rather more powerful type, however, and the current drawn is much higher, though taken for a much shorter period, compared with a mechanism of the type in Figs. 1 and 2. The movement of the pendulum is transmitted to a suitable gear train by a pawl and ratchet wheel such as in Fig. 2.

Master and Slave Clocks

If a clock suitable for master control is available, the construction of a slave clock is extremely straightforward. The master clock may be any fairly large timepiece of reliable type. As shown in Fig. 4, a small cam momentarily closes two contacts once each minute. The operating magnet of the slave clock is thus energised each minute, and a pawl transfers this movement into a rotating motion for the slave clock hands. If the ratchet wheel has 60 teeth it will rotate once each hour, and may therefore be fitted to the spindle bearing the hour hand. If it has a smaller number of teeth a reduction gear is required, as in Fig. 4. A fixed pawl trailing on the wheel prevents back movement.

Any number of slave clocks may be controlled by one master clock, and such clocks will be found in various establishments, being distinguished by the sudden movement forwards of the hands at one-minute intervals. Current may be derived from a battery or a mains transformer used with A.C. mains. The operating voltage and current should not be unnecessarily high or excessive sparking may arise at the master contacts. The latter should be light, so that the correct running of the master clock is not impeded. With

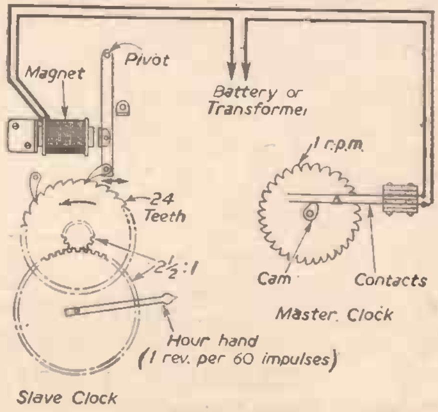


Fig. 4.—Slave clock and master contacts.

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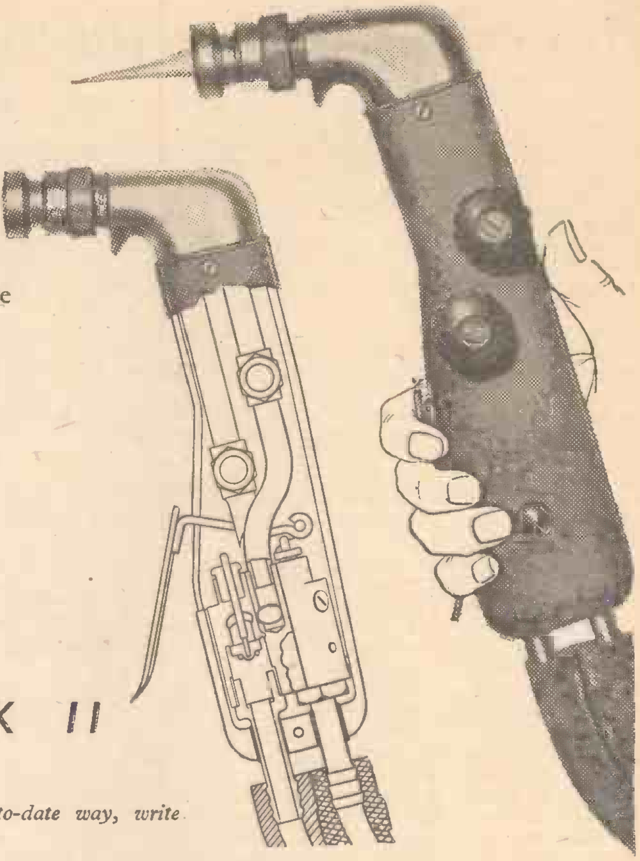

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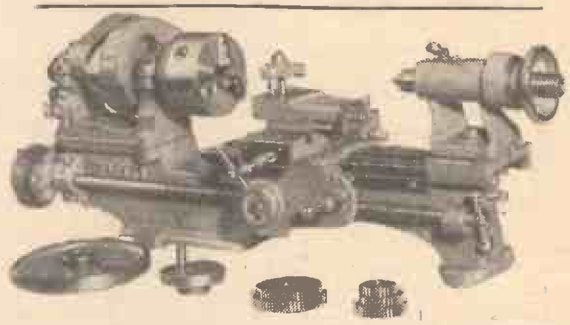

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several slave clocks a relieving relay may be used, energised via the master clock contacts, and in turn closing heavy-duty contacts which complete circuits to the slave clocks.

Synchronous Movements

These can be used where A.C. mains are available, and in some ways they are the most attractive since accuracy is automatically assured. Though current is drawn continuously, it may be so small that some hundreds of hours operation is obtained with a unit of electricity.

The simplest form of synchronous clock movement, but one which will run satisfactorily in practice, is shown in Fig. 5. The timing wheel is of thin sheet iron or other ferrous metal, with a number of equally spaced teeth which pass near the pole of a fixed magnet. With 50 cycle A.C. mains this magnet will be energised 100 times per second. If the wheel rotates freely, and is set turning at such a speed that 100 teeth pass the magnet each second, the impulses will result in it continuing to run. The correct speed is automatically maintained, because if friction or other cause slows down the timing wheel synchronisation will be upset and the wheel will cease to run.

The speed of rotation of the timing wheel will depend upon the number of teeth, and some of the most convenient wheels for home-constructed units are listed in the table. Other numbers of teeth are possible, of course, but some give very awkward ratio figures, while wheels with very few teeth run at a rather inconveniently high speed and are best avoided.

Greater efficiency (with greater power output and less difficulty in starting) can be achieved with improved magnet assemblies such as illustrated in Fig. 6. Other magnets may have shaped pole pieces which fit almost completely round the wheel, and notched to agree with the teeth on the latter. For A.C. operation the cores should be built up from laminations to prevent undue eddy currents in the core itself. This is not essential, however, and small cores of solid type can be operated with success for long periods. As a winding suitable for the usual mains voltage must consist of some thousands of turns of fine gauge wire, winding is greatly simplified if a transformer is adopted, with low-voltage coil. A tapped transformer giving an output of about 2 to 12 volts is ideal, but a single-ratio component can be used. For such coils, 26 to 32 s.w.g. wire can be used.

The type of core shown at "A" in Fig. 6 is readily made up from U transformer stampings, the ends being filed to a suitable shape. A second similar coil and core may be placed diametrically opposite that shown, thereby reducing some of the load on the wheel bearings. The type shown at "B" readily permits of a large winding, but needs to be situated at one end of the spindle carrying the wheel, which is not always possible.

A timing wheel of the required type may be cut from thin sheet iron without undue difficulty, and Fig. 7 shows one method of doing this for a 30-tooth wheel running at 200 r.p.m. The centre hole should be an exact fit for the spindle, and the disc should be filed up as accurately as possible. The scribed circle (1) should be so placed as to give clearance for the drill, and the required number of divisions is marked off with a protractor. The intersections should be lightly punched to assure that the drill starts in the correct position. After drilling, sawing and filing completes the disc. With a little care a sufficient degree of accuracy may readily be

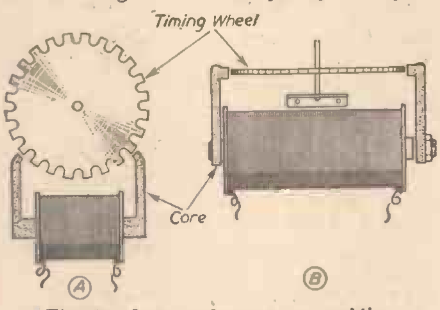


Fig. 6.—Improved magnet assemblies.

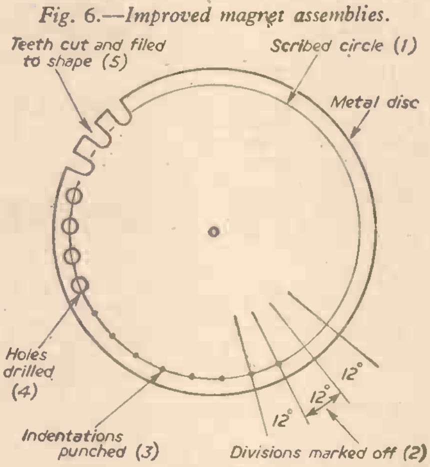


Fig. 7.—Making a timing wheel.

Table showing degree spacing of teeth, number of teeth, etc., for synchronous timing wheels.

Degrees	Teeth	R.P.M.	Ratio and typical reduction multiples for 1 r.p.m.
18	20	300	300 : 1 = 10 × 30, or 5 × 60, or 2 × 150.
15	24	250	250 : 1 = 10 × 25, or 5 × 50, or 2 × 125.
12	30	200	200 : 1 = 8 × 25, or 4 × 50, or 2 × 100.
6	60	100	100 : 1 = 100 : 1, or 2 × 50, or 4 × 25.
3.6, or 5 teeth in 18 degrees	100	60	60 : 1 = 60 : 1, or 2 × 30, or 4 × 15.

60 : 1 to hour hand = 6 × 10, or 5 × 12, etc.
12 : 1 to 12-hour hand = 1 × 12, or 2 × 6, or 3 × 4.

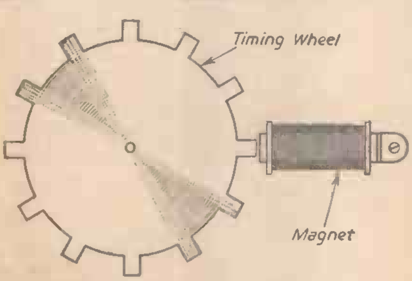


Fig. 5.—Synchronous clock movement.

achieved without any special tools. If some sets of gears are to hand the number of teeth may be selected to suit the ratios available.

The timing wheel may be soldered to a bush, or clamped between suitable flat wheels. The spindle should be of small diameter at its ends and run easily in suitable bearings.

A little difficulty may be experienced in achieving synchronisation initially, but after some attempts it should prove relatively easy to start the wheel at any time. The speed of rotation is not very high (only one revolution per second with the 100-tooth wheel, rising to five revolutions per second for the 20-tooth wheel), and this may readily be achieved by twirling the spindle between finger and thumb. Starting is usually most easy by working up slowly from lower speeds until the wheel commences to run in synchrony. In some cases it is not satisfactory to spin the wheel at higher speed, as in slowing down it may not commence to run. Initially, observation of the teeth by electric light is helpful as the teeth will appear to stand still as the correct speed is reached. This effect is much more noticeable if a neon bulb can be used.

To obtain silent running, and a sufficient reduction ratio, a worm drive is best, and a complete train of gearing for a clock is shown in Fig. 8. Here, it is assumed that the worm alone provides a suitable ratio for the minute hand (e.g., one revolution per minute). A friction drive enables the hour hand to be turned to the correct time.

In making up such a mechanism, clock or constructional toy gears and spindles may be used throughout, though a much smaller type of worm than that available from the latter source is desirable on the timing wheel spindle. For this, a worm of the required pitch may be made by winding steel wire round the spindle. Alternatively, a small gear train of about 5 : 1 or 10 : 1 reduction ratio may be used between the timing wheel axle and a second axle carrying the worm. Worms of large diameter cannot be used directly on the axle, as the friction is excessive. In addition, any type of large gear is likely to prove noisy, though this may be cured to some extent by allowing the worm or gear to dip in oil.

The greater the strength of the magnet and the nearer are its poles to the wheel the easier will starting be. But if friction is small, running may be maintained with a much increased space, even with small magnets operating at 2 to 4 volts. This will greatly reduce any tendency towards audible humming, which may arise when the gap is very small.

Finally, it should not be overlooked that such synchronous motors cannot be used with D.C. mains, which still exist in some parts of the country.

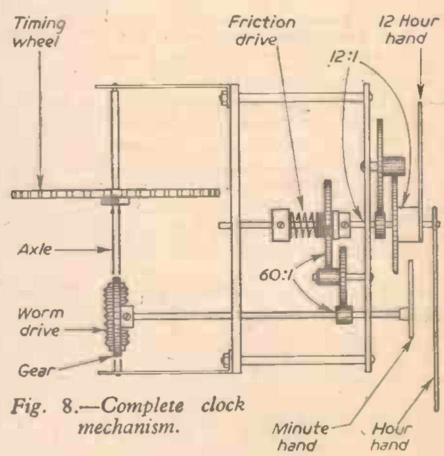


Fig. 8.—Complete clock mechanism.

SEPTIC TANK DESIGN

Two of the many designs we have received in reply to Mr. G. W. Ottaway's request for a Septic Tank Layout, which was published in our "Information Sought" column of the September issue.

Mr. F. E. Tudor's Installation

THE inside dimensions of the primary tank should be about 7ft. × 3ft. 6in. × 4ft. deep and divided by a cross wall as shown in Fig. 1, the main inlet entering the larger compartment.

The tank may be built in brickwork or in concrete and the base should be of concrete, 4in. to 6in. thick according to the nature of the ground. The whole of the inside of the tank should be smoothly rendered in cement and sand, three to one.

The inlet, outlet and centre pipes should dip well below the surface of the water so as to avoid disturbance of the scum that *must* form inside the tank before bacterial action can become effective. The outlet pipe should discharge into an open, shallow, concrete channel, about 12in. wide and 3in. deep, the effluent flowing over the lower edge of the channel to discharge on to a distributor placed over the secondary (filter) bed, the size of the bed being about 7ft. × 4ft. × 3ft. 6in. deep. This filter bed is best constructed with honeycomb brickwork so that the air can circulate freely through the filter medium which may be clinker or hard broken stone, the particles varying in size from, say, 6in. to 7in. diameter down to about 2in. Fine material should be avoided because such tends to clog and thus hamper the work of the aerobic bacteria.

A cheap and effective distributor can be made from corrugated-iron sheeting. Punch ¼in. diameter holes, about 4in. apart, along the channels, and through these holes insert galvanised nails, of such diameter that they fit the holes quite loosely and merely hang in position by the heads. The distributor should be supported on the surrounding brickwork some 9in. above the surface of the clinkers and set to a slight fall. Filtered effluent is collected in a concrete or half-round channel set along the lower edge of the concrete base, and from there piped to a ditch.

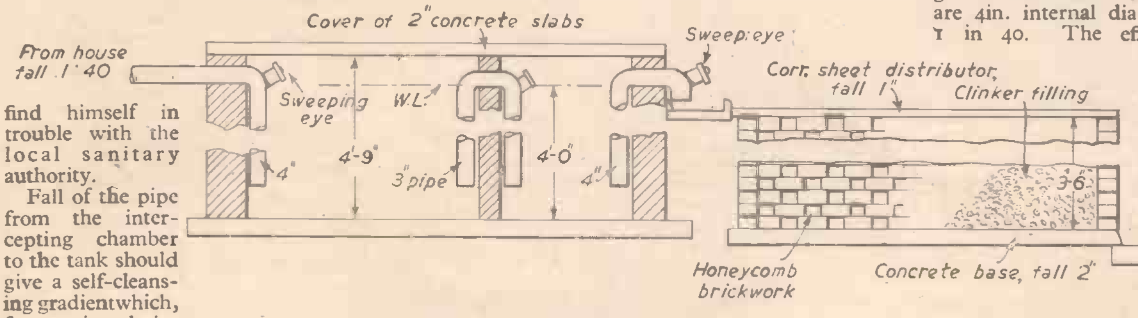
The filter bed is a necessity for proper bacterial action and purification of the sewage: without it the collecting, or primary, tank is merely a cesspool, and disposal of the effluent therefrom raises difficulties. If the untreated effluent is discharged into a ditch or water-course the constructor may well find himself in trouble with the local sanitary authority.

Fall of the pipe from the intercepting chamber to the tank should give a self-cleansing gradient which, for a 4in. drain, would be 1 in 40 or thereabouts.

No rainwater should be piped to the primary tank, otherwise the sewage may be so diluted that the anaerobes cannot develop sufficiently to do their work. The chief difficulty with a small installation dealing with domestic waste (including bath water) is to keep the sewage strong enough.

The primary tank should be covered with concrete slabs and it is convenient to insert manhole covers therein for inspection and cleaning out when necessary, but it is seldom necessary to open up the tank for the removal of residual sludge; once in four to six years would be needed with sewage of normal strength. The channel at the head of the distributor collects such small particles of humus that may come through the outlet pipe. A sweep-out with a broom every so often keeps the channel free, and the interception of humus prevents the filter from getting clogged.

Without knowledge of the contours of the site on which it is proposed to build, it is only possible to give a hypothetical layout which, in general principles, shows what is required for a purification scheme.



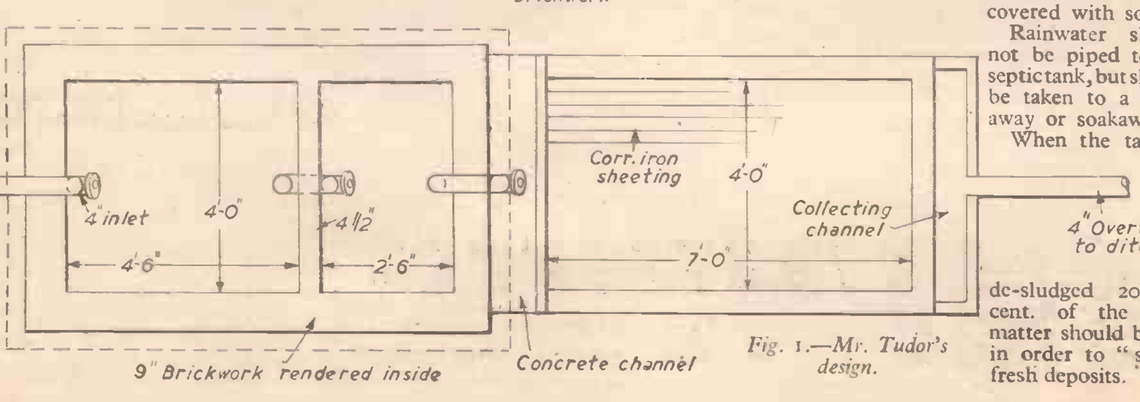


Fig. 1.—Mr. Tudor's design.

Mr. J. M. F. Averill's Design

IT is assumed that the sludge will be removed from the tank at approximately six-monthly intervals. A sludge storage capacity of 15 gallons per head will, therefore, be required. Since the design caters for six persons as a maximum, the storage capacity will be $6 \times 15 = 90$ gallons (or $\frac{90}{6.25} = 15$ cu. ft.).

Settlement Capacity

Allowing 30 gallons of waste per head per day the total D.W.F. (dry weather flow) would be $6 \times 30 = 180$ gallons.

Because of the disturbance created by peak discharges of sewage in small tanks, the Ministry recommend that the settlement capacity for such a tank be increased to 48 hours D.W.F., i.e., 2 × normal D.W.F. $= 2 \times 180 = 360$ gallons per day (or $\frac{360}{6.25} = 58$ cu. ft.).

∴ Adding sludge storage capacity and settlement capacity, we have:

Total capacity of tank $= 15 + 58 = 73$ cu. ft.

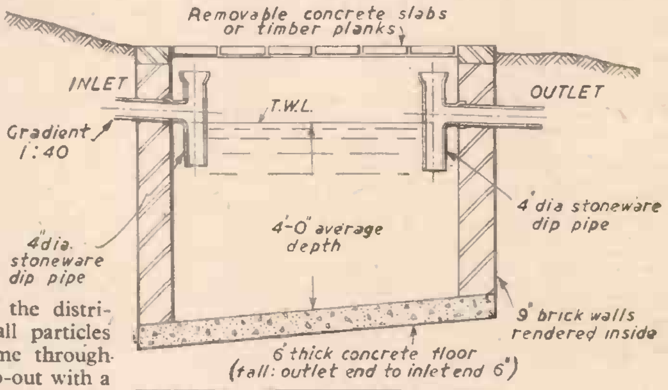


Fig. 2.—Section and plan of Mr. Averill's septic tank.

A suitable depth for the tank would be about 4ft. (i.e., from top water level).

This would then give a tank of inside dimensions 6ft. × 3ft. × 4ft. (average depth).

Diagrams of the tank with details of construction are shown in Fig. 2. The gradient of the outlet and inlet pipes (which are 4in. internal diameter) should be about 1 in 40. The effluent from the outlet pipe could discharge, after passing through a suitable filter, into a nearby stream or a soakaway pit (i.e., a hole about 4ft. or 5ft. square and about 6ft. deep, filled to within 1ft. of the surface of the ground with rubble, the remainder being covered with soil).

Rainwater should not be piped to the septic tank, but should be taken to a soakaway or soakaways.

When the tank is de-sludged 20 per cent. of the solid matter should be left in order to "seed" fresh deposits.

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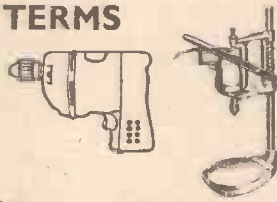

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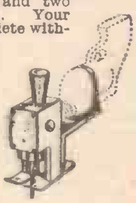

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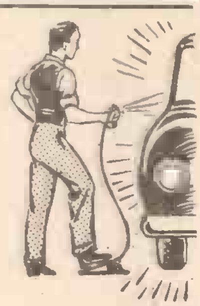

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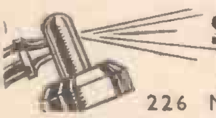

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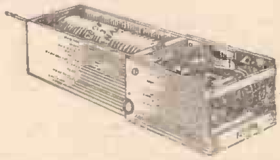

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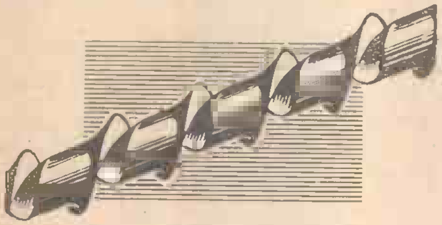
Trade Notes

Spiral Saws, Ltd.

THE above firm, whose address is Bedford Avenue, Trading Estate, Slough, Bucks., have introduced a new spiral hacksaw blade which they claim is the only hacksaw blade that cuts tubing without tearing or binding, has a blade strength equal to or better than the conventional hacksaw blade and which enables intricate internal work to be carried



The new spiral hacksaw blade.

out. As will be seen from the illustration the Tyler blade cuts in any direction. The blade fits any standard frame by means of adaptors which fit on the same pins as those on which the standard hacksaw blade fits. The retail price for six 10in. blades and adaptors is 3s. 6d. and extra blades cost 1s. for three.

Another product of interest to the home handyman with an extensive workshop is the "Marvel" 7in. bandsaw which will take either spiral or flat blades. This has the same cutting advantages as the hand hacksaw spiral blade and all the additional advantages of motorised operation. It is made of machined castings and is equipped with a built-in ¼ h.p. single phase motor, mounted on a belt tensioning base of special design, giving easy and quick speed change. Saw speeds are 200, 400 and 750 ft. per min. Overall sizes are: height 22½in., length 19in. and width 11in. The height under guides is 2¼in., throat 6⅝in., table size 6¾in. × 7in., weight complete with motor 65½lb. The price ex-works is £33.

At the A.G.M. of the Institution of Mechanics, Spiral Saws, Ltd., was among the six companies that were awarded a Diploma of Merit for the quality and manufacture of their products.

A Hand Cleaner

A USEFUL hand cleaner, marketed in a collapsible tube by Douglas Holt, Ltd., Holborn, London, W.C.2, and which can be carried in the tool compartment, will speedily remove grease, grime and tar from the hands without harmful effect to the skin. It is first applied when the hands are dry until all grime is removed and then water is gradually applied to swill off. It is non-abrasive, non-caustic and antiseptic. It may also be used for cleaning clothes, paint brushes and cleaning rags.

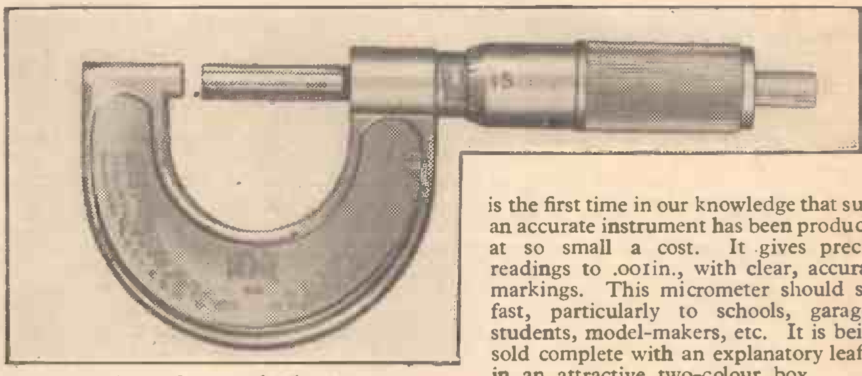
Casco Glues

WE have received from Messrs. Leicester, Lovell and Co., Ltd., North Baddesley, Southampton, who manufacture glues under the trade name "Casco," an interesting booklet dealing with their products, giving information on their characteristics, explaining how to use them and what their applications are. There is also a section of the booklet giving hints on a wide variety of glueing jobs.

"Casco P.V.A." is a smooth, white, easy-spreading glue, is non-tacky, non-staining and almost transparent. It is used for wood, toys, lampshades, bookbinding, ornaments, leather, tiles, wallpaper and linoleum. "Cascamite One Shot Resin Glue" has been developed to provide a glue similar to the resin glues used in industry, but without the disadvantages of short storage life and the necessity to add a hardener. This glue, which is in powder form, merely requires to be mixed with cold water. It is specifically a wood glue, with the additional advantage that it is waterproof. The other versatile glue in this range is "Casco Casein Cold Water Glue," the uses for which include wood to wood or wood to metal, lino, cork, plastics such as Formica and Arerite, asbestos, hardboard, cardboard, paper, etc. This glue is water resistant, but not waterproof and is mixed by the addition of cold water.

New Micrometer

DIE CASTING MACHINE TOOLS LTD. are now distributing their new micrometer which retails at only 10/-. This is the first time in our knowledge that such an accurate instrument has been produced at so small a cost. It gives precise readings to .001in., with clear, accurate markings. This micrometer should sell fast, particularly to schools, garages, students, model-makers, etc. It is being sold complete with an explanatory leaflet in an attractive two-colour box.



A novel type of micrometer.

BOOKS Received

The Gyroscope Applied. By K. I. T. Richardson, M.A. Published by Hutchinson's Scientific and Technical Publications. 384 pages. Price 30s. net.

THE first thing that springs to the layman's mind on hearing the word "gyroscope" is the device with a wheel spinning inside a framework which will balance on the edge of a penknife. Most people are, however, aware also that it plays an important part in the control of ships, aircraft—the automatic pilot, for instance—and many other modern devices. The purpose of this book is to describe the theory of the gyroscope and to describe its practical applications in a manner understandable by all. For this reason the mathematics of the subject have been confined to a special appendix. The book does not claim to be an exhaustive treatise on the gyro in theory and practice, and for those wishing for more detailed information there is a bibliography at the end. It is fully illustrated with excellent line-drawings and photographs, and a comprehensive index is included.

Thanks to Inventors. By Prof. A. M. Low. Published by Lutterworth Press. 200 pages. Price 12s. 6d. net.

THIS book pays tribute to the inventors of the world by pointing out to the reader the multitude of things great and small made possible by the ingenuity of inventors, things which are almost always taken for granted. The author points out, too, that often the inventor goes unrewarded while the credit and the profit are collected by others. The chapters all have simple titles, such as "When You Wake Up," "In the Kitchen," "Going to the Cinema," but what a wealth of fascinating stories is revealed when the history of even simple domestic objects is investigated. The reader receives a definite impression of what life must have been like centuries ago, without modern comforts, and begins to appreciate present-day amenities.

Modern Airlines and Airliners. By H. A. Taylor. Published by Temple Press, Ltd. 85 pages. Price 9s. 6d. net.

THIS book, another in the Boys' Power and Speed Library, should prove a source of information to all youngsters interested in air transport. Many aspects of airline flying are dealt with, including air traffic control, radio navigation, safety in the air, airliner development, pressurisation. There are special chapters on flying-boats and helicopters, the turbojet airliner, development in America, and a concluding chapter entitled "The Britannia, the Comet Series 3 and the Future." Technical points are illustrated by line-drawings and there are some fine aeroplane photographs.

Scientific Training for Cycling. By C. R. Woodard. Published by Temple Press, Ltd. 75 pages. Price 4s. net.

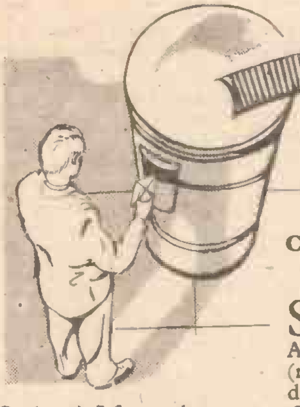
THIS is the second edition of a small book which deals with all the aspects of training for a tough sport; the mental approach as well as the physical is considered. There is a new chapter on the subject of staleness, stamina and fatigue, and in addition to a number of action photographs of famous cyclists, line-drawings illustrate the chapters on exercises.

Everybody's Book of Electricity. By R. Barnard Way. Published by Percival Marshall & Co., Ltd. 112 pages. Price 3s. 6d. net.

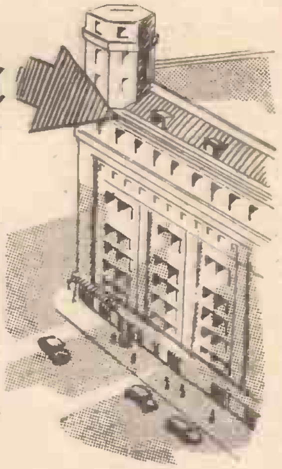
THIS compact little book is aimed at the younger reader and explains electricity in simple form from the beginning. It is plentifully illustrated by line-drawings.

Practical Lessons in Metal Turning and Screwcutting. By Percival Marshall. Published by Percival Marshall & Co., Ltd. 180 pages. Price 6s. net.

THE chief object of this book is to explain the principle of the small lathe and to give practical instructions in its use. In addition to dealing with the more important operations capable of being performed on the lathe, the book contains chapters on tools and toolholders, measuring appliances, chucks and mandrels. The final chapter is devoted entirely to screwcutting. The book is illustrated with both line-drawings and photographs.



Letters to the Editor



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

Cosmogony of the Solar System

SIR,—In the name of Andromeda (nebula—not daughter of Cepheus) I hope that none of your readers had his introduction to the oldest of the sciences through E. W. Twining's provoking astronomical article (September issue). It does not do justice to the work of the astronomers. [*Nonsense.—Ed.*].

The accuracy of a theory can be judged by the compatibility of its deductions with empirical data. Does Mr. Twining's theorising satisfy this criterion ? I think not.

Elementary considerations show the spiral nebulae to be situated outside our galaxy. A study of their spatial distribution reveals a zone of avoidance following roughly the Milky Way band, and is due to obscuration by the dense matter which permeates it; whereas the galactic nebulae show a strong concentration towards the galactic plane. Significant, too, are the long exposures required to record images of the spirals on photographic plates, upon which stars of our galaxy are superimposed.

That the spiral nebulae were extra-galactic objects was established beyond doubt in 1924, when Hubble published photographs showing resolution of the arms of neighbouring spirals into myriads of stellar images. In the Andromeda nebula (M31) especially, Cepheids, supergiants, novae, clusters, star clouds, and diffuse gaseous nebulae have all been detected; and Mr. Twining asks if anyone can see any similarity between Andromeda nebula and the Milky Way galaxy ! The similitude is striking.

It must be remembered that we are viewing M31 from without and afar, giving the centre of the nebula the semblance of a hyperdense nucleus. If we were situated within its system, as in our own, there appears to be no reason why the central regions should not resemble the dense star clouds and opaque matter in Sagittarius, Scorpius and Ophiuchus, which are, perhaps, actually part of the Milky Way nucleus.

Astronomers do not "only think" the sun is revolving around our galaxy. Galactic rotation is confirmed in a number of ways; to mention only one, the phenomenon of star streaming is in accord with radial velocities. Contrary also to Mr. Twining's belief, two spiral arms in the Milky Way were identified by Morgan, of the Yerkes Observatory, in 1952. The discovery has since been corroborated by several independent researches, most worthy of mention being the radio spectroscopic work of the Dutch cosmologists.

Why does man so often postulate a cosmic catastrophe for the origin of the solar system ? Are there not more subtle forces in nature ? Schmidt's cosmogonic theory accounts for the main features of the solar system more completely than any hitherto propounded hypothesis.—HAROLD R. ISLIP (St. Albans).

The Author's Reply

YOUR correspondent, writing a criticism regarding my article on the origin of the solar system, ignores my illustrations of the nebulae in Canes Venatici and Ursa Major and seems to concentrate on my mention and drawing of the great mass in Andromeda. Mr. Islip does not state what "neighbouring spirals" Hubble, in 1924, published photographs of. Were they undoubtedly nebulae or were they star clusters ?

I should like to see such photographs of the Great Bear Spiral. I do not believe it would be possible to resolve its arms into myriads of stellar images. For one reason : no magnifying power can be obtained great enough and I do not think it ever has been obtained.

I postulated a cosmic catastrophe, if it was a catastrophe, to account for the birth of the solar system, because there have been collisions between stars. I remember well one which occurred in the year 1901 and I still have photographs of it.

There is much in Mr. Islip's letter which I do not understand, for instance his statement that two spiral arms were identified by Morgan, of the Yerkes Observatory, in 1952. Identified with what ?

It appears to me that many astronomers allow their imaginations to find questionable facts and that they then proceed to build up theories for which there is no tangible evidence. For the theory which I put forward in my article there is the evidence of sight and common sense. In the nebulae (some of them) can be seen planetary systems in process of formation.

Is our own planetary system the only one in the universe ? Of course it is not, and such systems must be in all stages of development from the nebulous form to the state in which is our own, and beyond it.—E. W. TWINING.

SIR,—May I point out an error in the astronomical article of your September issue ? Jupiter possesses 11 satellites, not nine as quoted in your table. In addition to the four principal ones discovered by Galileo there are seven others, two of which were found as recently as 1938.

Also, Saturn's solar distance is 886 million miles not 883.—C. HOLWILL (Portsmouth).

SIR,—With reference to your September astronomy article by E. Twining, observations of cepheid variables, by Hubble, in the nebula in Andromeda have lead to the strong conclusion that this object is of the order of 900,000 light years from us, making it of a size comparable to the Milky Way itself, i.e., about 42,000 light years. This evidence is supported by observations of Novae and Super Novae in this and other spiral nebulae. From these, and other considerations, by independent lines of approach, the same conclusion concerning the distance and size is reached—making it impossible to hold any of the theories advanced by Mr. Twining.

We are left with the conclusion that either every astronomer—and every idea in astronomy—is wrong, or Mr. Twining is wrong.—G. B. HAMILTON (Romford).

SIR,—The real origin of the universe is still very much in doubt and yet we are content to state and accept that all forms of energy and matter cannot be created nor destroyed, only changed in form.

Must there be a beginning and end to the universe as a whole; cannot we accept curved space and time ?

In order to satisfy the arguments of Mr. E. W. Twining in P.M. and the opposite line of thought as to the existence of galaxies other than our own, I would like to offer my theory on the subject.

Looking out in almost any direction into a space curved in all planes, we see the light which has travelled through great time and distance. Could this galaxy and all other galaxies be views of our own Milky Way as it was in the distant past when the light began its journeys along curved paths through space, paths varying in direction, distance and time ? Could we not see this same light after it has completed two or more circuits and so gather the impression of galaxies at great and varying distances ?—W. G. WHEELER (Manchester).

Hammering in Water Pipes

SIR,—I would like to reply to Mr. F. Robinson, page 456, July, 1954. The knocking in the water pipes is known here as a water hammer and the continuous hammering inside the water pipes can loosen the joints. Quite a simple way of overcoming this trouble is as follows. Turn the water off, go to the highest point; take the elbow off and put a tee in its place, looking up. Into the top leg of the tee put a nipple and from this nipple build up with bushes to a 1½in. cap. The larger this cap is, the better the results. Screw all up tight. Turn the water on. The action of this is, inside the cap there is a cushion of air that will eliminate this hammering entirely. After a few years the noise may start again. If so, just empty the water out of the cap.—E. RICHARDS (New South Wales).

Gas to Oil Firing Conversion

SIR,—In answer to the query of Mr. T. S. Gooch, Farnham (September, 1954), on conversion from gas to oil firing for water heating, the firm of D. E. Stuttard, Westfield Mill, Mytholmroyd, Halifax, Yorks, offer boilers, space heaters, boiler conversion units and cooking ranges in vitreous enamel finish with 75 to 82 per cent. efficiencies, safe and clean in use ("no smoke, no smell and no soot"). The heaters require no attention and no cleaning out and are silent in operation. The fuel used is light fuel oil (diesel) which is cheaper than paraffin. The units are claimed to be quite revolutionary in this country. They can be manually or thermostatically controlled.—JOSEPH BROWN (Co. Durham).

Pendulum Timekeeping Method

SIR,—Amateur clock enthusiasts among your readers may be interested to know of a method I have used to calculate the increase or decrease necessary to the length of a pendulum if the timekeeping requires adjustment. It is assumed that the gear train is unknown, therefore the theoretical length of the pendulum will not be taken into consideration in this calculation.

Assess the number of minutes error over a given period. In this example assume we

(*Continued on page 87*)

READERS' SALES AND WANTS

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

FOR SALE

STARLON PLASTIC ENAMEL PAINT in tubes, 1/- each, covering approximately 8 sq. ft., or complete cycle frame; suitable all paintable surfaces. Colours: rich brown, bright red, pink, bright blue, maroon, turquoise, cream, yellow, black, deep green, bright green, mid-grey, white and clear; home trade and export. Obtainable from Handicraft, Hobbies and other shops, or send 1/3 for sample tube and colour card, post free, to sole manufacturers: Starline, Southend, Essex.

NUTS, BOLTS, SCREWS, Rivets, Washers, and hundreds of other items for model engineers and handymen; s.a.e. for list. Whiston (Dept. PMS), New Mills, Stockport.

HOW TO RE-WIND and Service Electric Motors, Generators. Complete Practical Book only 3/-; p.pd. Below:—

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BUILD YOUR OWN PHOTO Equipment. 12 designs in two books. Enlargers, printers, dryers, timers, etc., 6/-; p.pd. Below:—

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CAR BODY REPAIRING. Complete A B C course; illustrated: 7/6, p.pd.; lists free. American Publishers Service (P), Sedgeford, Norfolk.

HOUSE SERVICE METERS, credit and prepayment; available from stock. Universal Electrical, 221, City Road, London, E.C.1.

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

COMPRESSORS for sale, 2¼ CFM, 180lbs. sq. in., on metal base, with driving wheel and receiver, price £3; ¼ h.p. Heavy Duty Motors, price £3; carriage forward. Wheelhouse, 1, The Grove, Isleworth. (Phone: Hounslow 7558.)

TYPEWRITERS; moderate instalments; delivered everywhere expeditiously; satisfaction guaranteed. Verney Clayton, M.C., Market Rasen.

TUFNOL: Rod and Sheet; Perspex: Coloured and Clear Sheet, Clear Rod; Cements and Polishes; Acetate and P.V.S.; no order too small; price list on application. Lawrence & Jeffreys Ltd., 16, Gloucester Road, Brighton, Sussex.

FOUR-WAY TOOLPOSTS, locating and non-locating, cheap; also various material, widest range. 5d. Lists. Synek, 73, Sherbrooke Road, London, S.W.6.

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ELECTRICAL

BARGAINS FOR ELECTRICIANS.—Brand new Cables in 25-100yd. coils: T.R.S. twin 1/.044, 42/-; 3/.029, 55/6; 3/.029 and Earth, 63/3; 7/.029 and Earth, 112/6; P.V.C. twin 1/.044, 35/-; 3/.029, 52/-; Transparent Flex, 14/36, twin, 15/9; all per 100yds.; Lampholders, 6/6; Switches, 1-way, 16/3; 2-way, 19/- doz. Requests lists. Jaylow Supplies Ltd., 93, Fairholt Road, London, N.16.

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PLYWOOD. 24 x 12 x 3/16, 9/6 doz.; 12 x 10 x 3/16, 5/- doz.; 8 x 6 x 3/16, 3/2 doz.; carr. pd. Parmount, Burnley Rd., Rawtenstall.

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"THE WOOD TURNING LATHE," an authoritative book by Ray Haines, Department of Vocational Education, New York University. 21/9, post paid from Stobart & Son, Ltd., Handicraft Book Specialists, 9, Victoria Street, London, S.W.1.

PHOTOGRAPHY

ENLARGER and Camera Bellows supplied; also fitted. Beers, St. Cuthbert's Road, Derby.

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CAN YOU SOLDER? That's all you need to make a really good radio from guaranteed Osmor Components. Send 5d. (stamps) to-day for free circuits and lists. Dept. P.M. Osmor Radio Products Ltd., 418, Brighton Road, South Croydon, Surrey. (Croydon 5148/9.)

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WANTED: 12 volt Oil Dilution Magnetic Valves, type F.A.W. Cooper McDougall & Robertson Ltd., Chemical Works, Berkhamsted.

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

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MISCELLANEOUS

BOOKLETS. "How to use ex-Gov. Lenses and Prisms," Nos. 1 and 2, price 2/6 ea.; ex-Gov. Optical lists free for s.a.e. H. English, Rayleigh Road, Hutton, Brentwood, Essex.

BUILD YOUR OWN REFRIGERATOR, all components available at reasonable prices. Frigidaire flowing cold units, £5; small units, Kelvinator, etc., £4; ¼ h.p. heavy duty Motors, £3; Chrome Cabinet fittings, new, £1; money back guarantee; s.a.e. for list and schematic diagram. Wheelhouse, 1, The Grove, Isleworth, Middx. (Phone: Hounslow 7558.)

have an advance of 9 minutes over a week, i.e., 9 minutes gain over 10,080 minutes. Therefore, regardless of the pendulum's length or rate of oscillation, we know it is making 10,089 oscillations during the time it should be making 10,080 oscillations. We also know that the rate of oscillation alters in inverse proportion to the square of the length of the pendulum. Therefore we can correct the length of the pendulum by the equation.

Present length of pendulum

$$\times \left(\frac{10{,}089 \times 10{,}089}{10{,}080 \times 10{,}080}\right)$$

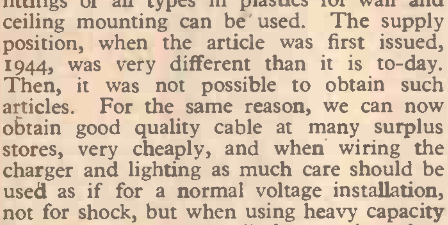
$= $ Present length of pendulum $\times$ 1.00178.
—P. KRAMER (N.W.11).

Small Wind Power Plants

SIR,—After reading the article, Small Wind Power Plants, in the September issue I would suggest a great deal of work could be saved, and a far more reliable job done, by using standard lampholders, switches, etc., when installing the lighting points. Simple adaptors can be made from old lamps of standard B.C. by breaking away the glass and fitting small lampholders in the brass caps. The flashlamp type of holder is first connected to the two wires left in the cap, after insulating them with P.V.C. sleeving; plaster of paris will hold this in the cap. The small bayonet type of lampholder is easily bought in brass, which after connecting as above can then be soldered to the cap. The advantages of this method are: one can change the size of lamp easily; that the many varied fittings of all types in plastics for wall and ceiling mounting can be used. The supply position, when the article was first issued, 1944, was very different than it is to-day. Then, it was not possible to obtain such articles. For the same reason, we can now obtain good quality cable at many surplus stores, very cheaply, and when wiring the charger and lighting as much care should be used as if for a normal voltage installation, not for shock, but when using heavy capacity batteries heavy current discharge takes place with short circuits. As the wind charger is likely to be used in caravans and holiday bungalows, where the fire risks are above the average, such a short circuit can be dangerous and cause fire.—E. DOHERTY (Salford, 6).

A Rear Lamp Modification

SIR,—With the forthcoming new regulations it will be necessary for a bicycle rear lamp to be not less than 1½in. diameter. The following idea is cheap and effective for those who have plastic-lensed rear lamps. Cut a piece of Perspex 1½in. diameter, the thickness is not critical, it can be 3/16in. to ⅛in. This can then be stuck to the face of the lens (Fig. 1) or a hole drilled to fit over the lens cover, as in Fig. 2. If thick material is used this can be shaped into a cone. The



Figs. 1 and 2.—Two methods of adapting rear lights.

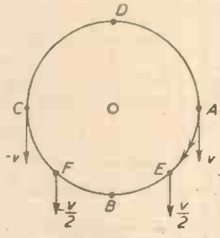
back of the Perspex is frosted with glass-paper. Perspex can be stuck to Perspex with chloroform, only a small amount being required. Perspex to glass with Durafix. I have found this to work very well and it saves destroying a useful lamp.—E. WILLIAMS (Croydon).

Interplanetary Space Travel

SIR,—There are two points I would like to make connected with correspondence in the May issue.

First, J. C. D. Marsh gives as an answer to the question: "Can heat be radiated through space irrespective of the length of the vacuum's path or the intensity of the heat?" the sun manages to warm the earth through 93 million miles of space. This is all very true, but it is not heat as we speak of it that traverses the vast distance, but ultra-violet radiation of much higher frequency which is absorbed by the earth's atmosphere and the earth itself, and which is then re-radiated in the form of heat. This effect is very apparent on flying at high altitudes, where intense cold is experienced.

The second point I should like to make is the fact that there is no such force acting on a body rotating in a circle as centrifugal force. There is actually a force acting on the body towards the centre of the circle, which is known as the centripetal force. Now when a force acts on a body it gives the body an acceleration. This comes from Newton's second law of motion. Acceleration is the rate of change of velocity; hence the velocity of a body moving in a circular orbit is not constant. This is, in fact, true, for velocity and speed are not the same thing. Velocity has direction, whereas speed has not.



The mass of the particle is m

Consider a particle at A in the diagram moving round the circle with speed v. Its velocity downwards at A is v, but its velocity at B is zero since it is no longer moving downwards. Half way between, at E, the velocity $= \frac{v}{2}$. At C it is moving in the opposite direction with speed v; therefore its velocity $= -v$. Similarly at F the velocity $= \frac{-v}{2}$. It can be shown by resolving the velocities at two points, a fraction of time apart, that there is an acceleration *towards* the centre of $\frac{v^2}{r}$ where r is the radius of the circle. By applying Newton's second law: $p = ma \therefore p = \frac{mv^2}{r}$. The acceleration is therefore produced by a force of $\frac{mv^2}{r}$ towards the centre of the circle. This is the centripetal force and if it were not present the particle would no longer move in a circular path, but would continue in a straight line according to Newton's first law of motion, which states:

"Every body continues in its state of rest or uniform motion in a straight line except in so far as it is compelled by external forces to change that state." This law, together with the other two, is fundamental to the study and interpretation of dynamics.—M. D. ECCLES (Cheltenham).

Making a Spotlight

SIR,—With reference to the query of Mr. G. B. Dodd (Spalding) in the September issue, I would like to make two comments which might be of value to him.

1. I doubt whether the cooling slots he proposes to use will be adequate in view of the fact that he may find it necessary to use the bottom slot as a slide to enable the lampholder to be moved backwards and forwards, so I suggest that a series of holes be drilled in the sides of the case and provided with light baffles. It has been my experience that these stage lanterns generate a considerable quantity of heat during the hours when they are running so that the maximum possible amount of cooling should be provided, especially if the proposed focus flood is to be used as a hand-operated spotlight, as nothing is more distressing to the operator than to have his fingers burned every time he moves the lantern. Also, if coloured gelatines are to be used it will be found that they deteriorate rapidly with heat.

2. I suggest that for the use which Mr. Dodd intends to make of his lantern a 200 w. lamp would be quite inadequate, the minimum I would say should be 250 w. and preferably a 500 w. bulb should be used.

Before Mr. Dodd builds his lantern may I suggest that he talks to the electrician at his local theatre and examines the lamps there, he will then get much valuable information which is difficult to pick up from books and may save him considerable disappointment later.

In conclusion may I wish him the best of luck with his project for it is all too rare nowadays for amateurs to make their own lighting equipment even though the cost of hiring and buying it is almost prohibitive.—L. CORDEAUX (W.1).

SIR,—With reference to Mr. G. B. Dodd's Spotlight query, I should like to make an addition to your reply, which I think will be of service to him.

Having made quite a number of spotlights, floodlights, and acting area lanterns, and experimented with every type of projector lamp manufactured, I should like first to strongly recommend that he uses a stage projector lamp of no less than 500 watts, in view of the fact that the spot is to supplement the original stage lighting, which may be anything from 4,000 w. or 5,000 w. upwards. The use of a 200 w. lamp as suggested would not show any appreciative improvement.

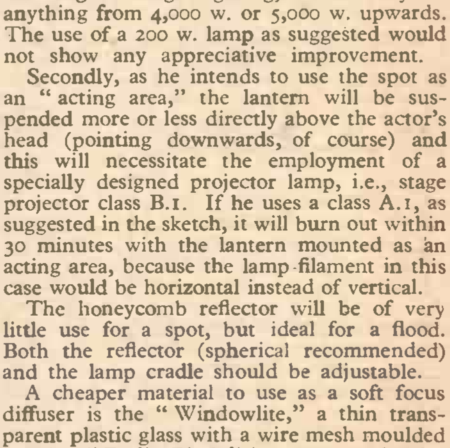
Secondly, as he intends to use the spot as an "acting area," the lantern will be suspended more or less directly above the actor's head (pointing downwards, of course) and this will necessitate the employment of a specially designed projector lamp, i.e., stage projector class B.1. If he uses a class A.1, as suggested in the sketch, it will burn out within 30 minutes with the lantern mounted as an acting area, because the lamp filament in this case would be horizontal instead of vertical.

The honeycomb reflector will be of very little use for a spot, but ideal for a flood. Both the reflector (spherical recommended) and the lamp cradle should be adjustable.

A cheaper material to use as a soft focus diffuser is the "Windowlite," a thin transparent plastic glass with a wire mesh moulded into it. "Berlin Black" is a very good paint for both interior and exterior, it is cheap, and we find it stands up to the heat.—LAURIE A. UPTON (Southsea).

Clothes Drying Cupboard

SIR,—Regarding Mr. Hart's request for information regarding Cupboard for Drying Clothes, I am afraid Mr. C. F. Cox's idea (Sept., 1954) will not work, as the flow and return pipes are bridged by the coils A, B, C and D. A satisfactory system I have working in my house



is simple. It consists of four ¾in. elbow bends and two ¾in. copper pipes 4ft. long and one 1ft. long. You only need to cut 1ft. out of the hot flow pipe and tighten up the Securex bends (see sketch). This is cheap and efficient.—DAVID MUIR (Cumnock).

Your Queries Answered

RULES

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

Telescope Lenses

COULD you give me some information regarding telescope lenses? I recently purchased a second-hand telescope, rather on the old side. The object (end lens) has an iridescent look when you get the light on it. Can you tell me if it is possible to clean this?—A. W. Ladner (Penzance).

THE object glass of your telescope is made up of two lenses, one double convexed and the other plano-concave; unscrew the cell and take the glasses out. You may find that the two lenses are cemented together.

If they are not cemented and you find that you have two loose glasses, clean all four surfaces with a clean soft cloth and either tepid water or methylated spirit. If the two components do not come apart when removed from the brass cell, clean the outer surfaces and if this does not remove the iridescence the cement between them must be dissolved. This cement is Canada Balsaam and the writer has found that spirits of turpentine, which can be obtained from a chemist, is the best solvent. Immerse the lens for two or three days in the turpentine and after separation wash in fresh turps.

Try them back in their cell, without recementing them, but if you decide not to use them dry, then a little of the balsaam, fresh from the chemist, must be dropped into the concaved lens, spread over the surface with the finger and the convexed lens pressed back to its original position, any balsaam squeezed out being wiped away with turpentine or rag. Care must be taken to leave no air bubbles between the lenses. Then replace the object glass and cell in the telescope and test for definition.

Episcope Projection Problem

I HAVE made a simple episcope, using a plano-convex lens, 4in. diameter, 10in. focal length, but have been unsuccessfully attempting to correct the image (with another lens), which, of course, is always inverted. Putting the object in an upside-down position is of no use to my present experiments, which are centred on the possibility of projecting puppets on a screen. For this reason the use of mirrors is also impractical.

Can you suggest a lens or combination of lenses to solve my problem?—E. J. Tibbitts (Sevenoaks).

THE only way in which we think it possible to project right-way-up figures on to the screen, for right-way-up viewing, will be to use two similar lenses with, in between them, a first screen of finely-ground glass or tracing paper; glass for preference. The lens nearest to the marionettes will project their images on to the ground glass and the picture so formed will be a visible, inverted real image. The second lens is placed on the other side of the ground glass and will project the inverted picture on to the viewing screen in the desired corrected attitude. Independent focusing of the two lenses will have to be provided for and also the adjustment for position of the ground glass. It is likely to be found that very brilliant illumination of the puppets is necessary. The size of the ground glass will have to be arrived at by experiment, and it is suggested that a temporary picture plane of tracing paper, or greaseproof paper, be used until the best dimensions are found.

Recording Electrical Impulses

I WISH to record electrical impulses (of short duration) on paper by using the paper as an electrolyte and passing current through it.

Could you please tell me how paper can be chemically treated so that the passage of current through it will result in discoloration? Also what order of voltage and time of application is required? Must the electrodes be of any special material?—D. Atkinson (Cheshire).

THE paper could be wetted with a solution of prussiate of potash, to which a small quantity of nitric and hydrochloric acid have been added, the paper being passed over a metal roller. A piece of steel or copper wire in contact with the paper could be used as the pen. We regret that we are unable to advise you the exact time required to mark the paper, but in general this should be quite short and quite a low current could be employed. The time required to mark the paper will be reduced as the current is increased.

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.

Other solutions which can be used for the paper are a few crystals of white iodide of potassium dissolved in water to which a little starch paste is afterwards added; or ferrocyanide of potassium may be used with an iron anode.

Graining Woodwork

I AM re-decorating my home and wish to grain the woodwork. Can you give me any advice, please?—E. J. Ormerod (Waltham Abbey).

YOUR best plan is to use a varnish comb, which can be bought from an oil and colour merchant. Treat your surface first with a light-coloured varnish as a background and allow to dry. Then paint over this light ground with dark varnish and, while wet, use the comb.

Preserving Biological Specimens in Block Plastic

I WISH to preserve some biological specimens permanently in solid blocks of plastic.

I believe the plastic used is partially polymerised methyl methacrylate. Could you give any information on the preparation and mounting of such specimens, and suggest a source of supply for the materials used?—Derek G. Childs (Watford).

THE plastic material usually used is a polyester resin and the appropriate catalyst is supplied with this material by the makers, Messrs. Bakelite, Ltd., 12, Grosvenor Gardens, S.W.1.

I would suggest a Petri dish as your mould. Place a layer of the polyester resin in this dish and "kill" by raising the temperature to, say, 60 deg. C., having added your catalyst. Then place your specimen upon this layer and add a further quantity of the resin, taking care not to float the specimen. Then add your catalyst again and "kill" once more with temperature rise.

We advise you to obtain the materials and more detailed instructions from Bakelite Ltd.

(*Continued on page* 90)

Ultra-violet Light

CAN you give me some information *re* fluorescence under ultra-violet light ? I can hire the necessary lighting equipment but some information regarding materials to use would be of interest. —F. G. Morgan (Manchester).

THE following substances, if deposited on ground glass surface, will give interesting phenomena when irradiated with U.V. light. You are probably aware that you must shield your own and observers' eyes from direct illumination from the rays by screening the light with a sheet of aluminium foil.

Moisten some anthracene with water, and brush this paste on surface of ground glass, to which surface most of it will adhere. Having prepared your surface with either anthracene, as above stated, *or* alumina, put on to this surface, separately, the following substances: (If you wish to try a variety you must have a freshly-prepared screen of anthracene or alumina for each new substance.)

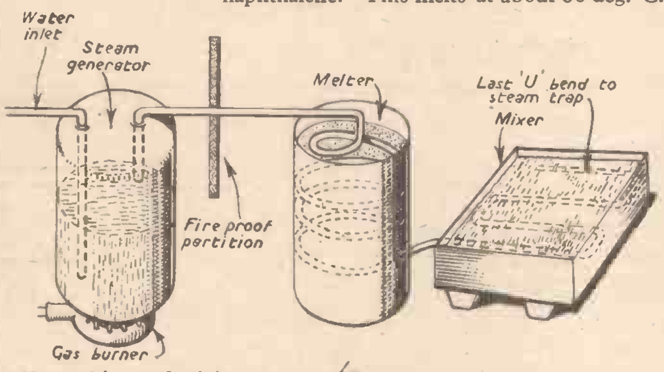
Substance	*Colour*
Resin (abetic acid)	Green
Acetanilide.	Bluish violet
Aspirin plus alumina	Brilliant blue
Alizarine	Yellow
Fluorescene	Blue
Manganese-stearate	Rose
Manganese-resinate	Violet
Rhodamine	Red orange

Cellulose Spraying Aluminium

I HAVE recently built a sports car body in aluminium (polished) and I now wish to cellulose-spray it. From previous experience in spraying on aluminium I have found that after weathering I can peel the cellulose off in strips. Is there any method of treating the aluminium surface to prevent this happening ?— G. Thomas (Swansea).

THE trouble which you describe in cellulosing polished aluminium may be due to the metal surface being not only too glossy, but also too greasy. It may also be due to the cellulose lacquer being insufficiently plasticised and, therefore, drying off with too hard and inflexible a film.

The best treatment which you can give to the aluminium surface is to brush over it a warm solution of 1 part of caustic soda in 8 parts of water. To this solution a little waterglass should be added (about 1 per cent. of the volume of the solution). Put this solution on with an old brush. Allow it to remain for five minutes or so. Then wash it off with plenty of water. The solution will attack the aluminium surface and matt it slightly, thus providing a grease-free and a well-keying surface for the reception of the cellulose preparation. When you buy this latter preparation you should make sure that it has been sufficiently plasticised. You can do this for yourself by stirring into it about 1 per cent. of its volume of either tricresyl phosphate or dibutyl phthalate, or even about ½ per cent. of high-grade castor oil. Do not exceed these proportions of plasticising agents, otherwise the cellulose film will be slightly tacky ever afterwards. The object of the plasticiser is to make the cellulose film slightly flexible so that it does not become too hard and brittle and thus peel off, but, naturally enough, if the plasticisation is overdone, the result is a permanent tacky cellulose film which is an even greater evil than a film which is too hard.



The melting and mixing apparatus.

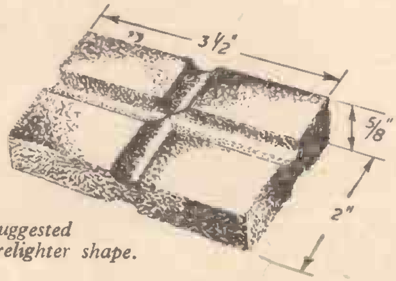
Making Firelighters

PLEASE give me details for making firelighters, the type which you break into small cakes, about 2in. long, 1in. wide, and about ½in. thick. They appear to be made from sawdust, and a brown wax, and smell like naphtha. Where can these components be obtained ?—G. Mason (Birmingham).

LET us first of all caution you against fire risks ! The operation is quite simple, but you must carry it out away from the house, say in an old shed in the garden.

You will need some form of boiler, oil heated or gas heated, from which you can lead a steam heated coil into the melting tank. You should then continue the coil as a simple grid of two U-bends under the mixing tank. For heat economy both vessels could be lagged. Use an iron pot for your melting tank and this must be screened from your boiler with its naked flame. Your mixing pan should be about 2ft. square and 6in. to 8in. deep. Use an iron shovel for mixing the compound.

Materials: Crude naphthalene or creosote salts can be obtained from the local gasworks. If you wish slightly to retard the combustion rate of the product incorporate not more than 0.25 per cent. creosote oil with the naphthalene. This melts at about 80 deg. C.



Suggested firelighter shape.

Place sawdust in pan and add the melted naphthalene or creosote gradually to the proper consistency. Mix well all the time with shovel. To make a neat firelighter cake you should then use a hand press with a former to the design sketched. You will notice the fluting for passage of air to aid combustion. If you do not want to go to the trouble of fashioning a press you could make a mould with false bottom, compress the mixture therein by hand with a metal ram, and wrap the product in grease-proof paper.

Leaflet No. 9, obtainable from the Rural Industries Intelligence Bureau, 258-262, Westminster Bridge Road, S.E.1, will give you full information if you wish to conduct this process on a larger scale. They also tell you where to buy the presses and their cost. We have assumed that you wish to carry out this process for your own convenience and as cheaply as possible.

Information Sought

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

H. F. Hall (Leamington Spa) writes : "I am interested in constructing a haybox to be used for continuing the cooking of vegetables. Would you please give me complete details of such a box."

Mr. J. Broome (S.W.19) writes : "Please inform me how to construct a Daylight Projection Screen for showing 9.5 mm. cine films. I have in mind a screen portable rear projection unit made of wood."

Mr. G. T. West's letter is as follows : "I understand that a machine called an Optophone was manufactured about forty years ago to enable blind people to read a book, magazine, or anything written in ink. Can you, or any of your readers, give me any information regarding this machine ?"

A letter from P. Parsons (Berks) states : "I require information on how to remove rising dampness in my house by a process known as 'Electro-osmosis.'

The walls are 9in. thick and there is a damp-course although this is faulty in many places due to settlement of the foundations.

I would be grateful if one of your readers could tell me how to set about the job and the materials required."

Received from Mr. W. Donnelly is the following : "I am making an ornamental garden and I wish to have a fair sized fountain combining a waterfall and lights, also I wish to make, say, a small mediaeval castle, a church, and other items of interest, and fit with electric lights, also to simulate the "moon" showing.

Can you, please, supply diagrams of the circuits and inform where I can get the component parts ?"

Mr. D. Campbell, of Glasgow, asks : "Can you supply or let me know where I may obtain instructions for making a set of bathroom scales ?"

Mr. C. Morgan, of London, E.1, writes as follows : "With reference to your Dictionary of Metals and Alloys, I am interested to note the item on page 43 of Mendeleeff's Spectroscopic Prediction of Metals. Would you please, therefore, inform me whether there are any publications on this subject or any relative subjects."

Mr. L. E. Roberts, of Romford, writes : "I wish to make up a set to do some acetylene gas welding. I believe it requires a low pressure system, with the acetylene gas generated on the spot from calcium carbide and water and a low pressure blow pipe.

Can you tell me how to go about it ?"

Mr. R. Wallace (Drayton) asks : "Could you inform me where I could purchase a constructional sketch or drawing of a work bench 4ft. x 2ft. Also where spare parts can be bought for a Swiss made 'King George' movement for a pocket watch ?"

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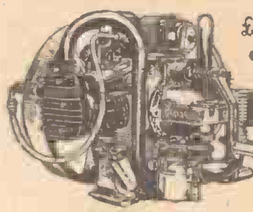

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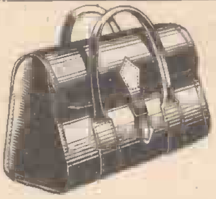

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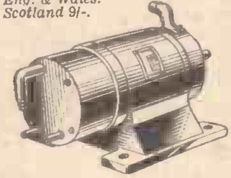

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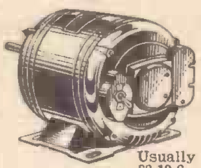

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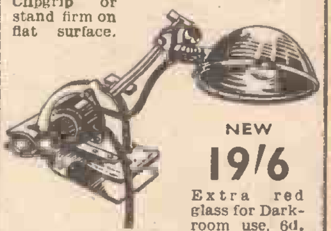

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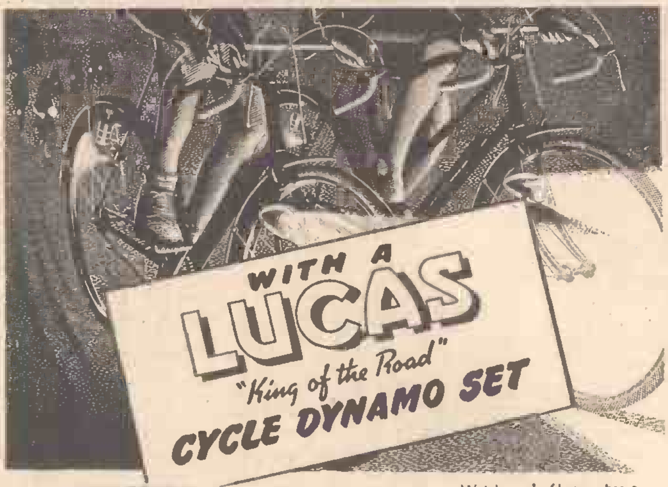

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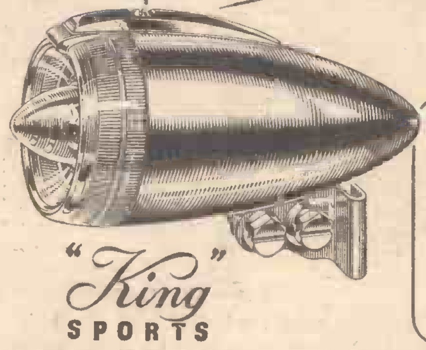

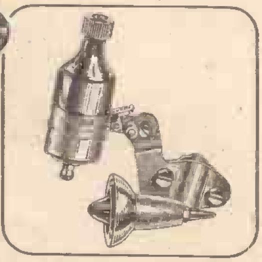

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THE Cyclist

Editor: F. J. CAMM

VOL. XXIII NOVEMBER, 1954 No. 390

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

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COMMENTS OF THE MONTH By F. J. C.

Wanted—A Cycling Museum

IT is time that bicycle manufacturers got together and formed a committee for the purpose of founding a really authentic museum of bicycles. This should have been done many years ago while many of those associated with the cycling movement were still alive. Some, however, are still with us and it is not too late to start. We are aware of the fact that the late H. W. Bartleet got some sort of museum together but many of his claims to possess particular machines are known to be unjustified, some positively misleading, and others untrue. His claim, for example, that one of the machines in his collection was that on which the late W. Hume won the first race on pneumatics at the Queen's College Sports at Belfast in 1889 is false; for Hume said during his lifetime on a number of occasions that the machine was destroyed. Bartleet, unabashed by this statement, continued to exhibit a bicycle which resembled Hume's. This was in furtherance of his pose as a cycling historian. He had the *idée fixe* that the mantle of the real and only cycling historian, the late H. H. Griffin, had fallen upon him. He endeavoured, however, to provide himself with a veneer of popularity by allowing himself to be called "Sammy." Before it is too late, the committee which we suggest should investigate his claims, sort out the wheat from the chaff and use the residue of his collection as the basis of the proposed museum.

The Science Museum at Kensington has a number of old machines depicting the development of the bicycle, including a replica of Macmillan's. But the collection is by no means complete.

The obvious home for such a museum would be in Coventry, the city of three spires where the bicycle was really born. Sir Arthur du Cros in his famous book "The Romance of Wheels," the copyright of which is vested in us, has provided an accurate record of developments since the introduction of the pneumatic tyre and this could be used as a basis, in conjunction with Griffin's book.

The manufacturers might also offer prizes for an annual competition for models of bicycles so that an exhibition in miniature could be staged at the Cycle Show each year. Such would prove an enormous attraction as indeed the Model Motor Cycle Competition organised by the Auto Cycle Union has proved to be in connection with motor cycles. The Society of Motor Manufacturers and Traders could equally organise such a competition for models of motor cars. Thus, there would be a museum of the father of the motor cycle, the bicycle, a museum of motor cycles, and a museum of cars. Such would not occupy a large space.

Specimens of some of the earliest bicycles are still in existence and, with a properly funded scheme, purchases could be made to provide the nucleus of such an exhibition. England was the home of the bicycle and it should not neglect to preserve for posterity examples of its manufacture, upon which a most flourishing industry has been founded from such inauspicious beginnings.

"A Potted History of the Bicycle"

CONGRATULATIONS to the B.S.A. Cycle Co. on producing an interesting little booklet free to readers entitled: "A Potted History of the Bicycle." Most of the dates and illustrations are taken from Griffin's book which was reprinted in serial form in THE CYCLIST in 1939. The cover shows an illustration of the famous stained glass window in Stoke Poges Church illustrating a cherub sitting astride a two-wheeled vehicle. This window dates from 1642. Every cyclist will find this little potted record of great interest.

Reflectors—a Legal Point

ONE of our readers informs us that in common with a group of other cyclists he was recently stopped by the police who examined all the bicycles for mechanical and brake efficiency. While his machine was found to be in good order, they pointed out that it was not fitted with a rear reflector and his reply was that he did not ride at night and only used his bicycle in the daytime. The police argued that reflectors must be fitted and he therefore took our advice on the matter. We wrote to the police in question pointing out that reflectors need not be fitted to a bicycle if it were only used in the day time. We should be glad to receive details of any similar instances where the police have endeavoured to arrogate unto themselves power they do not possess.

Incidentally, since the new regulations concerning reflectors on motor cars came into force we have observed that a number of them are very inefficient and do not reflect nearly so well as those fitted to bicycles.

An Unfair Brake Test

BECAUSE the brakes of a power-assisted pedal cycle would not lock the wheels its rider was summoned at Croydon Magistrates' Court recently for failing to maintain his brakes in efficient working order.

When stopped by the police, the rider was asked to sit astride the machine and apply each brake in turn. Neither brake locked its respective wheel and, by pulling hard on the handlebars, the police were able to move the machine forward a yard or two. Counsel, instructed through the Royal Automobile Club, of which the defendant is a member, submitted in Court that the test was not a proper one and that there was no case to answer.

The regulations require that the brakes of a motor cycle shall be sufficient to bring the vehicle to rest within a reasonable distance. A consulting engineer was in Court and prepared to give evidence that the brakes of the machine concerned gave a reading of 65 per cent. efficiency when tested with a Tapley meter. This is equivalent to a stopping distance of 21 feet at 20 m.p.h., a degree of efficiency universally recognised as "Very good."

The magistrates accepted counsel's submission and the case was dismissed without the defence witnesses having to be called upon to give evidence.

The ancient Wool Market Cross, standing in the main street of this delightful little Wiltshire village.

Wayside Thoughts

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

Winter in the Dales,
Downham.
Lancashire
Looking towards Pendle Hill.

Ancient Thoughts

I WAS out the other Sunday with one of my old wheeling comrades who wisely, I think, has kept cycling fit in his seventy-fourth year, despite being the owner of several cars and a nice taste in food. We started in windy sunshine and came home easily, without any sense of weariness, for the breeze did not desert us when it rained. We may have ridden forty miles all told in nearly eight hours, but how gracious they were among the lanes of Warwickshire, with green tunnels of shimmering light, while the shine lasted, and then on the way home bowers of switching foliage almost as heavy with wet as the gale-driven rain. There was no need for us to wear leggings—those horribly hot envelopes—for the wind was with us after the rain came. So we went comfortably and were remarkably dry at the end of the journey, due to some extent to our easy speed.

On that journey we reviewed a multitude of our old friends, and re-lived some of the days we spent along the road before and after the turn of the century, and it was very good to bring to recollection so many people and so many incidents. Among them was a night watch at the summit of Shatterford Bank outside Kidderminster, when Dr. F. W. Wesley was on his amateur Groats trip. It was two a.m. and a moonlight night but there was no rider; and then there was a glimmer of light, the handing up of a drink, and away he went for Bridgnorth, with the pair of us a hundred yards behind. There were no following cars then, it was all done on bicycles which seems now to be more sporting. We waited at Bridgnorth to see what the Doctor left from his feed, for we were hungry in that June dawn and it was many miles to where we handed the trim North Roader over to the Anfield lads.

We talked of other such rides over that classic route, Peck's and Welsh's and Harry Green's on all of which we were the official observers.

The Epic Ride

YES, we recollected, too, that journey of Green's when he wanted to give up at Kendal after drinking a stiff brandy and was persuaded to go on as far as Carlisle by F. T. Bidlake, who could then catch the mail train to London. After some argument he went on, sailed over Shap with ease, and actually never looked back, gaining the record and holding it for 21 years. The story is worth remembering as an occasion when a dose of brandy evidently cleared up the stomach troubles from which he was suffering; and a ride that gave him an income of £200 a year during all the years he held it. In fact, the interested cycle company had to send—or did send—another rider, Jack Rossiter, to lower the figures (which he did), in order to cancel the long-time contract made with Green.

It is good now to remember those days—and nights—along the road, the hectic chases from point to point to pick up train connections, snatch a little restless sleep, and join the helpers farther north. I remember being at Groats Hotel once, and all we could buy to celebrate a triumph was shandy-gaff, beer or Guinness; not a bottle of wine to send us to sleep and dream of triumphs yet to come.

I'm glad I lived through those days when we helped the great journeyers to obtain their victories without any aid from cars. There seems now, in looking back, to be more romance about the performances, when for over 800 miles all sorts and conditions of people proffered ready help, and kept the rider and his followers in the spirit of friendship which in some stretches was almost as valuable to him as the speed of the going.

These attempts and triumphs will not happen again in similar conditions, the vigour of the combined efforts of the helpers is now confined to keeping awake, changing a tyre or escaping the boredom attracted by slow and inactive travel.

I Would Not Go Back

"WOULDN'T you like to be able to do it all again?" asked my companion. No, I don't think I would, for my mind has accepted the fact that this life, at any rate, can only be lived once, and the memories of its little adventures are very precious, particularly, perhaps, because I am still a regular cyclist when so many of my companions have either passed on or have dropped out of this delightful game. I have had my day and it has been a good one, and there are still some more to come, I hope. They may not be so exciting, but will, nevertheless, fill me with the quiet joy as I go silently over the hills and far away.

It is a mistake to think a man grows sad as he grows old, and I think that to be specially true if he still plays the old game and occasionally finds an incident reminiscent of the bygone which stirs him to antedotage and brings to activity those happy and sometimes strenuous hours that ran through the young years. Some cynics say the happiest man is he who has no past, but that is not true; he may be happier if he can completely forget some moments of the past, providing there are compensating good ones he can rejoice in. I possess many of the latter, and nearly all of them are concerned with cycling and the roads running over the shires. So I shall go on, find and gather contentment on the way and forget to find time to ruminate on the unattainable; for here is the compensation; I can go out with a saddle to sit on and be happy almost any day of the year, wander as far as I like, and find all those things on the way that make life desirable to anyone with rural inclinations. It is true I like companionship and fortunately I can still get it among those few old friends who have added to their riches by cycling; and as we go quietly along, we occasionally congratulate ourselves on being wise men.

Tricky Riding

AFTER that short treatise I rode to town the next morning into a N.W. gale, wet as despair, with the wind trying to tear the cape from my back. It took me ten minutes longer on my seven miles trek, for I allowed the gale to send me into the lowest gear and stop there except downhill. It was as fierce as that, and the young riders who passed me shot remarks on the weather of an unprintable kind. Yet, as I have so frequently said, the weather never seems so bad when you are in it as when you look at it from shelter, so I duly arrived at the office to be "told off" for not 'phoning for the car. My monitors may have been right, but I wasn't going to admit the impeachment. They may have been right because when the gale is on and the rain is lashing, to keep a straight course near the kerb is not always an easy matter, and it would almost seem some of the passing motorists are totally ignorant that a single track vehicle is a rather delicate steerer when the wind is really rough. I wish my motoring friends would remember this and act accordingly, giving the cyclist as much leeway as possible instead of crowding him into the gutter. I have been a rider too long to give way to traffic nervousness, but I can understand less expert cyclists finding such conditions a little frightening, and more often than not there is no need to impose them. Indeed, some road users appear to think close passing is a kind of hall-mark to their driving skill, ignoring the fact that such conduct can be very ill-mannered. When I rode home that evening, the rain had ceased but the wind was twig-tearing, and I sailed along feeling the morning journey had been worth the buffeting, had given me a little experience of stormy riding in traffic, and a sneaking satisfaction that my office friends still had some regard for my welfare.

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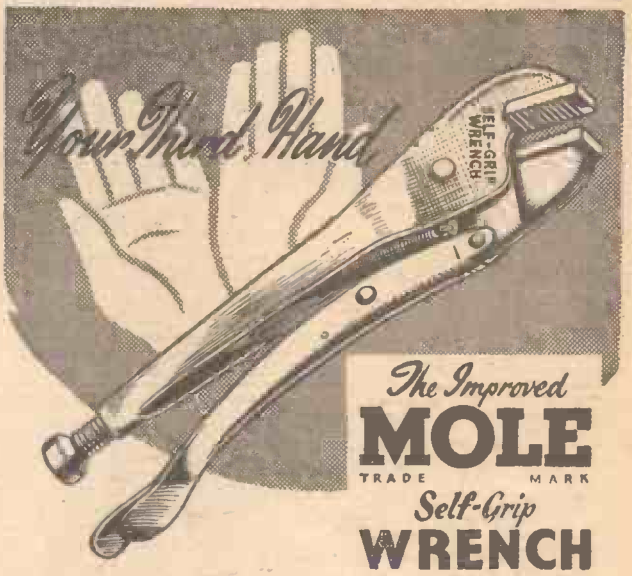

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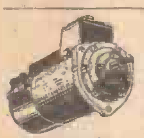

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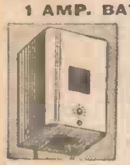

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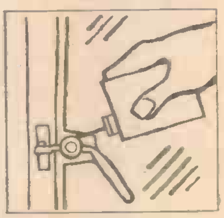

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AROUND THE WHEELWORLD

By ICARUS

Long v. Short Cranks

MR. T. DUDLEY, of Newcastle, asks me to explain why it is standard practice to fit a 6½in. crank to a bicycle with a 26in. diameter road wheel when a longer crank could increase the mechanical advantage and reduce human effort. Note that he does not ask whether a longer crank *would* increase the mechanical advantage; in fact, it does not. If two combinations of crank and gear give the same mechanical advantage, the effort required of the rider in any road condition must be the same in both cases. The two combinations produce the same result, except in so far as one size of pedalling circle may suit the anatomy of the rider better than the other. It is this factor alone that decides what crank length is best for any particular rider. After that, the best gear ratio for him depends on his particular combination of strength and nimbleness.

The power loss in a chain drive is only one or two per cent. of the transmitted power, whatever gear ratio is used, and so nearly all the power produced by the rider is expended in propelling the machine and himself whatever crank length and gear ratio are used. Many years ago, the late Colonel Crompton (Colonel "Cranky" Crompton as I prefer to call him) organised a contest between long crank and short crank cyclists to prove that the long crank had the advantage. Before the test, however, he must have seen his error for he wanted to introduce new factors into the contest, such as testing the physical condition of the riders before and after the test ride, and to check their basal metabolism. Finally, the contest was called off. As each generation of cyclists comes along, however, there is always someone among them who will raise the question again, and convince himself, at least, that you can get something for nothing out of long cranks. There are still some old fogeys of the past who subscribe to the long crank theory. Cranks they certainly are. In Mr. Dudley's case, he produced figures to prove his point, and I give them here:

The mechanical advantage when using a 7.5833in. crank with a 56-teeth chainwheel, an 18-teeth sprocket and a 26in. road wheel, using maximum effort =

$$\frac{1}{1} \times \frac{7.5833}{56} \times \frac{18}{13} = \frac{3}{16} = \frac{1}{5.333} \text{ in. lb.}$$

The mechanical advantage, when using a 6½in. crank with a 48-teeth chainwheel, an 18-teeth sprocket and a 26in. road wheel, using maximum effort =

$$\frac{1}{1} \times \frac{6\frac{1}{2}}{48} \times \frac{18}{13} = \frac{3}{16} = \frac{1}{5.333} \text{ in. lb.}$$

Therefore, by using a 7.5833in. crank with 56-teeth chain wheel, the maximum road speed of the cyclist is increased by 16⅔ per cent. without any additional effort; taking a 48-teeth wheel as the comparator.

Mechanical advantage, using a 7.5833in. crank with a 42-teeth chainwheel, an 18-teeth sprocket and a 26in. road wheel with maximum effort reduced by 25 per cent. =

$$\frac{3}{4} \times \frac{7.5833}{42} \times \frac{18}{13} = \frac{3}{16} = \frac{1}{5.333} \text{ in. lb.}$$

Mechanical advantage, when using a 6½in. crank with a 48-teeth chainwheel, an 18-teeth sprocket and a 26in. road wheel, using maximum effort =

$$\frac{1}{1} \times \frac{6\frac{1}{2}}{48} \times \frac{18}{13} = \frac{3}{16} = \frac{1}{5.333} \text{ in. lb.}$$

Therefore, by using a 7.5833in. crank with a 42-teeth chainwheel, the maximum effort applied to the cranks is reduced by 25 per cent., without any loss in road speed as compared with a 6½in. crank 48-teeth chainwheel, 18-teeth sprocket and 26in. road wheel.

Mr. Martin Hawley, a student at Birmingham University, rides this 80-year-old Rudge cycle two or three miles every day to the Cheltenham Branch of the Electricity Board, where he is taking a graduate course in electrical engineering.

Some of the New Cycle Lamps

Joseph Lucas, Ltd.

THIS season the Lucas "King" range of cycle dynamo lighting sets comprises the Major, Minor, Sports, and 683. The Ambassador, Courier, and Silver King sets will no longer be available. Also introduced is a redesigned version of the CT88 tail lamp, which now complies with the new lighting regulations. It is really a modification of the existing Lucas CT88 lamp, and those already possessing this rear lamp may bring their rear lighting into line by purchasing the extra collar-type lens (price 9d.) and shell (see photograph top right).

Rear reflectors in the Lucas range, the 45S, 46, 47 and 43, continue without change in price or performance as they comply with the regulations.

Ever Ready Equipment

THE newly introduced rear lamp is constructed to the same specification as the standard front type. It has an octagonal plastic unbreakable moulding, ribbed to give horizontal diffused red light, and the light can be seen by the cyclist from the riding position. The price, including bulb and battery, is 5s. 6d. (see photograph).

Now on sale again, after a period of some years, is the Ever Ready Front Cycle Lamp with an octagonal lens rim. The new model has both lens and lens rim combined in clear plastic, replacing glass and metal and an added advantage is that it provides "edge lighting"—reflected light from the lens can be seen when the lamp is viewed from the side.

"Sparto" Products

LONDON BANKSIDE PRODUCTS, under the above trade name are making a combined reflector and rear lamp, which complies with all the new legal requirements. It can be used with either dynamo or battery and has a rubber backing pad curved to fit cycle mudguards (see photograph). The price without bulb is 5s.

Also available is a newly styled dynamo rear lamp to conform to the current regulations. It is fitted with a universal bracket and is suitable for all types of bulb. The cost without bulb is 2s.

A new design of reflector can also be supplied which has a vertically split lens to increase the angle of reflection and conforms to the new regulations. It costs 3s. 6d.

The redesigned Lucas tail lamp.

Ever Ready rear lamp and the "Sparto" combined reflector and rear lamp.

CYCLORAMA

By H. W. ELEY

Minehead, Somerset
The picturesque old town . . .

Lord Salisbury and His Tricycle

IT seems a far cry to the days when the old Marquis of Salisbury was Prime Minister, but those days were recalled by Hannen Swaffer at a Pedal Club meeting some little time ago, when the veteran journalist recalled seeing the Noble Marquis riding along Pall Mall on a *tricycle*—going to see Queen Victoria ! Fashions change, and it would seem odd to-day to see a Prime Minister on a "trike," but there were days when this machine was a great favourite, particularly with the more elderly. Of course, it is not by any means a "museum piece" even to-day, and I suspect that if a census were taken of the number of tricycles in use, we should be surprised !

The Art of Thatching

I ALMOST wrote the *lost* art, for there is not very much thatching done in our land to-day, and it is a pity, for in the old days the thatcher was indeed a skilled craftsman, and nothing was more delightful in the country scene than the evidence of his patient perfect work. In my travels, I am always intrigued and delighted when I see a good bit of thatching, and I fancy that the best examples are to be seen in Wiltshire and Suffolk. Riding in Wiltshire a few summers ago I came across some lovely examples of the thatcher's work, in the villages in the Devizes district, and in Suffolk, too, I have recently been charmed by the thatched cottages in Long Melford and Clare. Those who have lived long in thatched cottages always tell of their warmth and cosiness, and it is amazing how long a good thatched roof will defy the storms and stresses of the weather.

The Cyclist and Road Safety

THERE is still much loose and foolish talk about the "menace of the cyclist" when the evergreen subject of Road Safety is under discussion. Frequently, I take up the cudgels on behalf of the rider of the bike, for I believe that in general he is as conscious of the need for care on the road as any other road-user, but there are times when I feel that he could be a little more considerate. The other day, when I happened to be in a busy industrial town just when the factory workers were streaming out of the works gates and speeding homewards, there was definitely room for improvement in road manners and highway-code observance ! Riding three abreast, many of the cyclists alarmed me by their behaviour, and I think that perhaps a little judicious propaganda in our big factories, maybe undertaken by the firms' welfare officers, would be no bad thing.

The Ancient and Modern in Dover

ONCE again I have to thank a reader of "Cyclorama" for an interesting letter. This time it comes from Dover, and the writer (a native of the place) waxes eloquent over its history and its immemorial place in the chequered story of our country. My "pen-friend" reminds me of the cannon on Dover Heights, generally known as "Queen Elizabeth's Pocket Pistol," and points out that actually the cannon was a gift to Henry VIII, from the Emperor Charles V. He writes, too, of the concrete model of an aeroplane which one may see in a meadow behind the ancient castle, an appropriate memorial to mark the spot where Bleriot, the first airman to fly the channel, landed on that memorable day in July, 1909. My good correspondent tells me that he never looks at this model without a feeling of wonderment, and thoughts of the early days of aviation, when folk stood still and gazed in astonishment whenever a 'plane hummed overhead and when aged countrymen shook their heads and muttered that "it was never meant to be." Dover, England's oldest seaport, bastion of our ancient realm, is certainly historic, and I was pleased to hear from a native of the place and rejoice at his enthusiasm for cycling, despite his good innings of 67 years !

Now it is November

AMONG the months of the year, I fancy that November might well be described as "nobody's favourite"—for I rarely hear anything good of this month which sees the immemorial celebration of Guy Fawkes and his old-time plot. Yet I do not think that the month has such a bad record ! It is customary to associate it with fog, but from the desultory notes on weather conditions which I have compiled since living in the country, I find that November has usually been much more fog-free than February ! And the month has its own beauties ! Along Tallard Ridge the trees are dressed in lovely autumn garb, with varying shades of browns, russets, yellows, mingled with the dark sheeny green of the evergreens. It is well worth riding up to the Ridge to see this autumnal pageantry. Not for long will it delight the eye, for soon King Winter will again be enthroned on his icy throne, and the Ridge will be bare and desolate. When the snow comes, its slopes will be the happy playground of boys with toboggans and the near-by pool known as Long Mere will lure the skaters.

These November nights I like to cycle along the quiet roads to some such village as Trussley, or Rawdon's End, and spend an hour in an inn. The red blinds are drawn, the oil lamps are lit, and there is a welcome for every traveller and every "local." Darts and dominoes are the games played, and I find the atmosphere of these old village inns very restful, and the conversations full of interest. Old men of the farms and fields talk of the prices of feeding-stuffs, the care of cattle, the agricultural legislation of the Government and of the immemorial land. By "closing-time" the little tap-room is thick with the smoke from a dozen pipes ; tankards are banged on the tables when more ale is needed ; sometimes, just before the old place closes for the night, there is a song from some happy villager ; then when all is over, the little crowd melts into the November night. The village is silent, save for the mournful hoot of the owl in Hales Spinney, and the barking of a dog over at Daisybank Farm.

A Christmas Cycle Rally

ALTHOUGH it is rather a far cry to Christmas, old Mrs. Huggett, who keeps our village shop and caters for parties of hikers and cyclists, has had a letter from the secretary of the cycling club which comes to the village at week-ends in the summer asking for refreshments to be available for club members on Christmas morning—whatever the weather may be ! The club is holding a "Christmas Rally," and its members

Arreton, Isle of Wight.

propose to attend morning service at our ancient little church, have a meal at Mrs. Huggett's and follow it with a ride through the neighbouring countryside in the afternoon. Mrs. Huggett will not, of course, be able to provide a Yuletide feast of goose or turkey, but I gather that the Christmas riders will enjoy the traditional Christmas fare when they return home at night, tired but hungry after their hours in the winter air.

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