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EDITOR : F. J. CAMM

JULY 1952


SEE PAGE 336

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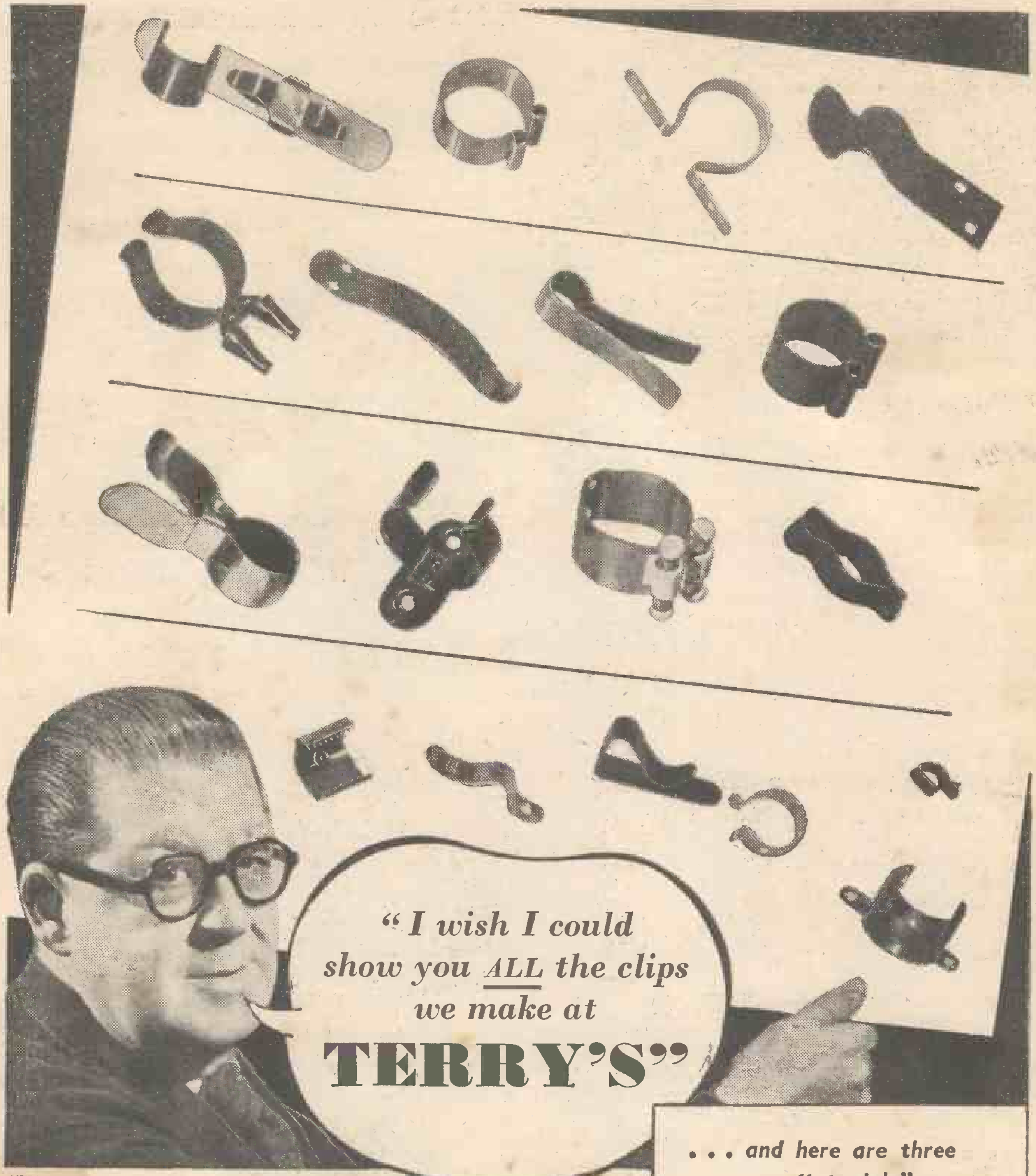


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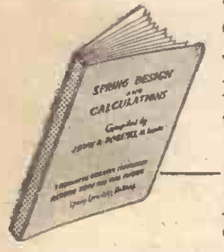


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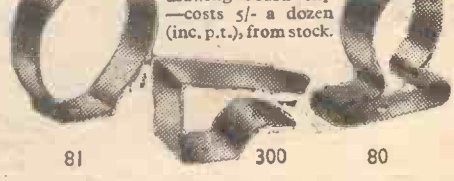


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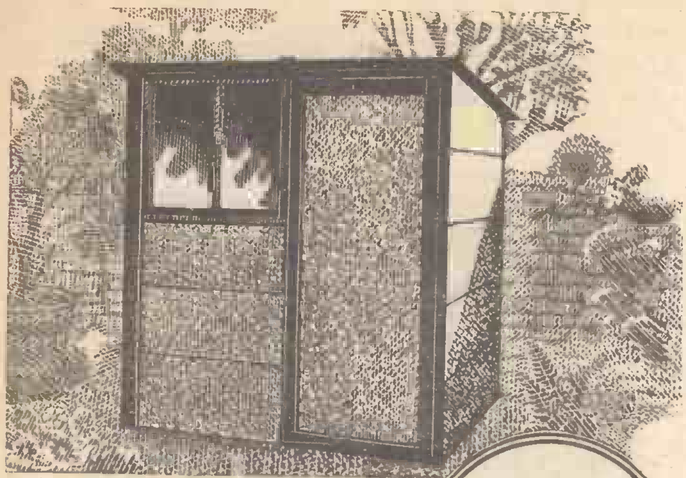

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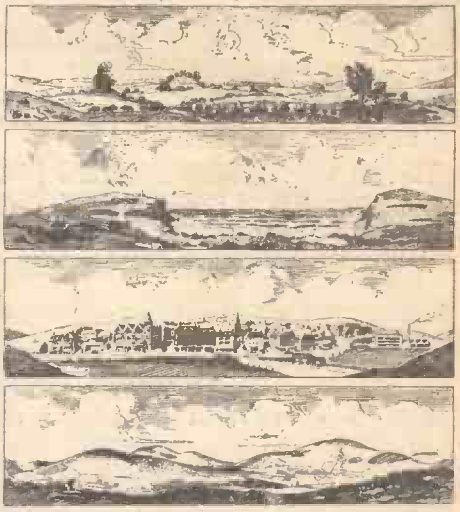

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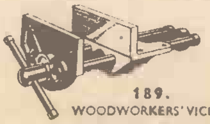
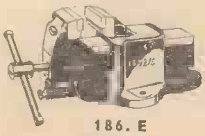
126. 'G' CRAMP

186. B. MECHANICS' VICE



189. WOODWORKERS' VICE



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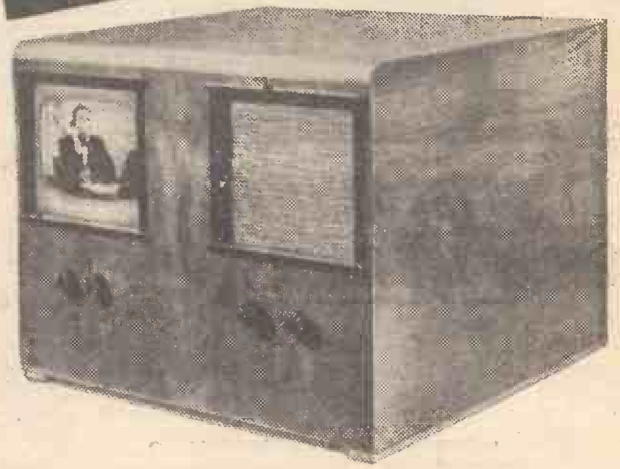

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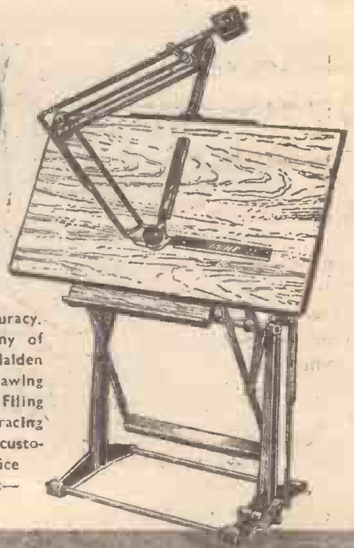

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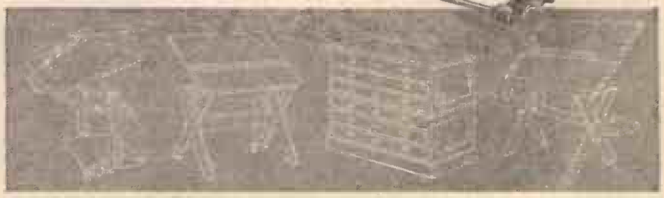

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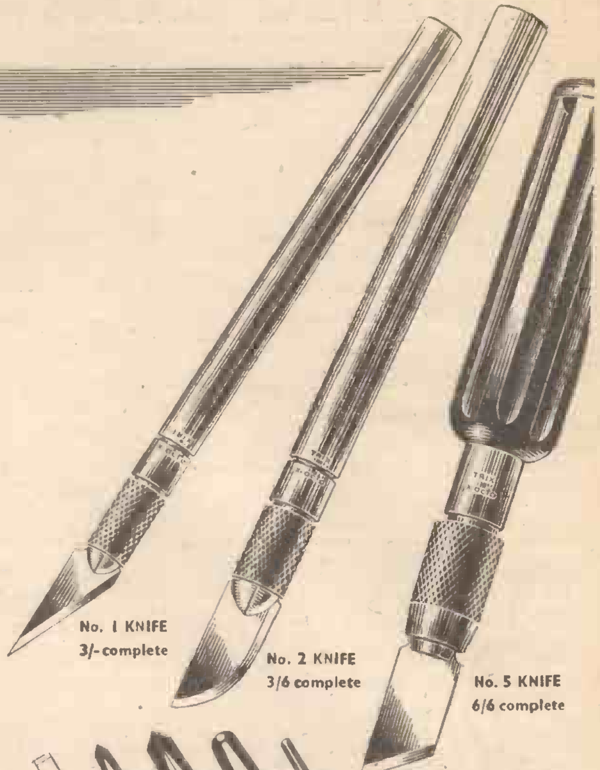

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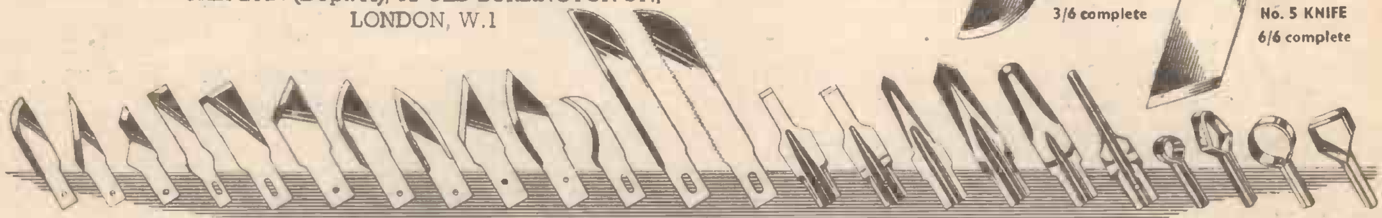

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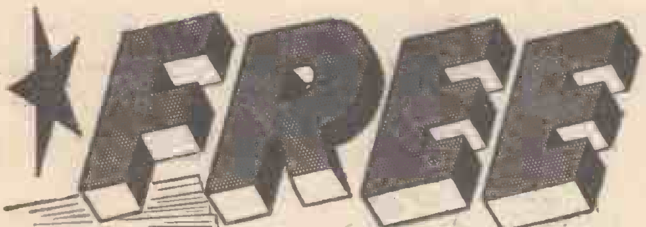



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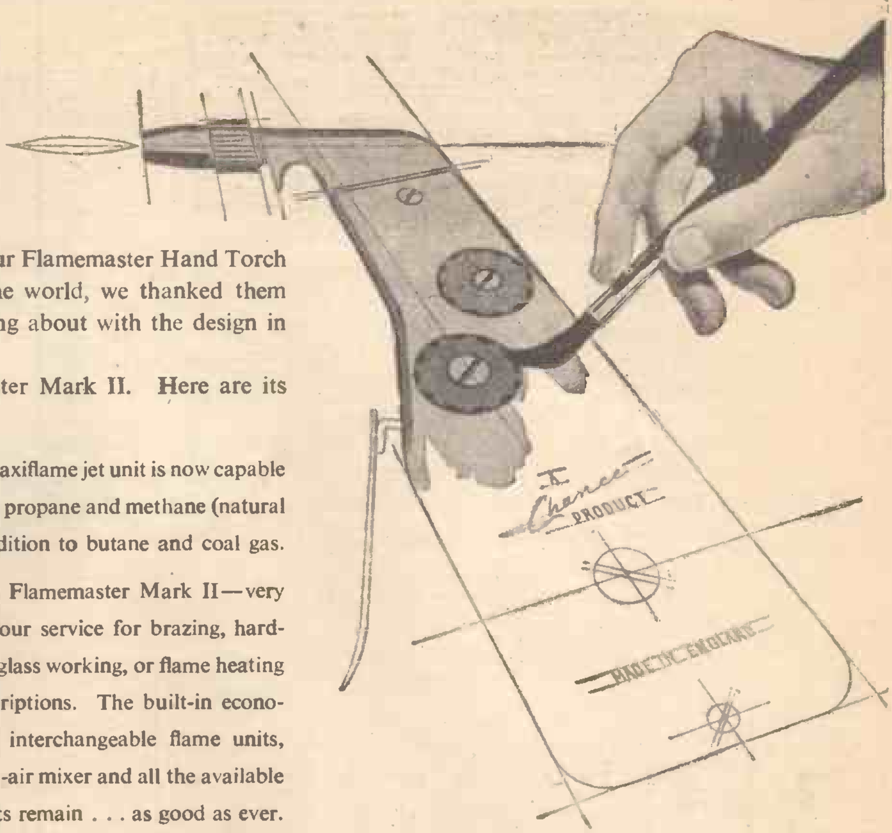


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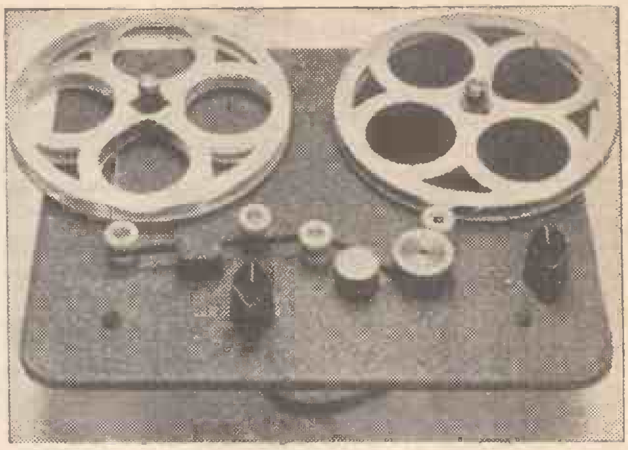

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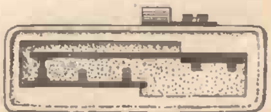

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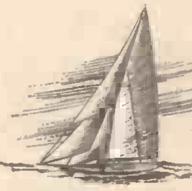

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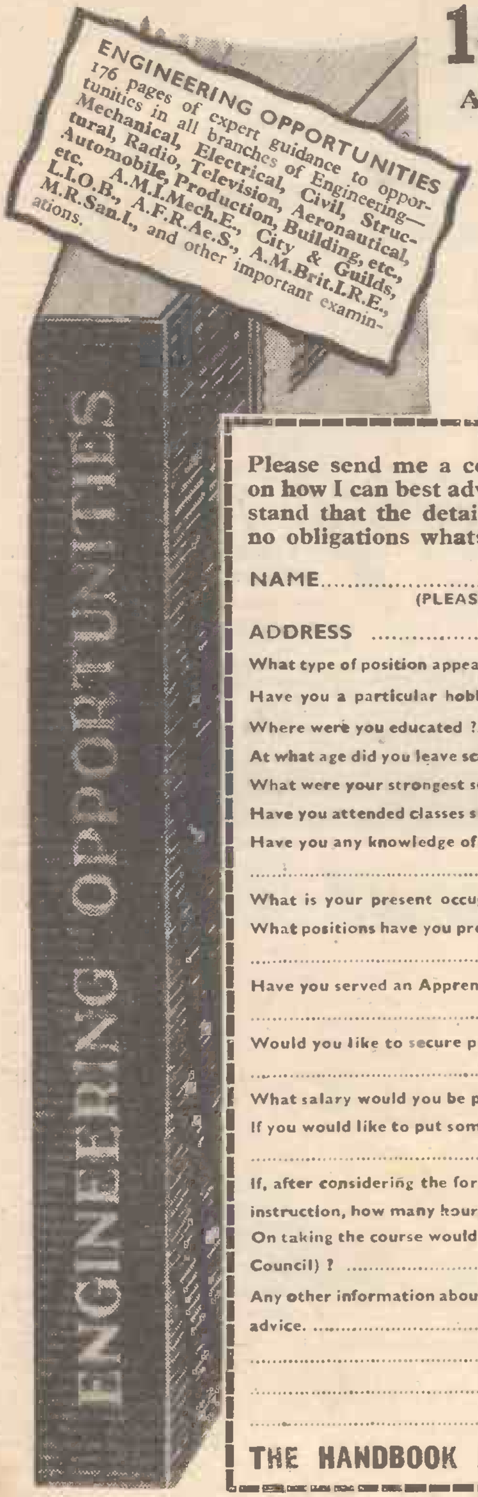


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JULY, 1952
VOL. XIX
No. 223

# PRACTICAL MECHANICS

EDITOR
F. J. CAMM

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

## FAIR COMMENT

By The Editor

### OUR £200 COMPETITION

A VERY large entry indeed has been received in each of the three sections of our £200 competition, announced in the April issue and which closed just as this issue goes to press. Each entry will be carefully scrutinised and judged on its merits, and we shall do our utmost to complete the judging in time to announce the result in next month's issue. We shall make a selection from the unsuccessful prizewinners and publish their entries. Senders of those entries will receive payment at our standard rates.

### ELECTRICITY DIRECT FROM COAL-GAS

IF a new patented process lives up to its claims, power plants may soon be generating electricity without first generating steam. And combination plants may be able to generate electricity with both steam and gas, and also produce gas from coal. Such achievements may follow development work which has resulted in a patented process that claims to convert producer gas directly to electrical energy—by means of a " fuel cell."

The process has the claimed high overall efficiency of almost 60 per cent. It is said to produce 0.5 to 0.9 volts per individual cell in a conversion unit which contains a series of such cells. Within the conversion unit, a high-melting glass solid electrolyte (sodium silicate, monazite sand, tungsten trioxide, and sodium-carbonate) separates an anode chamber (iron-magnetite) from a cathode chamber (iron-iron oxide). The electrical conversion in the unit proceeds briefly as follows :

Air is fed into the anode chamber at high temperature. At the same time, producer gas (carbon monoxide and hydrogen produced by the burning of coal) is fed through the cathode chamber. Oxygen from the air reacts with the iron to maintain a state of oxidation. The iron oxide at the anode picks up electrons, so that oxide ions are released into the solid electrolyte. At the cathode, oxide ions are discharged to release electrons and oxidise the electrode to a still higher oxide of iron. As producer gas circulates in the cathode it combines with the higher oxide so that the carbon monoxide in the producer gas changes to carbon dioxide ; the hydrogen oxidises to water, and the higher oxide is reduced.

It is claimed that the energy produced by this inter-reaction generates electricity in the conversion unit. The system appears to be adaptable to liquid hydrocarbons—such as methane—as well as to coal.

### UNDERGROUND GASIFICATION OF COAL

AFTER four years of extensive experiments made by the Bureau of Mines at Gorgas, Alabama, it has been proved that coal—as it lies underground—can be changed to a gas suitable for driving gas turbines and generating steam.

During one experiment, two gas turbines were installed and operated for 100 hours on combustible gases captured from the burning coal. The energy produced by the turbines was used to compress air and send it back underground to the gasification system. In commercial operations this excess energy would be produced for useful purposes.

Underground gasification of coal can be applied in three ways : by the complete combustion of coal underground with air and utilising the heat energy in gas turbines or in raising steam ; by the production of producer gas with air and utilisation of the gas in gas turbines ; and by production of synthetic gas by gasification of coal with oxygen and steam, and use of the gas in the manufacture of synthetic liquid fuels or organic chemicals.

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# AN ELECTRIC HEDGE TRIMMER

## A Labour-saving Machine for the Garden

By F. H. N.

*The completed hedge trimmer ready for use.*

PRIVET hedge trimming is always a tedious job, and if the hedge happens to be a long one many hours' work are necessary to keep the hedge in good shape during the summer.

The electric hedge trimmer, as shown in Fig. 1, is easy to construct, and if made from ex-Government materials may be built for less than the cost of a good pair of hand shears.

During two years' use on our rather extensive hedge the trimmer has worked very well and saved a considerable amount of time and energy. After dismantling for photographing and oiling, the machine is still good for many years' service.

The following instructions and dimensions are for converting a 24-volt blower (Fig. 2). These blowers may be obtained from most shops dealing in ex-Government surplus, and from advertisers in PRACTICAL MECHANICS, at prices from 12s. 6d. each. When purchasing a blower try to get one similar to Fig. 2, and make sure the fan revolves freely, or have it tested.

Dismantle the blower casing and remove the fan, then wire the motor temporarily and run to check direction of rotation. If opposite to that indicated in Fig. 5, check the wires and reverse the direction of the current in the armature A and B (Fig 3).

### The Toothed Disc and Cutter

The circular disc is marked out on a piece of 10- or 12-gauge mild steel sheet (Fig. 4). Cut out the 4¾in. diameter, drill and countersink the ¼in. diameter holes, using the backplate from the blower as a drilling jig for spacing, etc. Drill the 5/16in. diameter holes and cut out the slots with a hacksaw; dress off, smooth and file a radius on the ends of the teeth. Sharpen the cutting edges about 2 deg. where marked. This disc may now be assembled to the motor, using the original four countersunk screws. If the heads protrude, countersink until they are flush.

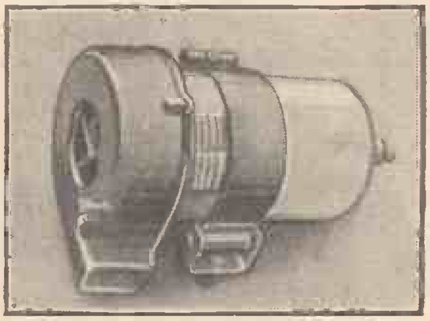

*Fig. 2.—The blower unit before conversion.*

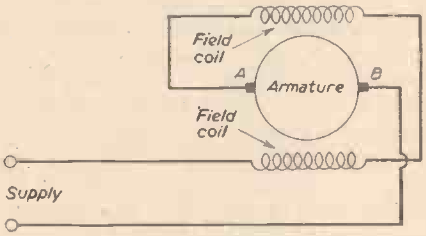


*Fig. 3.—Circuit diagram.*

The cutter should now be marked out on 14- or 16-gauge mild steel. A piece of stainless steel would be better if available (Fig. 5). Drill a ¼in. diameter hole in the centre, cut out or grind to shape, and sharpen the edges about 2 deg. where marked. Fasten the fan to the cutter with a ¼in. nut and bolt, and mark off the shape to be cut away; detach and cut to shape with a hacksaw, leaving a boss in the centre 7/16in. high. Fit together with the ¼in. bolt and drill the ⅛in. diameter rivet holes on a 2in. pitch circle.

Rivet together with countersunk rivets on the back face and file off flat. The cutter may now be mounted in position, but it is advisable to replace the existing grub screws with setscrews. This will facilitate easy removal for adjustment, and flats should be filed on the motor spindle to suit.

### Setting the Blades

Set the blades as close to the disc as possible, bending the disc blades slightly if necessary. The gap must be the same in any position, the cutting edges meeting in a similar manner to a pair of shears. To prevent any chance of the cutter coming off, drill a 3/32in. diameter hole through the shaft and boss and insert a split pin.

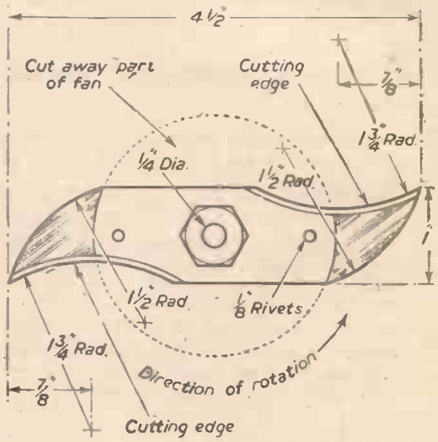


*Fig. 5.—How to mark out the shape of the steel cutter.*

The handle is made from a piece of ¾in. diameter steel or aluminium tube 8½in. long. Swage the end for a distance of 1in., round off, and drill a ¼in. diameter hole 5/16in. from the swaged end. Drill a ⅜in. diameter hole 1¾in. from the swaged end for the wire to pass through and remove all burrs. Fit a 7in.

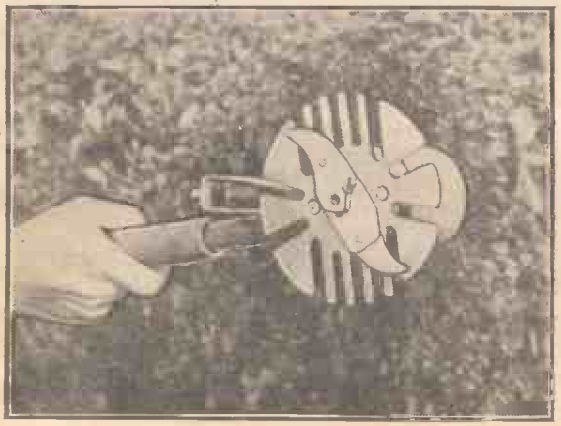

*Fig. 1. — (Left) The cutting side of the trimmer, showing the shaped cutter blade.*

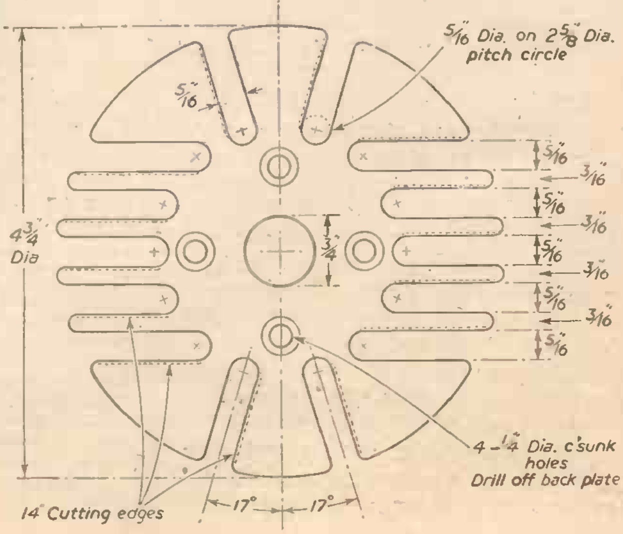


*Fig. 4. — (Right) The dimensions of the toothed cutting disc.*

length of $\frac{3}{4}$in. diameter hose to provide a good grip, and allow the rubber to protrude below the steel to make sure the electric wire will not chafe.

The clip and switch holder may be bent from a piece of 18-gauge aluminium or duralumin, 1in. wide and 16$\frac{1}{2}$in. long (Fig. 6). Bend to shape in a vice and round the motor or a circular object about 2$\frac{1}{8}$in. diameter, then mark off the holes and drill for the bolt and switch. Assemble on the motor with a $\frac{1}{4}$in. bolt 1in. long; nip up tight and measure for the distance marked X. Cut a distance-piece from $\frac{3}{8}$in. or $\frac{1}{2}$in. diameter tube and adjust this as required to hold the motor and handle securely at any desired angle.

Assemble the handle, clip and switch complete to the rest of the machine, and the trimmer is ready for wiring.

### Connections

The motor being series wound will have one wire from the fields and one from a brush. Pass the wires through the handle, breaking one wire at the switch; fit a two-pin plug (or a type not used in the home to prevent accidental use on a high voltage). Use a flexible twin-rubber cable of about 3 amps. which can be plugged in to a transformer at approximately 35 to 45 volts A.C., or if D.C. current is available, 25 to 35 volts will be suitable. This overrunning is necessary to obtain sufficient power with light weight.

It is not advisable to run the trimmer from an auto-transformer or through a 450-watt resistance, because when cutting a wet hedge there would be danger of an electric shock.

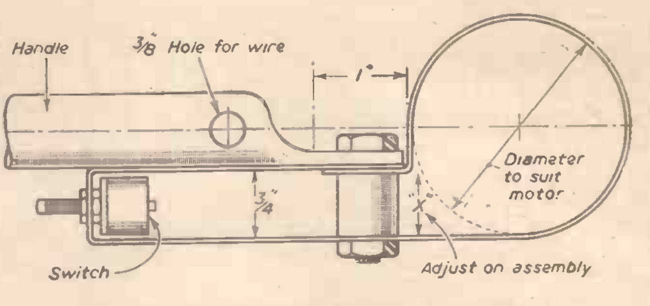

*Fig. 6.—Details of the clip and switch holder.*

The machine is used in a slow, sweeping movement, tilting the cutting plate slightly in the direction of the cut. The comb gathers in all the straggling ends, leaving a neatly trimmed hedge. The trimmer can be used to cut long grass and the edges of the lawn, but care must be used to make sure stones are not gathered by the blade. Always dry the machine after use.

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# The Stolen Railway

## How the Various Parts of the Birr and Portumna Railway were Dismantled and Used for Other Purposes

By C. G. GREY

THE Birr and Portumna Railway was one of several in Ireland which were known as Baronial Railways; not because they were owned or run by noble lords, but because the "barony," or section of a county, in which they were operated, guaranteed to make up to the parent line (in this case the Great Southern and Western Railway) any loss that it might suffer because of lack of passengers or goods traffic. The Baronial Railways were laid down in the first place in a wave of optimism when everybody thought that the great main lines would so help agriculture and commerce that the "barony" lines would pay sooner or later.

The B. and P. was intended to take the produce of King's County to the river at Portumna, and ship it down to Limerick for export or to feed the city, and bring back imported goods. But something went wrong. It was not motor-traction cutting into rail traffic, because we had no motors in those days. The loss of passenger traffic because people used bicycles, which were becoming popular from 1890 onwards, could not have affected the goods traffic, which was the mainstay of the line. Probably the cause was just hard times in agriculture.

The "barony" announced that it could not make up the losses, and the G. S. and W. Railway said that it would not carry the loss by itself, and shut up the line. It withdrew all rolling stock, the stationmaster, porters and goods yard men (at least six in all) from Portumna, two or three more from an intermediate station, and the line ceased to exist as a way by rail.

### Removing the Permanent Way

At the Birr end nothing happened. The rails and sleepers and switches just stayed there, as if a train could start off for Portumna at any minute, but a few miles out in the country the line began to fade away. There was a good bit to fade, too, for it was standard Irish gauge, 5ft. 3in., with flat-bottomed rails held down to massive sleepers by dog-spikes and held together by fish-plates and nuts and bolts—we had no flash-welding in those days. Also, with flat-bottomed rails there are many more sleepers to the mile than with bull-heads.

The first thing that began to disappear was the ballast between the sleepers. Local farmers found that it made fine metal for farm roads, and I have a notion that a good deal of it was "adopted" by local road-contractors, who used it on the barony's roads.

Then bright lads with big spanners started taking off fishplates. Nuts and bolts and pieces of iron of those sizes are surprisingly useful about farms, and were quite saleable in neighbouring towns. Brawny blacksmiths could hammer all sorts of things out of the plates themselves. Then, naturally, came the lifting of the rails and the extraction of the dog-spikes. The big, heavy spikes also made useful raw material for the local smithies.

The rails were not so easy to transform, but any farmer in a country where flat-bottom rails are used knows that, when cut to length, they make perfect gateposts. One end of the gate is swung on hinges which are bolted through holes in the web of the rail, the other end slams up against the inside (or top side) of the flat bottom, and the inside (or bottom side) of the head of the rail holds the bolt of the gate when shot forward.

The sleepers went easily, some for buildings, some just for firewood. There is always plenty of use for creosoted timber.

That accounted for the permanent way, but there was more to it than that. The switches at Portumna and the intermediate station were not much use, except as chunks of iron, against which to wedge things, but the rods and joints which worked them were good, weldable and forgeable material.

The stations, platforms, houses, offices and odd buildings and sheds were little gold mines. The windows disappeared before the local small boys had a chance to smash them, and doors, floors, rafters and joists quickly found good homes. Naturally, the slates and corrugated iron roofs were in great demand. When once the depredations began and people found that the local police had no orders to interfere things went quickly. In fact, I fancy, that sundry unconsidered trifles helped to add to the comfort of the Royal Irish Constabulary barracks round about.

The R.I.C. were a fine body of men, absolutely honest, loyal and trustworthy, but they were Irishmen and sportsmen, and so were bandits in a mild way when they knew that they were not harming anybody.

The stone edges or kerbs of the platforms when pried loose with crowbars, made fine doorsteps for houses or cow-sheds or stables, and the bricks of the buildings, when there were no roofs or insides to the walls, soon came away with a little persuasion and were made useful elsewhere.

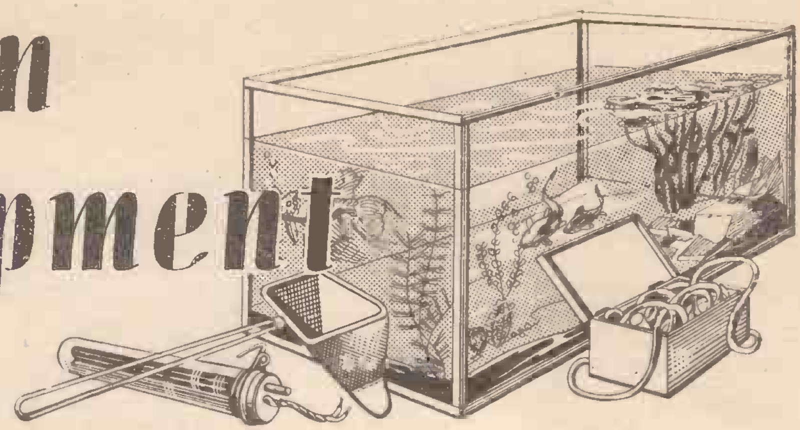
The crowning jest concerned what *had* been the greatest glory of the line—that was the great water tank at Portumna, the terminus. There the little saddle-tank engines used to tank up. I suppose water from the Shannon was cheaper than water at Birr, and that was why they had that huge tank there. I have no idea what it held, but it looked very big and dignified at the terminus. That disappeared, too.

### The Water Tank

Years afterwards when the railway had all gone and there was just a long, thin strip of waste land, I was in an hotel in Portumna and had a chat with the manager about the way the whole railway had been stolen. "But," said I, "it has always puzzled me what became of the big water tank at this end. It was rather on the big side for loot"——"Ye might well be askin' that," he said. "But believe me, sir, the people round these parts never wasted a thing, though some of it was terrible hard to move." With that he cocked his eyes up out of the window, and, following his line of sight, there sure enough was the water tank neatly built into the roof of the hotel stables and wash-house. I suppose that he had also installed the pump which brought the water up from the Shannon.

Contrary to common belief, the Irish are not a reckless, improvident breed. The Irish farmer, as my friend the publican said, never wastes a thing, and the taxpayers of the barony saw that they got back full value for their money that had in the past been spent on the Birr and Portumna Railway.

# Aquarium Equipment



## The Construction of Simple Accessories, and the Care of Aquaria

By DOUGLAS GOHM, F.Z.S., Author of "Tropical Fish"

WHILST most of the accessories and equipment used by aquarists can be purchased, it is usually cheaper and more satisfying to make them yourself.

Nets, for instance, can be made from old nylon stockings, and to any dimensions required; those obtainable from shops are procurable only in standard sizes, and the pockets, although quite strong, are not so durable as nylon.

Rectangular nets are the better shape, as they offer a large mouth area and leave no possible escape path between the nets and the interior corners of the tank, as do circular nets.

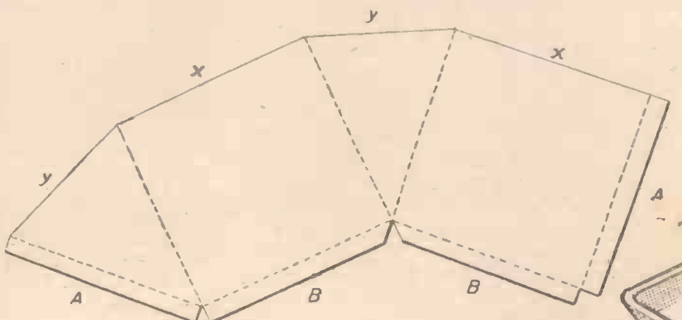
### Net Frame

The frame and handle are made from one length of 14 s.w.g. galvanised iron wire which is formed to shape with a pair of pliers (Fig. 1). If more than one net is to be made, a simple jig consisting of a board with screws positioned at all the bends for forming the wire around will make the job easier and the nets consistent. The two free ends are clipped together with any odd piece of tin and soldered. The frame is now complete.

To make the net pocket obtain an old nylon stocking and cut it carefully along the seam. Make a pattern in paper, as in Fig. 2, *x* and *y* being equal to frame sides, A equal to the required depth, and pin it to the nylon and cut-out. Sew edges A and B together; a sewing machine will make a neater and stronger join, but hand sewing will do.

After the seams have been sewn, turn the pocket inside out and resew the seam, as Fig. 3.

The completed pocket can now be sewn to the frame, and the net is ready for use.



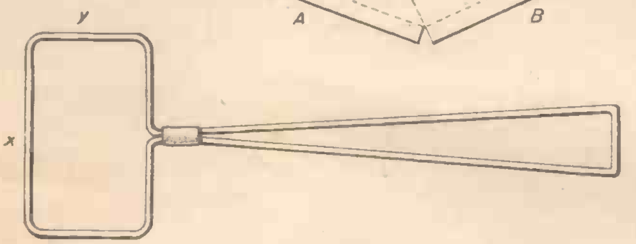




*Fig. 1 (Left).—Wire frame for a net.*

*Fig. 2 (Above).— Paper pattern for making a net.*

Nets for catching young and very small fish can be made exactly as above, except that the bottom of the pocket is cut off and replaced with a piece of surgical oiled silk, as in Fig. 4. This will ensure that a small quantity of water always remains in the net for the young fry to swim in whilst they are being transferred from one tank to another.

### Rubber Frame Edging

Glass laid on top of aquaria often collects condensatation and causes dampness between the glass and aquarium frame which, in time, causes rust and destruction of the paint.


**At last a standard British book on the Subject, a volume for which thousands of enthusiasts have been waiting—just published—TROPICAL FISH IN THE HOME, by Douglas Gohm, F.Z.S. With a magnificent range of colour reproductions of all the popular breeds, and full details for making a success of this most popular hobby. 30/- net from all booksellers or 30/8 post free direct from C. Arthur Pearson, Ltd., Tower House, Southampton St., London, W.C.2.**



To prevent this, obtain a length of rubber tube equal in length to the internal perimeter of the tank frame, and cut it carefully with a wet razor blade through one side only and push it over the inside edge of the frame. Now lay the glass top on this rubber edge. This will cause collected water to drain back into the tank without making the frame wet (Fig. 5).

Another method is to make two clips from ½in. wide aluminium strip to form a ledge about 1in. below the frame top on one side of the aquarium only (Fig. 6). The glass cover is then inclined at a slight angle so that condensation runs back into the tank.

### Simple Syphon

Sediment collecting on the bottom of the aquarium can easily be removed with a syphon.

The syphon simply consists of a piece of rubber tube filled first with water from a tap or by completely immersing it in the aquarium. One end is then hung over the side of the tank and into a bucket, the other dipped into the tank. Care should be taken to keep the tube full of water by squeezing both ends between thumbs and fingers until one end is in the water. It is

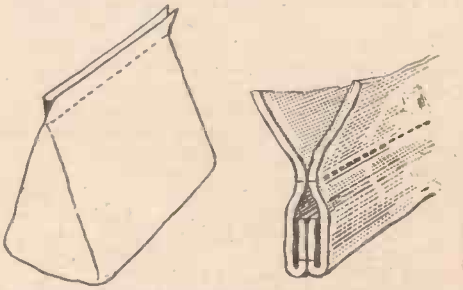


*Fig. 3.—How the seams of the net material are turned in and sewn.*

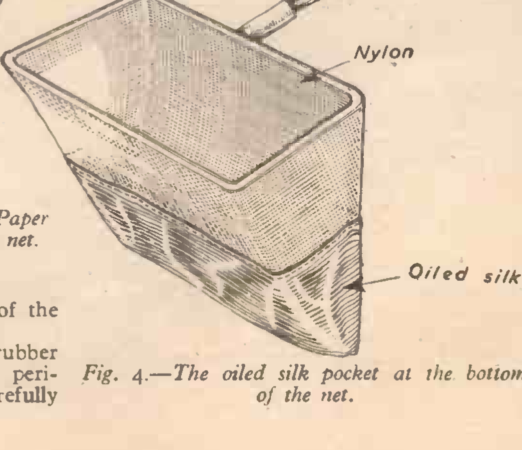



*Fig. 4.—The oiled silk pocket at the bottom of the net.*

then held about ¼in. away from the sandy bottom of the tank. Water rushing out will then take the sediment with it.

The water removed in this manner can be filtered through a piece of fine muslin in the form of a bag attached to the end of the tube in the bucket by an elastic band. The water can then be returned, quite clean, into the tank.

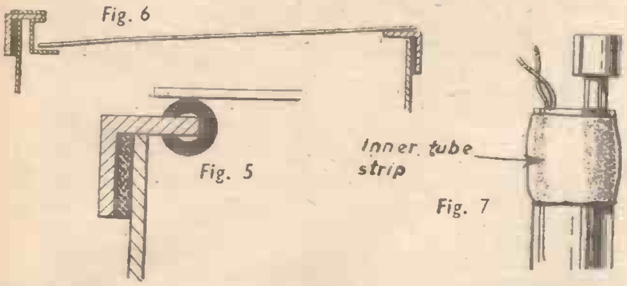



*Fig. 5.—Rubber edging for tank framing. Fig. 6.—Sloping glass tank top. Fig. 7.—Rubber sealing band for a thermostat.*

**Repairing a Leak**

Leaks are always a great inconvenience—very slight ones should be given a chance to cure themselves, but if after a few days the leak persists action will have to be taken.

In almost every case it is advisable to empty the tank, but if the leak is only slight and the tank inconvenient to empty, the following method may be tried. First dig out the cement between the glass and frame for a distance of approximately two inches each side of the leak and a quarter of an inch deep. This can best be effected with a hacksaw blade, broken into two, the broken edge will then have a slight lip that will act as a scoop small enough to go between the glass and frame.

Next mix powdered red lead with a very small quantity of goldsize. When the mass reaches the consistency of a stiff dough it is about ready to be forced into the cavity made by removing the old cement. If this should prove unsuccessful, it will be necessary to first empty the tank and then carry out the above directions.

An additional safeguard would then be to run goldsize carefully along all the interior corners, making absolutely sure first that the interior is free from moisture. A fountain-pen filler is a handy tool with which to apply the goldsize.

**Sealing a Thermostat**

Thermostats are sometimes prone to give trouble because of water seeping between the top of the glass envelope and the plug carrying the bi-metal strip. This can be prevented by cutting a one-inch long strip from an old cycle inner tube and stretching it over a joint (Fig. 7).

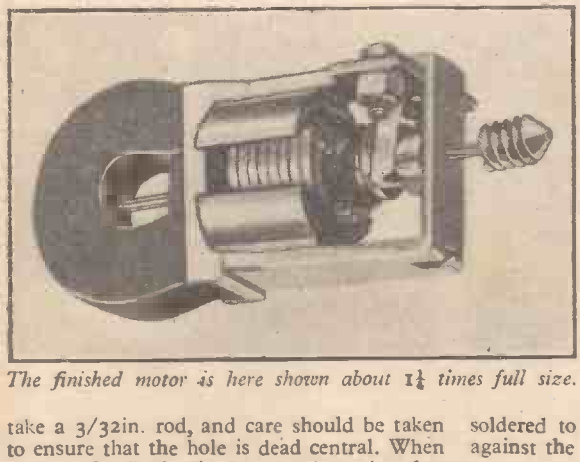
Water seepage into the electric lamp sockets of metal aquarium covers can be cured also with a strip of inner tube pushed over the socket and rolled a little way on to the lamp.

# A Miniature D.C. Motor

## Constructional Details of a Power Unit Suitable for a "00" Gauge Locomotive

By G. W. MARSH

THIS small motor can be made very cheaply as only the "Eclipse" magnet (costing 2s. 3d.) need be bought, the other parts being made from scrap metal. If the worker does not possess a lathe or other suitable means of making parts perfectly round, it is better to purchase the commutator (cost about 3s.), otherwise running difficulties may be experienced. Beginning with the armature, the laminations are made from old transformer stampings or thin sheet mild steel. Sufficient pieces are cut to make the armature about 7/16in. long, the number of pieces depending on the thickness of metal used. The diameter of the laminations should be the same as a silver threepenny piece. A hole is drilled in the centre to take a 3/32in. rod, and care should be taken to ensure that the hole is dead central. When cutting the laminations a metal cutting fret saw is advised, using a template; a warding file could also be used. After cutting the laminations clamp them together on to the spindle, the end laminations being punched so that a firm fixture is made to the spindle.



*The finished motor is here shown about 1½ times full size.*

The spindle, of 3/32in. dia. and 3in.-long silver steel rod, is heated at one end in order to file the bearing point, after which it can be re-tempered.

**Winding the Armature**

The assembly is then lined with thin paper and wound with 34 gauge enamel wire for 6v. working, or 38 gauge for 12v., as many windings as possible being placed on each pole piece, making certain that there are equal turns on each. The windings should be checked for insulation with the armature, and the ends joined inner to outer of the next; the three ends are then fixed to the segments of the commutator, the whole being sealed with balsa or similar cement.

**Commutator**

The commutator can be made from copper tubing cut in three pieces lengthways and stuck on a piece of insulated rod through which a central hole has been bored to take the spindle. The brass block, "A," should next be made. This fits between the pole pieces of the magnet, the front side being flush with the pole faces. It should be the same width as the magnet and is drilled to take the spindle. This block is filed to be a tight fit inside the magnet, but not too tight or the magnet may split. Next, thin brass strips, "B," are cut to shape and soldered to the block "A" at the centre, one each side of magnet. Brass strips, "C," about 1/16in. thick, are soldered to the pole pieces so that they rest against the magnet face.

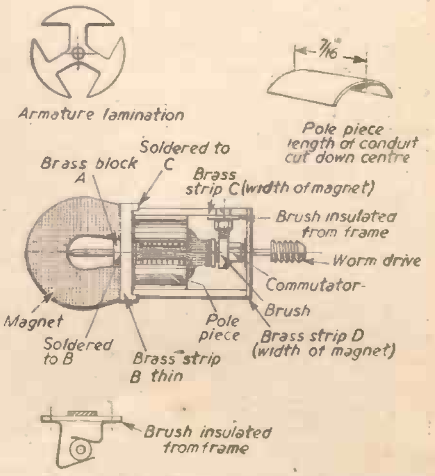
**Assembling**

The armature is then placed in position, wrapping it with thin paper for clearance. The pole pieces are then put in position and held while brass strips B and C are soldered together. The armature is then removed. Brass strip "D" is next cut and a 3/32in. hole drilled in the centre. The armature is again placed in position, putting a fibre washer between the commutator and strip D, which is then soldered into position. Care should be taken to see that the armature assembly is positioned centrally between the pole pieces.

**Brushes**

The brushes are cut from thin strip phosphor bronze or other springy metal. The brushes are insulated from the frame by fixing a piece of fibre or paxolin to strip C and bolting the brushes to the insulated strip. If required for three-rail working one of the brushes is connected direct to the frame.

Carbon brushes can be used, small pieces of brass or copper tubing serving as holders. One end of each tube is threaded to take a small bolt, the outside being also threaded to take a clamping nut. These holders are fixed to strips "C," one being insulated.



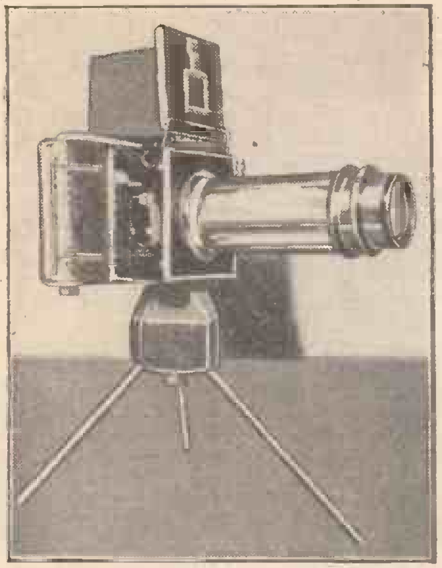

*Side view of the motor and details of various parts.*

The small pieces of carbon (pencil lead will do) can be spring loaded, adjustment being made by the bolt to obtain the required tension.

# Simple Telephoto Lenses

## Notes on Their Construction and Fitting to a Camera

By F. G. RAYER



*The completed long-focus lens attachment.*

IT may be wondered what the advantage of a telephoto lens is, and this perhaps should be explained first. Briefly, such a lens gives a bigger image on the camera film when snapping an object from the same distance. The same is true with long-focus lenses, as made clear in Fig. 1. The increase in dimensions of the image is almost exactly proportional to the focal length of the lens. For example, many popular cameras have a lens with a focal length of 7.5 cm. If a 15 cm. lens is used the image on the film will be twice as large in each direction. Likewise, if a 22.5 cm. lens were used, the image would be three times as large in each direction, or occupy nine times the area. There is, of course, no need to keep to exact multiples, but a lens which gives an image two or three times the size of that obtained with the usual camera lens is convenient.

The advantage achieved is well illustrated in the two photographs. Both were taken from the same position with the same camera. In one the main point of interest occupies insufficient area, and the road in the foreground spoils the picture. (Had the camera been tilted up a little, a considerable area of blank sky would have been included.) The lens used to take this picture was of 4in. focal length. The second picture was taken with a lens of 9in. focal length, giving an image slightly over twice the size in each direction.

Some photographers possessing enlargers may feel that they could take the important part of the first photograph and enlarge it up to the same size as the second! But this is not so—in enlarging, detail is lost, and much enlarging makes a very fuzzy picture. Then again, some photographers only make contact prints, and no enlarging is possible. Furthermore, using a long-focus lens and standing well back gives a much better perspective to buildings. While, when photographing distant scenes, ships at sea, inaccessible architectural subjects, and so on, a telephoto lens becomes invaluable.

### Long-focus Lenses

Before describing how such an arrangement can be made up, it is perhaps wise to distinguish between long-focus and strictly telephoto lenses. The long-focus lens increases the size of the image, as already described. Such lenses are easily obtainable from dealers. That used in the attachment to be described being of 18 cm. focal length, with an iris giving apertures from F6.8 to F36, and costing 25/-. The telephoto lens proper, however, consists of a long tube with three or more lenses arranged at various points down it. This type costs £25 upwards, though a second-hand one in good condition may be obtained for £10 to £15. It is the long-focus type which is used here, and the effect is almost exactly the same as the telephoto. The difference does not lie in the amount of magnification, or the quality of the image, but in the fact that the corners of the picture *may* be cut off slightly by the tubing employed. (This does not arise in the telephoto because the latter has a lens at the camera-end of the tube, to spread the light rays all over the film or plate.) The longer the focal length of the lens used, the more will corners of the picture be cut off.

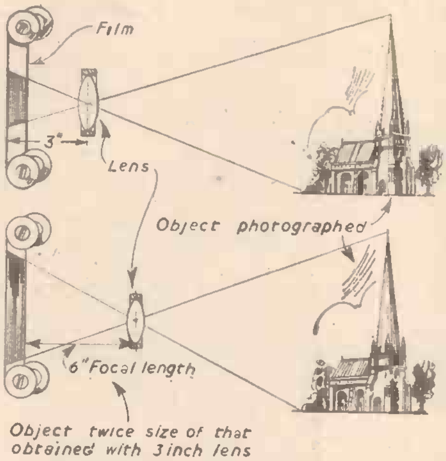



*Fig. 1.—The effect of using lenses of different focal lengths.*

The 18 cm. lens mentioned just cuts off the extreme corners, the amount being so small many people would not notice it. Actually, this is no particular disadvantage.

### Fitting to the Camera

Cheap box or folding cameras are not very suitable for this type of lens because they would have to be permanently modified. However, film and plate reflex cameras and plate cameras with a back screen for focusing are quite inexpensive, second-hand. These will have the lens screwed into a flange. It is, therefore, only necessary to unscrew the standard lens and screw in the long-focus lens (which will give the telephoto effect). Similarly, the original lens can be replaced whenever necessary. Cameras with permanently fixed lenses are unsuitable.

The construction of the new assembly is shown in Fig. 2. A tube is required to screw into the flange which took the original lens. These are available from dealers, being known as extension tubes. An outer tube slides over this tube, and has a slot cut at an angle. A pin or screw is driven into a small hole drilled in the inner tube. When the outer tube is rotated, it therefore moves backwards or forwards for focusing. The tube illustrated was made from clean tinplate, rolled round a suitable object and soldered. Brass, aluminium, or other tubing would give a better finish.

The long-focus lens was fitted permanently in the outer tube, being lightly soldered at two or three points. The inside of the tube was then carefully blackened to prevent reflections.

*Photograph taken with a lens of 4in. focal length.*

*Photograph taken from same spot using same camera, but fitted with 9in. focal length lens.*

The length of the outer tube will depend upon the exact items used. It is possible to measure from the lens, not forgetting to include the camera itself. With the 18 cm. lens used, a distance of 18 cm. was required between film and lens. This was made up by 7.5 cm. in the camera, plus 1 cm. (approx.) for the screwed tube, plus 9.5 cm. for the outer tube. If the focal length is not known, hold the lens until a clear image appears on the screen, then cut the tube to a suitable length. Particular exactitude is not required, since adjustment can be made by the means described.

### Focusing Details

With reflex cameras and cameras with a rear-focusing screen of ground glass, the image will be seen just as it will appear on the film, and can be focused sharply by turning the outer tube of the assembly. The picture can then be taken.

With cameras not equipped with such means, a scale of distances can be marked off opposite the pin. Distances of 20ft., 30ft., 40ft., 50ft., 100ft., and "infinity" are suggested. Positions for the markings can be found by taking the film from the camera and substituting a piece of ground glass, fixed, undeveloped plate, or thin paper. The lens is then focused on various objects at suitable distances and settings marked. These can then be returned to, when photographing, the user judging the distance of the object photographed in the usual way. Again, complete accuracy is not required, though the object will be rendered more sharply on the negative when correctly in focus.

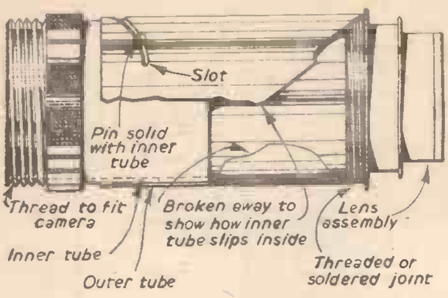



*Fig. 2.—Sectional view of extension tube showing construction.*

It should be noted that the focal length given for lenses is usually for objects at infinity (e.g.—far in the distance). To photograph near objects the lens will have to be moved away from the film. The camera should therefore be tried out of doors before the lens is finally fixed in the tube. If not, it may afterwards be found that the tube is too long to permit distant objects to be brought into focus.

Exposures will be just as for the short-focus lens originally used, that is, about 1/100th second at F8 during sunny, summer weather, increasing to 1/50th during weak sunshine, and 1/25th for bright, winter days, with an average 30 deg. Sch. speed film. With poorer light, longer exposures or larger apertures may be used, just as with the usual lens.

# GLASS-BORING TOOLS

## How to Make and Use Them

By W. T. CLAGUE

TO the uninitiated the drilling of glass seems to be regarded as a rather long and tedious operation, calling for the acquisition of expensive tools.

The following article describing the tools and method employed by the writer for many years may help to explode this fallacy, and enable the reader to successfully undertake any glass boring likely to be met with by the amateur mechanic. In the early days of wireless dozens of sets were made by the writer, using $\frac{1}{4}$in. plate glass for the panels instead of the usual drab looking black ebonite usually employed.

The glass was first ground on one side with flour emery powder and water. After drilling the necessary holes the panel was then stained on the ground side with spirit stain in various colours or left plain ground (frosted).

These panels presented a very attractive appearance, especially so when glass control knobs moulded from coloured glass were fitted to the various controls. The writer still has in his possession an old 12in. x 8in. x $\frac{1}{4}$in. panel with 20 holes—a relic of the days when most of the sets components were mounted directly on the back of the panel.

### Shaping the Drills

The drills here described were made from good quality silver steel, which may be obtained in all sizes from 1/32in. dia. Do not be tempted to use broken drill shanks or old files, as the quality of steel used by different makers varies so much that it is hardly worth the trouble of experimenting. Silver steel can be obtained from any tool dealers quite cheaply.

The small drill, Fig. 1, is made from $\frac{1}{8}$in. silver steel, and is used exclusively for centring the position of holes to be bored with the drilling tool. The cutting edge is forged to the same shape as a common drill, except that the angle of A is slightly more acute than drills intended for drilling metal.

The boring tool is forged from $\frac{1}{4}$in. steel to the shape shown in Figs. 2 and 3, which clearly show the form of the point of this tool. Fig. 3 shows the sides of the tool backed off to form a cutting edge the whole length of the edge C.

Do not attempt to forge the steel below a bright red heat, otherwise cracks may form, which will not show until they are hardened.

### Hardening

To harden, heat quickly to a bright red heat and plunge vertically into a strong solution of salt and water. They may now be ground to a keen edge, or if a grinder is not available, file to shape before hardening

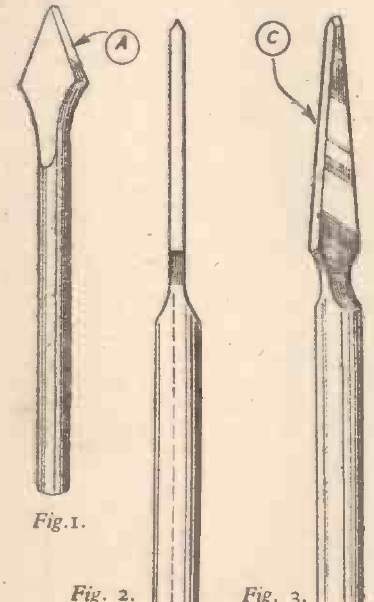



*Fig. 1.—A drill made from silver steel and used for centring the position of holes.*

*Figs. 2 and 3.—The boring tool which is forged from $\frac{1}{4}$in. steel. The whole length of C is a cutting edge.*

and finish afterwards with a small carborundum stone.

The drills thus hardened are now in a glass hard condition, and must not be used for drilling metal, owing to the fact that should the drill bind in the hole it would be almost certain to break, as the cutting edge is now very brittle. For small holes up to 3/16in. the form of drill shown in Fig. 1 may be used to completely drill holes directly.

For holes 3/16in. to $\frac{1}{2}$in., first use the small drill Fig. 1. Grip same securely in a hand drill, and centre the hole position with two or three slow turns of the hand drill, and then complete the hole with the boring tool, Fig. 3. When the point of the tool breaks through it acts as a reamer and will ream out the hole to the required size. When drilling, apply only sufficient pressure to keep the drill cutting, and turn slowly, about 60 turns per minute, lubricating frequently with a copious supply of a mixture of turpentine and camphor.

This lubricant is very important, as the camphor keeps the turpentine ice cold.

Do not continue drilling until the glass borings have absorbed the lubricant, and formed it into a paste, for at this stage the drill will have become sufficiently hot to have dulled the cutting edge; keep the drill flooded all the while drilling is proceeding.

Feed the drill, i.e. apply only sufficient pressure to keep the drill cutting; the right feed and speed will soon be acquired. With a little practice the right touch will enable one to drill right through from one side.

It will soon be found that $\frac{1}{4}$in. holes may be drilled through $\frac{1}{4}$ plate glass in a couple of minutes.

The tool shown in Fig. 3 may be used alone to drill and ream holes, but requires the hole position to be first located with the drill shown in Fig. 1.

It may be of passing interest to mention that one radio set built in the early 'twenties had a glass panel on which the square holes for the escutcheon plates were cut by drilling a series of outline holes; thirty 3/16in. holes were required for the two escutcheon plates. This panel was completed in just over two hours, with a total of 36 holes.

It must be stated, however, that very cheap and efficient glass drills—the "Glazemaster"—are available from John S. Perkins and Smith Ltd., Braunston, near Rugby, in various sizes.

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# Simple Dividing Attachment for a Lathe

## A Simple Method for Use on an Amateur's Lathe

By G. MURRAY

ACCURATE dividing in the lathe normally requires the use of attachments which in many cases are beyond the amateur's limited resources, particularly if the necessity for dividing only occurs occasionally. The simple device to be described here costs little to make, but enables a wide range of dividing work to be done with sufficient accuracy for most requirements. In addition to the usual jobs, such as setting out holes in flanges, etc., clock and instrument dials can easily be graduated. The writer has recently made a micrometer drum for the cross-slide of his own lathe, divided into 200 parts, so as to read thousandths of an inch on the diameter of the work.

The principle underlying the device consists in first marking the circumference of the chuck back-plate with a convenient number of accurately scribed divisions, and then registering these marks against a fixed "vernier" which is suitably graduated to give the required number of divisions on the work.

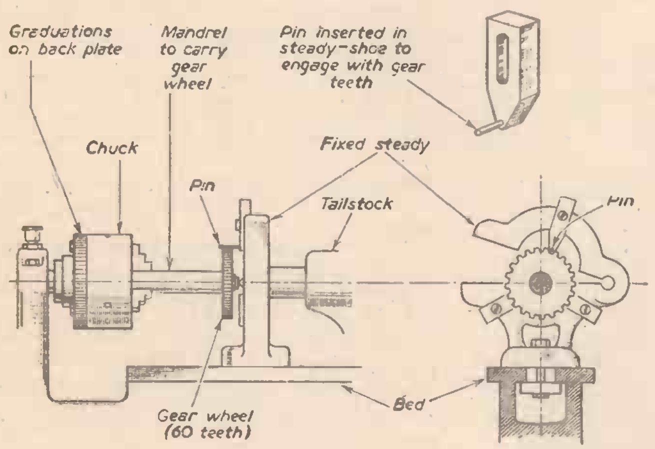



*Fig. 1.—Set-up for dividing the back-plate.*

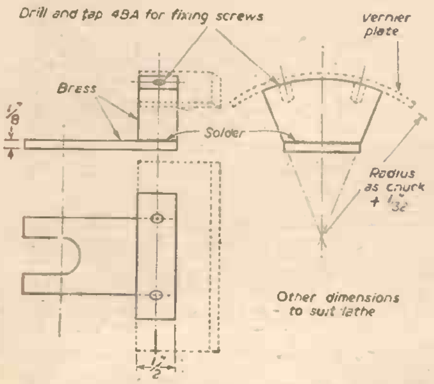



*Fig. 3.—Details of vernier support.*

### Marking the Back-plate

Fig. 1 shows a convenient method for marking the "master" graduations on the back-plate from a gear wheel, which may be one of the change-wheels of the lathe. The gear-wheel, which should of course be new and accurately cut, is mounted on an arbour and held in the chuck, supported by the tail-stock centre. The length of the arbour should be chosen so that the saddle (not shown in the diagram) can be placed to the left of the gear-wheel, allowing for about 1in. travel. To register the consecutive positions of rotation of the gear-wheel, a fixed steady is adapted as shown in Fig. 1. A projecting hardened steel pin is driven into a hole drilled in the top shoe of the steady, the diameter of the pin being such that it registers firmly between the gear teeth, without backlash. The top half of the steady, being hinged, can be lifted to enable the gear-wheel (and with it the chuck) to be rotated a tooth at a time. With the pin firmly registered in each tooth in turn, fine clear lines are scribed on the edge of the back-plate by means of a sharp scriber held in the tool-post. The graduations should be numbered, by engraving or etching, on the chuck in such a way that when it is rotated in the normal direction increasing numbers come against the register-point on the vernier. (See Fig. 2.)

The choice of the number of divisions is a matter of convenience, but 60 is a useful number, since it is divisible by 2, 3, 4 and 5 and a large variety of different numbers can be obtained directly. Other numbers of divisions are obtained by means of interchangeable verniers fixed to the headstock bearing as shown in Fig. 2. The method of attachment shown in Fig. 3 allows the vernier plates, which are, of course, curved to fit the support, to be changed easily.

### Verniers

Two types of verniers can be used, the first of which is the "true" vernier, an example of which is shown in Fig. 4. This works on the well-known principle used in vernier calipers, etc. In the example in Fig. 4 the object is to subdivide each interval on the main scale (on the chuck) into six parts. This is done by making six divisions on the vernier scale cover five divisions of the main scale, as shown. As the main scale is moved downwards 1/16th of a division at a time, coincidence between the graduations on the two scales occurs at consecutive numbers on the vernier. In general, if the number of sub-divisions required is N, then N divisions on the vernier should cover N-1 divisions on the main scale.

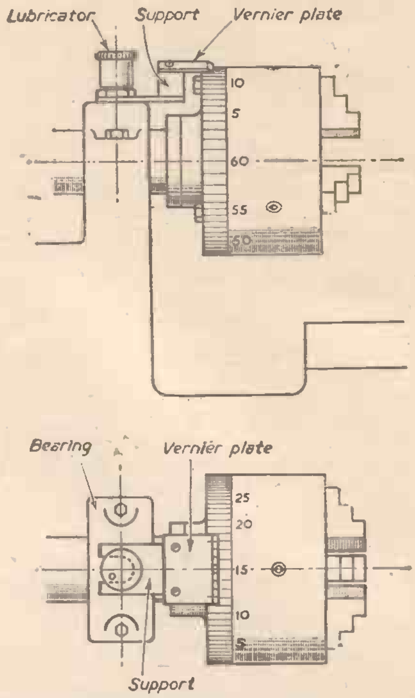



*Fig. 2.—Side elevation and plan of vernier arrangement.*

The second type of vernier, illustrated by an example in Fig. 5, operates on a different principle. As can be seen in the diagram, every six divisions of the main scale correspond to ten divisions of the vernier, to give 100 divisions on the work. To operate this type of vernier it is convenient to mark the positions of every sixth graduation of the main scale with chalk (marked X in the diagram). Each such chalk-mark is brought into coincidence with each of the graduations on the vernier in turn. The same principle can be used to obtain almost any required number of divisions in the work. To design verniers of this type, divide the required number of graduations on the work and the number of graduations on the chuck by their

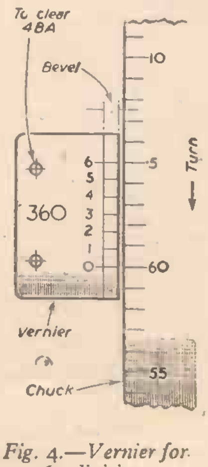



*Fig. 4.—Vernier for 360 divisions.*

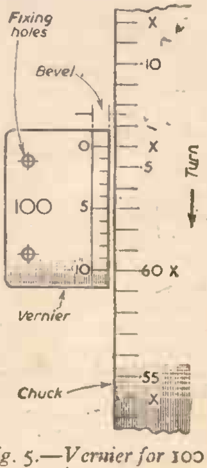



*Fig. 5.—Vernier for 100 divisions.*

greatest common factor. The quotients give the corresponding numbers of divisions on the vernier and main scale respectively. In the example:—

Required number = 100
Number on chuck = 60
H.C.F. = 20

so that

Number of divisions on vernier = 100/20 = 5
Number of divisions on chuck = 60/20 = 3

so that five divisions on the vernier should cover three divisions on the chuck (or 10 to 6, for convenience). Similarly:—

Required number = 64
Number on chuck = 60
H.C.F. = 4

Number of divisions on vernier = 64/4 = 16
Number of divisions on chuck = 60/4 = 15

In the graduations of verniers care must be taken to avoid errors due to parallax. The vernier should have a bevelled edge and be set to slide gently over the main scale. To mark a new vernier it is best to place a piece of clean white paper between the vernier and the chuck, and mark on this paper the positions of the extreme graduations of the vernier, lifted from the main scale. The paper can then be removed and subdivided as required, after which it is replaced and the marks transferred to the blank vernier plate. Vernier plates are easily made, and a very few different plates enable a large variety of divisions to be made. Thus, with 60 divisions on the chuck, and the two verniers shown in Figs. 4 and 5, the following numbers of divisions can be obtained: 2, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 25, 30, 36, 45, 50, 60, 90, 100, 180, 240 and 360.

### Method of Use

The work to be divided is held in the chuck, or in such a way as to rotate with the chuck, and the divisions are scribed by a suitable tool held in the tool-post. For cylindrical work the saddle is moved; for "face" work, such as clock and instrument dials, the cross-slide is moved, and for conical work the top-slide, set at the correct angle, is moved. Since the tool must be withdrawn every time a graduation is completed and returned for the next one, it is convenient to note the reading on the micrometer dials of the lathe so that the tool can be brought back to the same position, ensuring an even depth of lines.

When dividing work, the chuck should of course be rotated by hand, and to do this accurately it is convenient to put the lathe in low gear and pull round with the driving belt. This gives accurate control for registering on the vernier, and moreover reduces the liability for the chuck to turn accidentally while a mark is being scribed. If the scribing tool is set at exact centre height, as it should be, there is little tendency to accidental turning, but if the mandrel is very free, or if there is backlash, it may be advisable to arrange a clamp, or temporarily to tighten the headstock bearings.

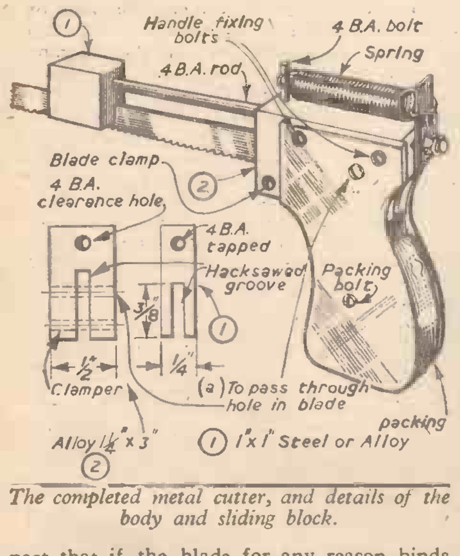
It is sometimes necessary or desirable to mark some of the graduations on the work with one vernier and the remainder with another, or it may be desired to interpolate between existing graduations. In such cases care is required to ensure correct registering, and this may involve turning the work slightly in the chuck. To avoid this it is helpful to provide means by which the vernier can be shifted circumferentially, for example by elongating the fixing holes in the vernier plate. More ambitious workers may care to provide slow-motion circumferential adjustment of the vernier plate, and if such motion is provided with a graduated dial, an almost infinite variety of dividing work is possible.

# Novel Sheet Metal Cutter

By W. E. CANNON

MANY amateur mechanics must, at some time or another, have come up against the problem of cutting a large irregular piece of sheet metal. The usual method is to manipulate a hacksaw so far as possible, and complete the work with a hacksaw blade clamped in a pad-saw type handle.

Users of this tool will have found in the past that if the blade for any reason binds upon the power stroke, it immediately snaps, and the replacements on a big job can be quite heavy.




*The completed metal cutter, and details of the body and sliding block.*

Having been annoyed by this trouble recently, I decided to try to modify the ordinary pad-saw, and evolved the tool described which, it will be found, completely eliminates any breakage of blades. I found that by giving support to the sides of the blade at the point where it is actually in contact with the material to be cut, it is impossible to snap the blade. The easiest way to give this support was a slotted block, spring loaded, to press against the sheet. The way this has been arranged is shown in the sketch.

### Constructional Details

The tool can be made from scrap alloy or steel. It is made in three main parts: (1) the sliding block, (2) the body and (3) the handle.

The body is drilled to take the guide rod from either end if no drill long enough is available. The slot for retaining the hacksaw blade is cut with a hacksaw. The handle is attached to the body by 4BA bolts passing through the body. These can be bolted or tapped.

The hole (a) through the body is to locate the blade in position. The tension spring is held at the front end of the body by a 4BA stud tapped in, and at the other end by a small plate attached to the rod between two nuts.

The sliding block, which is tapped to take the 4BA rod, must be an easy fit along the blade.

It will be found that as the handle is brought up to and away from the material being sawn the action of the spring will hold the block in position.

No rigid dimensions are given as these can be varied to suit the material available.

# A Powerful Electric Locomotive

*The most powerful electric locomotive yet built in Britain was recently completed at the Vulcan Foundry, Ltd., Newton-le-Willows, Lancashire. It is one of 60 locomotives, each of 3,600 h.p. and weighing 118 tons, ordered by Red Nacional de los Ferrocarriles (The Spanish National Railways) from the English Electric Company. They are being built jointly by the English Electric Company, Ltd., at Preston, and the Vulcan Foundry, Ltd., at Newton-le-Willows.*

# A Simple Telescope

## Constructional Details of an Easy-to-make and Efficient Instrument

By E. W. TWINING

*(Concluded from page 299, June issue.)*

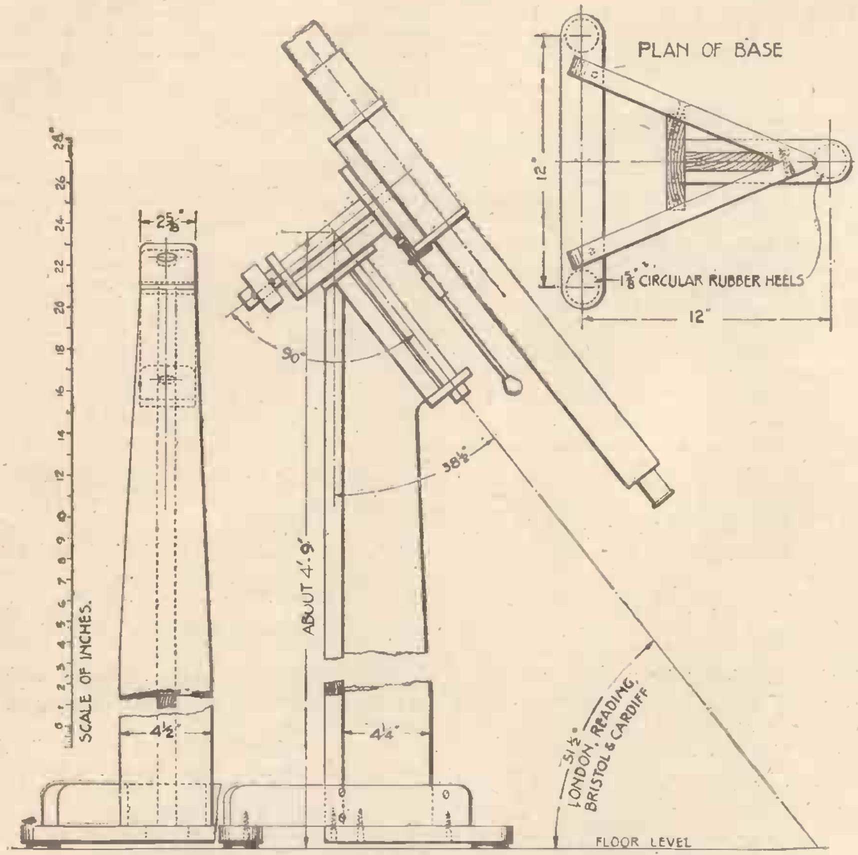



*Fig. 5.—A pedestal stand for use in a room.*

THE three-legged stand (Fig. 4) has one main leg permanently attached to the head; the other two legs are not pivoted to fold up to the main leg, but are made completely detachable by means of round-headed black iron bolts, fitted with butterfly nuts. The object of this is that once the correct lengths of these legs are determined, the stand will always, on level ground, be so adjusted that the polar axis angle will automatically be correct. There is only a remote chance of its doing this if the legs are freely pivoted. Such a stand as this is obviously for use in a garden or at any rate out in the open air.

### Pedestal Stand

Fig. 5 shows a stand which can be used either out of doors or close to an open window in a room. This is also of ⅞in. floor boards. The three points of support are provided by ordinary round rubber shoe heels, the use of which will guard against accidental slipping of the stand on a polished floor. This pedestal makes a very neat arrangement, but owing to the necessity to use it close up to a window the spread of the feet is unavoidably small and it would be advisable, in order to render it more stable, to have three fairly heavy weights to place on the feet, after the polar axis has been correctly set to point to the true pole.

To those would-be astronomers who live in flats or have no out-of-door means of setting up a telescope, such a pedestal mounting seems to be the only solution if equatorial motion is to be used. The chief difficulties lie in getting close enough to the window and the bugbear of having to align the polar axis every time the instrument is used. In the latter case, of course, the floor could be marked; such marking being little bits of wood tacked down to form positioning stops for the feet.

### Window-sill Stand

For use in a flat a much better arrangement will be that illustrated in Fig. 6, where a comparatively short stand is made to hook on to a window-sill. One great advantage of this is the large amount of projection of the telescope into the open air and the consequent wide angle of sweep of the heavens available. Another is that by having a turntable for movement in azimuth; the stand can be moved from the front of the house to the side—if there is a side window—or to the back; since all the sills in the house will be alike, the base will fit in any window.

With this stand, the vertical angle of the polar axis will be that of the latitude of the place, as before mentioned, but the horizontal angle with each window will depend upon the orientation of the house. Suppose for a moment that the front of the house faces south, then the window-sill shown in Fig. 6 will be a front window with a southern

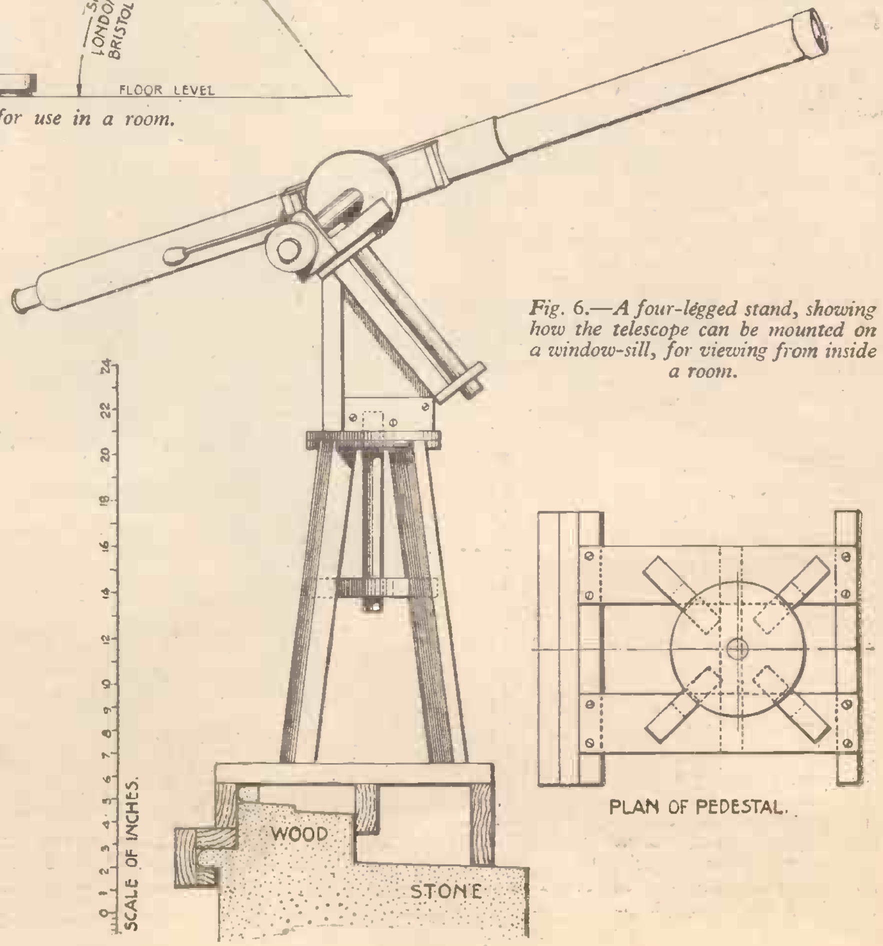



*Fig. 6.—A four-legged stand, showing how the telescope can be mounted on a window-sill, for viewing from inside a room.*

PLAN OF PEDESTAL.

aspect, and the polar axis will be pointing back into the room. If now the stand is taken to the back of the house the base of the stand will be turned the opposite way around in resting upon the sill of a back window and the azimuth turntable must be revolved through 180 deg. so that the polar axis shall still point to the north. Similarly, if there is a side window facing either west or east the top will be rotated 90 deg. in one or other direction, whichever will point the axis northwards.

### Setting Polar Axis in Azimuth

Whatever the direction is in which your dwelling faces it is useless to set the polar axis by means of a compass unless in so doing you make allowance for the magnetic deviation from the true pole. The best way will be, having made the complete stand to fit on and be detachable from your window-sills, to place the stand on the sill of a window from which the pole star (Polaris) can be seen, that is to say, towards the north; take out the polar axis and look up through the two apertures of the bearings, placing your eye at least 6in. below the lower bearing. Adjust the turntable until the pole star appears in the aperture of the upper bearing, a very little to the opposite side of the centre and farthest away from the big star group known as *The Plough*. In other words, the true pole is a point $1\frac{1}{2}$ deg. from Polaris in a direction towards the head of *The Plough*. Get the true polar point in the centre of the circular bearing, and, for the purposes of the present telescope, the setting will be sufficiently accurate.

Now, without moving the turntable, draw a strong indian ink vertical line right across the edges of both the discs of the turntable in any convenient position. The line will always give the setting in azimuth on that side of the house. Before drawing these lines the turntable should be given two coats of flat, white paint.

For the opposite side of the building bisect the circumference of the upper disc and draw another line on this disc only, 180 deg. on each side of, and exactly opposite to, the first line. If there is a window at the side of the house which will be used for observation, bisect again and draw another line on the upper disc at 90 deg. from the other two.

Bear in mind that there is to be one line only on the lower, fixed disc, and that this is to be used as a pointer for all the marks on the upper rotary disc. By this means it will be possible to take the telescope to the window of any room and, by setting the appropriate mark on the movable turntable to align with the fixed mark, to ensure that the polar axis will be pointing to the pole and be parallel with the axis of the earth. It is assumed, of course, that the walls of the building, front and back, are parallel and the side at right angles to the others.

The sill shown in section in Fig. 6 is that of all the windows of the house which I occupy; these have ordinary sliding sashes. This is the usual form of sill, but should the reader find that his are different he must modify the base of the stand accordingly. If there is no deeply projecting bead immediately above the plaster and wallpaper on the inside of the room for the stand to hook on to, a strip of wood should be screwed to the sill to serve the same purpose, for the hook is very necessary in order to guard against accidental pushing of the telescope and its stand outwards.

### Finishing

The whole telescope and its stand should first be coated with a flat paint, and the reader can adopt any colours he fancies, but the telescope barrel should be a very pale grey, a cream or a broken white; indeed, I think that pale colours are advisable everywhere so as to render the instrument visible in semi-darkness. Finally, a coat of enamel paint would be advantageous.

Should the telescope constructor possess, or feel inclined to purchase, an achromatic object glass instead of a simple lens, he can still follow all the structural details which I have here given, using either cardboard tube, brass tube, or a square section wooden-box barrel similar in design to that shown in blue prints which are obtainable from the office of PRACTICAL MECHANICS.

The equatorial head and the stands shown in Figs. 4, 5 and 6 are quite suitable for instruments up to 3in. aperture. For achromatics smaller than this the telescope itself will have to be shorter, for a 3in. has a focus no longer than 40in., whilst a $2\frac{1}{4}$in. O.G. would require a tube of no more than 30in. in length.

With achromatic O.G.s eyepieces of very much shorter equivalent focii than the 1in. I have recommended can be used.

# A Handy Depth Gauge

THE accompanying illustrations give constructional details of a handy depth gauge I have made, using an ordinary 6in. steel rule, the hole in which forms a location point. It will be seen from the drawings, which are self-explanatory, that the stock, Fig. 2, is fashioned from a piece of mild steel, the vertical slot being finished to hold the end of the rule firmly, and without side-play.

One end of the scriber rod is sawn down and splayed out to form a pointer, as indicated in Fig. 3, which also gives dimensions for the clamp bolt and knurled nut. The completed gauge is shown in Fig. 1, which indicates how the lower end of the scriber rod is filed flush with the lower surface of the stock after the pointer is set at zero. It will also be noticed, by reference to Fig. 1, that the graduated side of the rule faces inwards so that the scriber point is in close contact with the various markings when it is moved up and down.
—W. A. SPALDING.

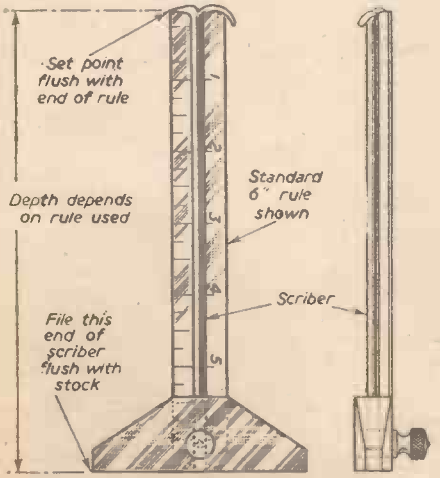



*Fig. 1.—Front and side view of the completed depth gauge.*

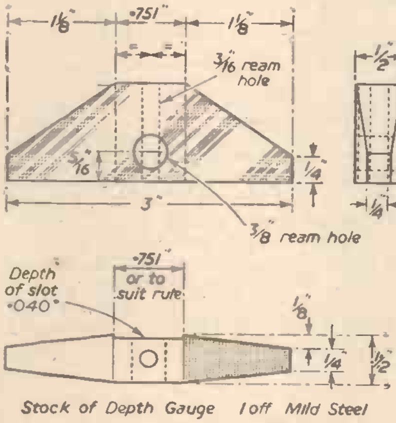



*Fig. 2.—Details of the stock.*

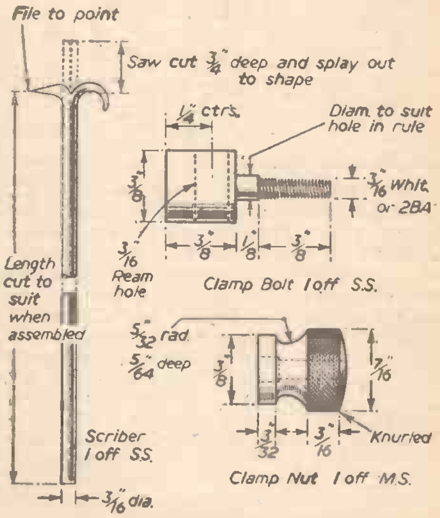



*Fig. 3.—The scriber arm, clamping bolt and nut.*

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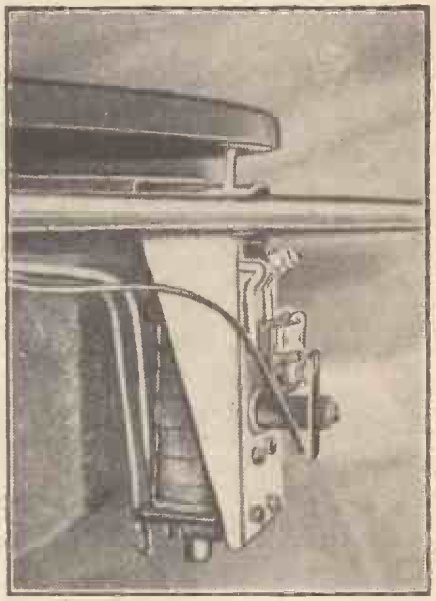
# A "Stop-start" Gramophone Switch

## Constructional Details of an Efficient Electrically-operated Device

By G. M. MARSTON

SOME months ago the writer wished to fit his home-made tablegram with an automatic switch. It was desired to make the mechanism very light in action, impose no load on the P.U. arm during playing time, have a powerful braking and power switching action, and most important to require only the use of hand tools. The only tool bought was a 6BA tap and holder. All holes shown tapped may be modified to take nuts and bolts if desired. The above characteristics were obtained by using the P.U. arm to operate a "micro-switch," which in turn operated a high resistance solenoid, this latter providing the power for the brake and the motor switch. The solenoid draws its power from either the receiver H.T. or in the case of a record player from the mains, via a rectifier.



*The solenoid assembly in position beneath the motor board.*

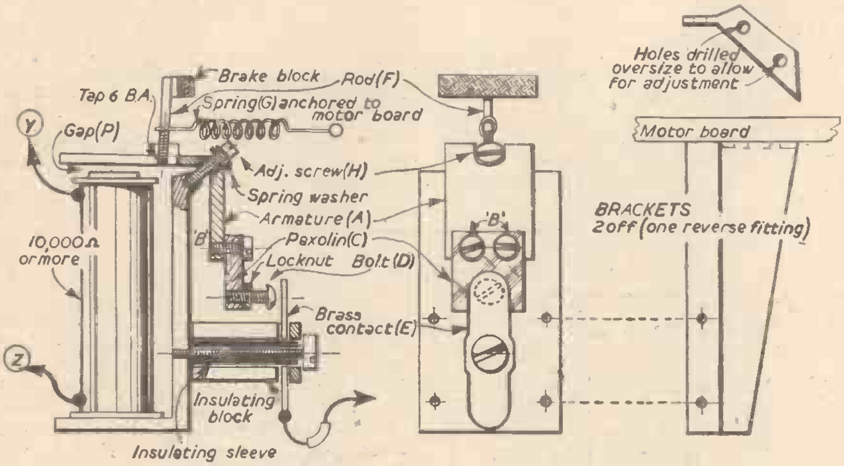



*Fig. 1.—Details of solenoid assembly and bracket.*

### Solenoid Assembly

This was obtained from an ex-W.D. chassis, but similar ones can be bought for about 2s. The requirements are a resistance of over 10,000 ohms and a light switch contact. Some solenoids have a pair of heavy contacts, if so these should be arranged to make when the solenoid is "on," if they do not already. If heavy contacts are not available, strip off all contacts and insulating blocks, retaining these. The armature "A" (Fig. 1) is drilled and tapped at "B" to take a piece of Paxolin "C," and this latter is tapped to take a 6BA bolt and locknut "D," this being one power contact. The other contact is a strip of brass "E" drilled to correspond with the original holes in the solenoid body, and fixed in position with the original bolts and insulating tubes and blocks.

The armature head is now tapped 6BA, and in this is fixed a short length of screwed rod "F," an old spacing bar from a condenser being ideal; the length can be found by trial and error to suit individual needs. To the top of this is soldered a strip of brass, to which the brake shoe of leather is fixed with Bostick. This will stop a heavy turntable in a half revolution, but felt may be used if a more gentle retarding action is required. A slot is cut in the motor board to take the rod, and the solenoid assembly is fixed to the motor board by two brackets, as shown in Fig. 1, but the constructor may vary these to suit himself. The adjusting screw "H" is tightened until the armature is just free but has no side-play, and a spring "G" is fixed to maintain the armature in the "off" position, the tension of the spring being adjusted by experiment.

### Micro-switch Assembly

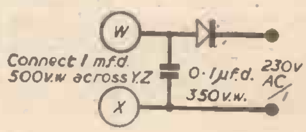
This is operated by a piece of 6BA rod "J" fixed to the P.U. arm about 1in. from the P.U. pivot centre. A U-shaped piece of brass rod "K" is soldered to the bent sheet brass arm "L" and this latter is drilled to pivot at the angle of the "L" (see detail in Fig. 2). The other end is drilled and tapped 6BA to take a strip of Paxolin "M" the other end of which is drilled and tapped to take one of the light contacts "N," taken from the solenoid, this contact having a solder tag. The contact head bears on a 3/16 Paxolin strip, the contact being made by taking a brass bolt, drilling through the Paxolin at shank size, and 1/16 deep at head size. The bolt is fixed in position, together with a solder tag, and then filed to the level of the Paxolin, the finished surface being smoothed with a piece of fine emery paper. The whole is now fixed to the motor board so that the bolt-head contact comes under the arc of the spring contact.

### Adjustment and Operation

First adjust contact "D" so that when the solenoid is energised the power contacts make with the gap "P" as small as possible. Now fix the assembly to the motor board and adjust by moving the whole so that when the solenoid is "on" the brake is just clear of the turntable. This ensures that the gap is not too large, as otherwise the magnetic flux is weakened.

Bend the "U" piece so that when the P.U. arm is moved an inch or so away from its rest the contact "N" makes, energising the solenoid, thus switching on the motor, and removing the brake from the turntable. Now from your records choose the one with the run-off groove farthest from the centre. Bend the other "U" arm so that when the needle reaches the innermost part of the run-off groove the contact "N" breaks, and the

*Fig. 3.—Circuit diagram showing addition of rectifier for A.C. operation.*



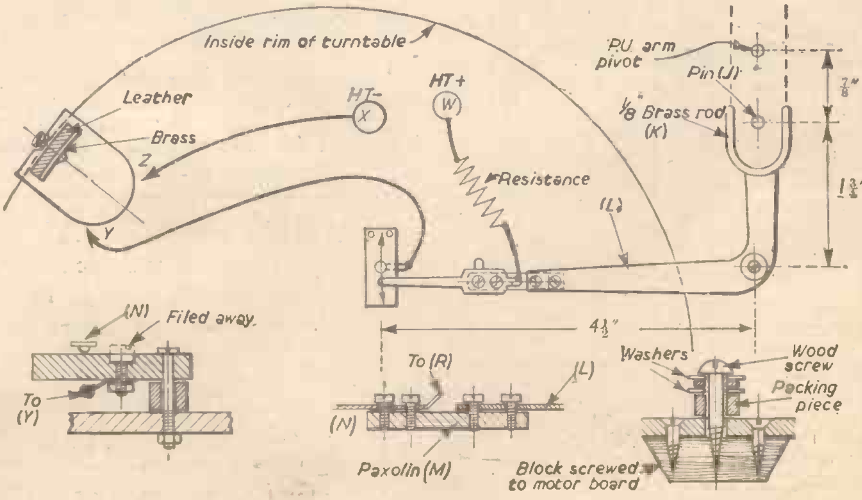




*Fig. 2.—General layout and details of switch assembly and main pivot.*

motor stops. The mechanism will now operate on all the rest of your records.

The resistance in series with the solenoid may be adjusted to the highest value consistent with positive action of the relay.

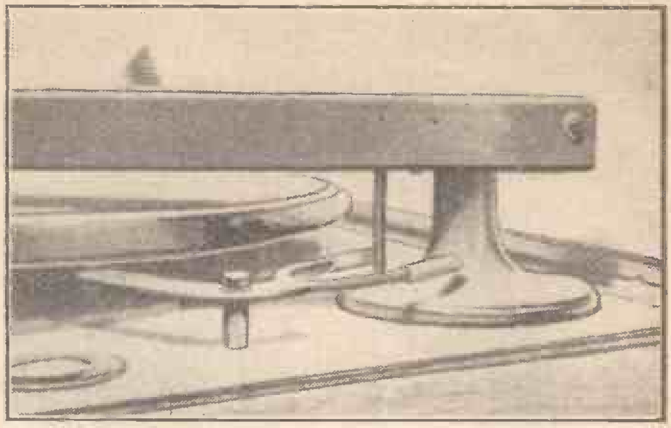
**Further Notes**

If the device is to be used with a record player the solenoid is fed from the mains via a rectifier, and a 1 mfd condenser wired across the relay coil, as in Fig. 3.

Should space underneath be limited, the rod "F" may be bent through 90 degrees, and the solenoid mounted horizontally.

If there is space under the motor board the P.U. rod "J" may be taken through a curved slot in the motor board, and the "micro-switch" mechanism mounted underneath, and in this case the arm "L" may be straight.

By turning the solenoid through 180 degrees the brake may be made to operate on the outside of the turntable.



*View showing how the operating rod on the pick-up engages with the arms of the micro-switch arm.*

# Catacast Casting Resin

## An Easily-worked Medium for Casting Small Objects

CATACAST is an ideal material for making large or small objects of intricate design by a simple casting technique. The resultant product is very attractive in substance, is firm and solid and can be machined and polished without difficulty. It is indispensable for the hobbyist and the practical engineer in the manufacture of articles of utility and pleasing appearance.

Catacast phenol-formaldehyde casting resins are obtainable in a range of colours and effects suitable for the production of castings for a variety of purposes. Each type of casting resin is supplied with an acid accelerator which is added to the resin immediately before use. The accelerator is packed separately in a glass bottle and, provided that it is kept stoppered, will last indefinitely. The resins progressively thicken on storage and should be used within three months of the date of manufacture as indicated on the container. The containers should be stored in a cool place and kept tightly closed.

**Mixing Catacast**

The required quantity of Catacast resin syrup should be weighed into a suitable vessel (preferably of stainless steel, glass, rubber, waxed paper, tinplate, unchipped enamelled iron or glazed earthenware). The accelerator is then added carefully by weighing in the proportion stated, and the two constituents are thoroughly mixed. For small quantities, a laboratory balance with gramme weights will be found useful, but is by no means essential. On addition of the accelerator, the colour of the resin often changes, but any streakiness disappears when the liquids are well mixed. During mixing some air is unavoidably introduced into the resin, not all of which will escape before the resin sets, resulting in tiny air bubbles in the finished casting. Where, however, the presence of trapped air is likely to be a major disadvantage, the mixing may be performed under vacuum, or alternatively the mix can be de-aerated by subjecting it to vacuum before or after casting. In the latter case it should be borne in mind that frothing will occur as the air bubbles expand under reduced pressure, and provision should be made in these instances against overflow by allowing additional head space in the mould. A vacuum extraction rate of up to 100 cubic feet per minute may be employed, depending on the amount of resin dealt with at one time.

**Moulding Material**

The moulds can be made from any material that is sufficiently strong to withstand the weight of resin which has a specific gravity of 1.3, i.e., equivalent to about 20 cubic inches to the pound. Such materials as wood, metal, plaster, Cataform or many plastics or any of the proprietary flexible Vinyl moulding compounds can be used with good results. In designing the mould, the pouring aperture should be as wide as possible. It is a golden rule that the better the surface of the mould, the better will be the surface finish of the casting, and it is equally true that imperfections in the surfaces of the mould will be faithfully reproduced. In the case of Vinyl moulds it has been found best to pour the hot moulding compound over highly finished metal master patterns.

Protection against chemical attack and adhesion of the casting to the mould may be effected with a special parting lacquer 830P thinned to the correct consistency with thinners 832P. Vinyl compounds require no such lacquer. Moulds in every case must be thoroughly dry and clean; any unwanted liquid resin can be readily removed with industrial methylated spirits.

**Curing Catacast**

Castings may be cured at room temperature or more rapidly at higher temperatures, e.g., by the application of heat in a well-ventilated electric oven. Because of the presence of moisture in the products of combustion, gas ovens are not considered so suitable. Temperatures up to 80 deg. C. (176 deg. F.) may be used and the curing time will vary between 12-36 hours at room temperature down to 15-20 minutes at 80 deg. C. The curing time depends very much on the size of the casting and on the type of accelerator employed. Large castings, or castings of very variable section, should be cured at lower temperatures (approximately 40 deg.-60 deg. C.; 105 deg.-140 deg. F.).

**Fabricating**

Fully-cured castings may be cut, sawn, ground, sanded, drilled, turned, tapped or machined in the same way as other plastic materials, but care should be taken to avoid local overheating which may tend to crack the casting. The material will not soften on heating, but castings should not be used at high working temperatures. Components made of Catacast are conveniently cemented by using accredited Catacast resin in the liquid or pre-cured state as an adhesive. Special cements for cementing Catacast to almost all other materials are available on application to Catalin Ltd., Waltham Abbey, Essex. Metal or other inserts should not be cast *in situ* but these can easily be cemented as a separate operation in the fully-cured casting.


*"At last, the fool-proof alarm. It ticks so loudly you never get to sleep."*

*Fig. 1.—The model of the Longstone Lighthouse with its designer.*

# A Working Mo

## Constructional Details of an Unusual Typ

THE outstanding features of this model are of three quite different kinds: a device for producing frictionless moving electrical contacts, a reflector for projecting a powerful parallel beam of light and a method of bending glass for the construction of a leaded-up lantern. The illustration and description of these three things is the main object of this article and though no one is likely to make a similar model to the one for which the devices were designed, it is quite possible to apply one or more of the schemes to some other totally different purpose.

The model referred to is shown, with its designer—the present writer—standing beside it, in Fig. 1. Its diameter at the base is 3ft. 2in., its height from the base to the weathervane, 11ft., and the scale, approximately, 2in. to 1ft. It is a replica of the famous Longstone Lighthouse, off the coast of Northumberland, and illustrated in Fig. 2. This was the home of the heroine, Grace Darling, and it was from the rock on which the lighthouse stands that, with her father, she rowed away and saved the lives of a shipwrecked crew.

The model was made for a beautiful and extensive pleasure park near Leeds, in Yorkshire, where there was a very large lake, with a 20in. gauge railway around it, and in its centre a small rocky island. It was on this island that the lighthouse was erected, current for the light and the motor driving the revolving lamp being supplied through an underwater lead-covered cable from the general service on the mainland. I am told that the place is no longer a pleasure park, and what has become of the lighthouse I do not know.

### Flashing Light

The periodicity of the prototype light on the Longstone Rock is one white flash at one-minute intervals and this was reproduced exactly in the model, a matter which was quite easy to arrange. Fig. 3 is a general arrangement drawing of the lamp, the parabolic reflector and the electrical gear. In this drawing A is a horizontal bulkhead forming the base of the lantern and carrying a self-aligning ball bearing. B is a bulkhead, much lower down, on which the motor and its gearbox are mounted, GBS being the gear box shaft. The bevel gear shown has a ratio of 2 to 1, so that GBS makes one revolution per half-minute and the larger wheel the required one revolution per minute. This wheel has a boss which is shouldered to take a taper roller bearing which is of both radial and thrust nature, and therefore carries the weight of the long tubular shaft, having the lamp and mirror at the top. Through the shaft the heavy rubber-covered flex leads to the lampholder, as shown.

At the bottom of the shaft the leads are taken out on opposite sides, through two holes in the tube and are soldered to plates having pins, P1 and P2, projecting downwards. The bottom of the tube is closed by a plug and over the outside is a flanged collar T. Both plug and collar are machined from "Tufnol." Of the two pins referred to, one, marked P2, is on the centre-line of rotation of the shaft and projects into a brass cup filled with mercury and the other, P1, which describes a circle of $1\frac{1}{2}$in. dia., dips into mercury M. in an annular trough of brass. Both cup and trough are bolted and screwed to shelf C, which is supported below B. The main current-supply leads are taken to the extension pins from cup and trough, below C, where they are clamped up by nuts.

By the use of ball and roller bearings and of mercury contacts instead of rubbing commutator rings and brushes, both friction and wear were practically non-existent and the lighthouse worked for months without attention. The lamp fitted was 100-watt type with "pearl" glass. This pearl surface gave a far more uniform beam than a clear glass bulb because, with the latter, the filament could not be focused by all portions of the parabolic reflector.

### Lantern

This is made up of diamond panes of glass, or "quarries" as they are technically known. Both in the full size lighthouse and in the model the vertical dimensions of two quarries only make up the height of the lantern. In the model this height is 17in., measured over the framing, with a diameter outside of 20in. or $19\frac{5}{8}$in. on the centre line of the glass.

The lantern is, of course, a cylinder and it follows from this that curved glass must be employed for the quarries. Now to obtain already curved glass bent to exactly the required curvature is difficult; it would almost certainly have to be specially made and, having obtained just what is wanted, it would be still more difficult to cut it up into quarries. It follows as a natural sequence of thought that for this lantern I should use ordinary flat, heavy sheet glass, 32oz. was just right, cut the quarries and half quarries and bend them myself in a kiln. For the complete lantern there were required: 36 whole quarries (three rows of 12) and 24 half quarries (two rows of 12), and these I decided to assemble by leading up in much the same way as a leaded light or a stained glass window is done, except for the fact that the job could not be done flat on the bench. I intended to use the heaviest $\frac{3}{8}$in. lead, which

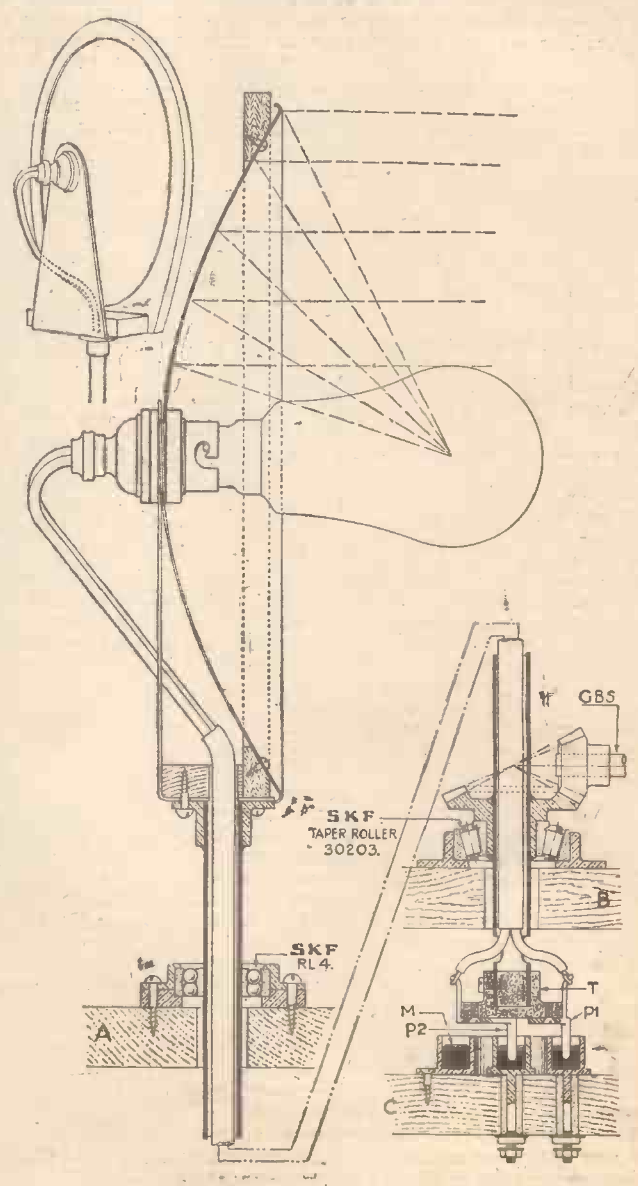



*Fig. 3.—The revolving light and details of the electrical mechanism.*

# odel Lighthouse

of Model

By "ENGINEER"

is milled so the inside diameter of the lantern became $19\frac{1}{4}$in. (20in.—($\frac{3}{8}$in. + $\frac{3}{8}$in.)). Fig. 4 shows a sectional plan and a portion of the leaded work in elevation.

For leading up I had a wooden drum made, $19\frac{1}{4}$in. dia. and 22in. high, of $\frac{7}{8}$in. battens, close fitted, on end cheeks and with a stout wooden rod through the centre for supporting on trestles.

### Bending the Quarries

Then I cut all the glasses and prepared the kiln trays for the bending. A glass-painter's kiln is provided with shallow iron trays filled with dry, loose plaster on which the glass to be fired is laid, and my kiln, to which there are six trays, was illustrated in PRACTICAL MECHANICS for June, 1949. Normally the surface of the plaster is soft and presents a flat surface, but for bending the quarries this had to be altered. The plaster was arranged in ridges across the trays and these ridges were pressed down hard and rendered smooth and true with a piece of polished steel plate, carefully bent to the correct camber.

On the top of each ridge the quarries were placed, as shown in Fig. 5, and each tray was then carefully lifted and passed into the warming-up chamber of the kiln. After about ten minutes of this pre-heating the first tray was withdrawn and slid into the firing chamber and the glass carefully watched through the spyhole. As the glass used had a fairly low melting point, about ten minutes in the firebox was sufficient to render it soft enough to sink by its own weight on either side to the camber of the plaster. When all the glasses on the tray had gone completely down the tray was transferred to the annealing chamber and the next tray dealt with. When all the trays were in the annealing compartment, they were left for about eight hours to cool off. With my six trays about four firings were required to bend all the quarries and half quarries.

Fig. 2.—The Longstone Lighthouse.

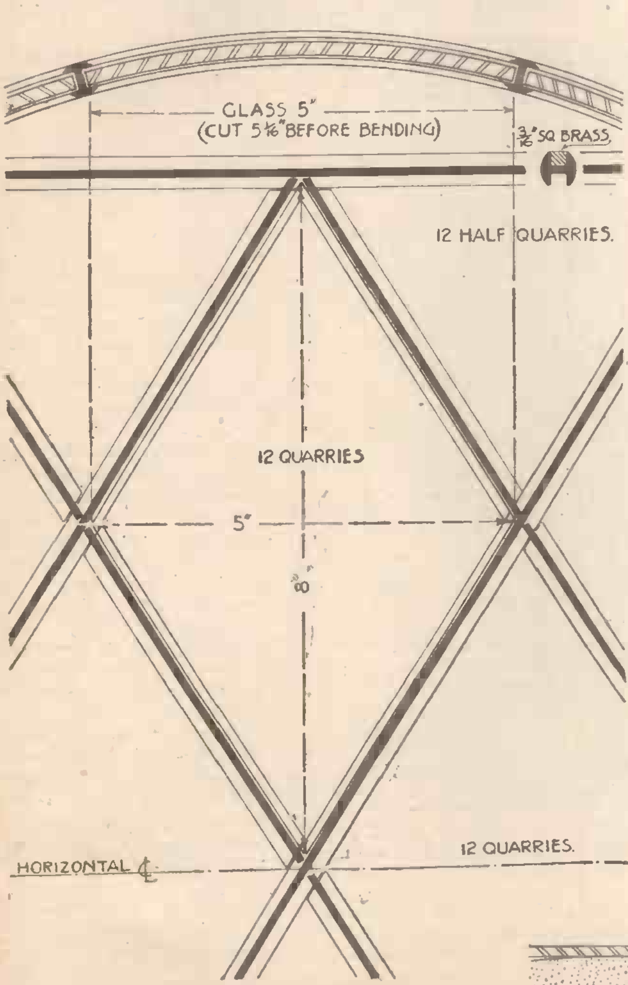



*Fig. 4.—Details of the lantern.*

### Leading Up

This was done in the ordinary way, using glaziers' nails knocked into the drum, but the top and bottom circumferential leads were put around the drum first and soldered up. Soldering of the leads had to be done as the work proceeded and, notwithstanding this, three cords had to be used around the work in order to support it as the drum was revolved; this up to the insertion of the last of the glasses and leads and the last of the soldered joints were made. Finally, rings of 3/16in. square brass rod, shown in Fig. 4, with scarfed and silver soldered joints, were inserted in the top and bottom leads to stiffen them.

### Parabolic Reflectors

It is possible by the use of a kiln to bend glass of other shapes than quarries and to other than simple curvatures. For instance, it is possible to produce circular parabolic reflectors of glass by first setting out the parabola on the drawing board, making a template of the cross section and, by means of this template, turning a concaved disc of close-grained hardwood, with a polished surface, for use as a tool in forming the convexed surface of the plaster in the kiln tray. The plaster *must* be convexed, not concaved, for if the wooden tool were convexed and produced a concaved plaster mould, air would be trapped under the glass when it is laid down and this air, on expansion by heat, would blow the softened glass to all sorts of unwanted shapes.

### Silvering the Glass Disc

Such a parabolic glass disc can be silvered on the outer, or convexed side, by the silver nitrate process, as used in silvering the mirrors of reflecting telescopes. The glass itself will provide the brilliancy to the silvered surface, as it does in an ordinary looking glass and the outside of the silver can be given several coats of white and red-lead paint to protect it. The reflector in the lighthouse was spun in thin copper and silvered on the inside, but such a parabolic glass reflector as I have described can be made suitable for small searchlights, theatrical stage spotlights and other purposes.

### A Helping Hand

If the would-be glass bender has no kiln of his own I suggest that he takes his glass or glasses and the plaster-moulding tool to a stained glass firm and persuades the kilnman to allow him to do the job there.

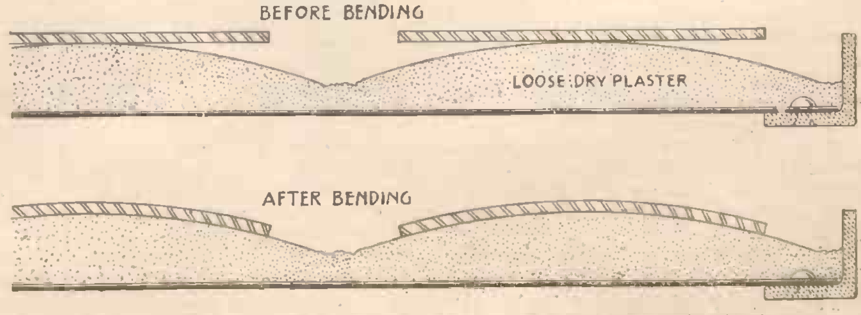



*Fig. 5.—The arrangement of the glasses on the kiln tray for bending.*

# Atomic-powered Warships

## How the Atomic-driven Submarine Will Work and Why We Shall Not Have Atomic-powered Motor-cars

By Professor A. M. LOW

THE United States Navy is building an atomic-powered submarine which is believed to be near completion and, according to Rear-Admiral Wallin, work may soon start on an atomic-powered aircraft carrier. It has been officially announced that contracts have been placed for the construction of an atomic-powered aeroplane.

Does this mean, in spite of pessimistic forecasts about the time it would take to "harness" the atom, as distinct from using nuclear fission as an explosive, that the age of atomic power is just round the corner? The answer to that must be qualified, but the successful construction of underwater, surface and air craft powered by atomic "fuel" would represent a tremendous advance.

### General Design

The technical details of the atomic submarine will be carefully guarded secrets, but there is no secret about the probable general design. The engine will consist of an atomic pile, probably using a fuel containing a considerable proportion of U 235 in some form. The activity will be carefully controlled and the heat generated carried off by a liquid. A liquid metal might be most efficient. This metal will be used to generate steam which will drive a turbine and then, through reduction gears, the propellers of the submarine.

The principle is fairly simple, the execution must be difficult, although a submarine offers special advantages. The pile and any stored fuel must be "screened" from the rest of the ship with great care so as to prevent harmful radiations escaping. In the case of a submarine great strength would be required to ensure that the pile was not destroyed by the vibrations of depth charges dropped near.

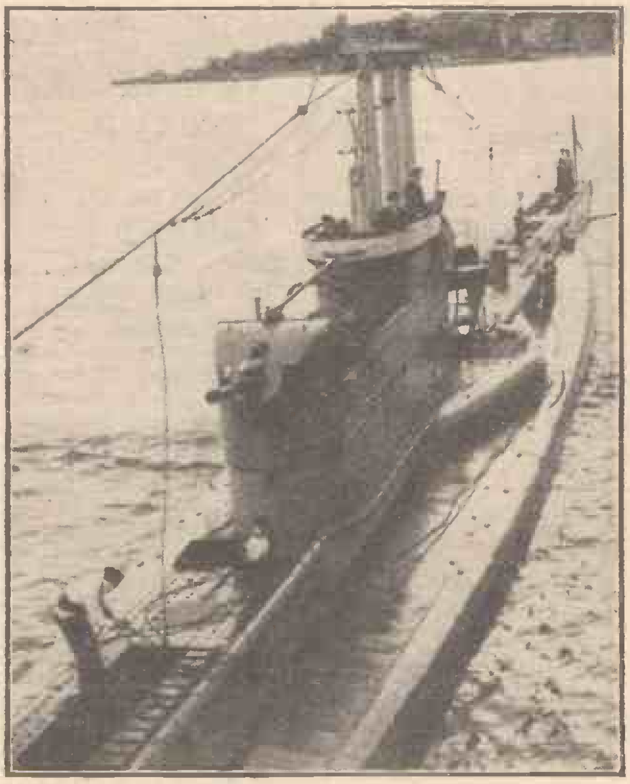
The advantages are also enormous and explain why the United States has been prepared to spend many millions on an atomic submarine. In spite of the heavy screening of the pile, there might well be a reduction in weight because there would be no need to store fuel. There would certainly be a great saving of space, always important in a submarine. There would be a reduction in noise and vibration, and the submarine would be able to stay submerged for very long periods without using a "Schnorkel." Oxygen would be provided and carbon monoxide absorbed. The range of the submarine would be limited virtually only by the need to replenish it with oxygen, absorbent, food and torpedoes, although the additional space would enable larger supplies to be carried. The atomic submarine, in fact, would be such a powerful weapon that some experts have suggested a small fleet of them would make all other vessels obsolete.

The construction of an atomic engine for an aeroplane would represent further difficulties because of the question of weight, but if the cost is no object the problem can probably be overcome. An atomic-powered aeroplane will have no need to re-fuel for days on end and possess a virtually unlimited range.

### Not Economical

The question of economy hardly enters into military matters. It will be surprising if the atomic submarine is "economical" in the ordinary sense, although it may be fairly efficient from the engineering aspect of making good overall use of the energy available. It is expected to have an underwater speed of nearly 25 knots.

When what is learned in the construction of these atomic "engines" for special purposes comes to be applied to merchant vessels, economy will be important. There is little advantage in constructing a liner that can run for years on a "handful" of fuel if the fuel and engine cost far more than the present orthodox methods. On the drawing-board it is possible to construct an Atlantic liner that will cruise at 30 knots for six months on a very low weight of U 235. The cost of the fuel at present is such that it might not be economical, but we can expect this cost to fall. Admiral Wallin has suggested that atomic engines for merchant vessels will be economical within 15 years, but this appears to be a somewhat optimistic view.



*The ordinary submarine has a limited range dependent on the amount of fuel it can carry, but the atomic-powered submarine would have a much greater range.*

The advantage they will enjoy is freedom from dirt—no funnels of any kind will be required—and greater space for cargo or passengers, the whole of the considerable space now used for fuel being saved. The Atlantic liner of the future may be wholly enclosed, the superstructure being of transparent plastics under which passengers will enjoy ideal conditions.

### Atomic Cars

When we come to consider the application of atomic energy to driving land transport, a further difficulty arises. There is always the risk of accident. The smashing of an atomic-driven car or even locomotive would mean that highly-radio active and dangerous material might be scattered. The danger would be such that, technique difficulties apart, the direct application of atomic energy to driving cars seems at present out of the question.

These technical difficulties are in themselves not inconsiderable for the "engine" for land vehicles has to be reasonably small. A small atomic pile could be constructed, but the fuel would be enormously expensive and the prospect that it would last a lifetime at no further specific cost would probably not weigh so much with the ordinary motorist as the great initial outlay. Then there is the question of screening the driver and passers-by from harmful radiation. The neutron absorbing materials we know are very heavy. It is possible to think of engines encased in two- or three-feet thick concrete in ships, but not in road vehicles. A more practical hope is that some method of storing electricity in "quantity," or inductive transmission, may be discovered. This would be more satisfactory than a return to steam when the problems of condensation have to be solved in a small space.

### Radio-active Waste Disposal

One great trouble that overshadows the development of all methods of harnessing atomic energy is disposal of the "waste." In the past we have disposed of waste quite recklessly, pouring smoke into the air and all sorts of chemicals into the rivers and sea so that the water is polluted. Radio-active wastes, however, are far more dangerous. It has been estimated that doubling the amount of radio-activity in the air would make it poisonous to man—and even present developments produce almost enough waste for that. The waste products are, of course, most carefully guarded and prevented from doing harm, but we cannot overlook the possibility of accident, especially when the amount of waste is greatly increased.

### Rocket Satellite

A suggested solution is putting the waste into a rocket and then firing it into space with an "escape" velocity. The rocket would become a satellite of the world, going round it like the moon, at a distance at which any radiations would be harmless, although no doubt people would blame any bad weather on the "radio-active rockets"! Conversion of "waste" to safe and useful products is far more likely in the future.

# Restoring Decaying Buildings

## How Modern Science Solves the Problem of Decaying Stonework

By J. F. STIRLING

THE fact that structural and architectural stonework of all descriptions is anything but permanently resistant to weathering and decay cannot have escaped the observation of the average person during the course of his daily activities, particularly in our industrial cities. Stonework is often subject to a severe weathering process. More than that, it frequently undergoes a species of decay, although it is very seldom that such deterioration endangers the structure or building within any reasonable period of time.

It is common, too, to see the slow deterioration of the so-called enduring stonework in cemeteries and churchyards. Memorials which, half a century ago, were in the prime of their condition, are now fast crumbling away and the inscriptions on them are often completely indecipherable.

The ancient builders and masons were aware of the liability of many types of structural stonework to crumble and decay, and they had two simple tests for the endurance of stone. The first was to immerse a block of it in water for a week or more. If it increased in weight too greatly they held that it was useless, because it would ultimately be "rotted by moisture."

The other test was to lay a piece of the stone on a hot fire. If it flew to pieces the material was taken to be useless for building purposes, for it would "bear neither sun nor heat."

The tests were fundamental enough in their way, but the old builders had not to reckon with the industrial atmospheres of our modern towns, conditions which, more than any climatic influences, have proved themselves sufficiently potent to bring about the active decay of many a formerly enduring building stone.

### Scientific Studies

It is only within recent years that scientific studies of the weathering and the sometimes subsequent decay of structural stonework of all kinds has been initiated in this country. As yet, the subject has not been fully investigated. Here, perhaps, more than in any other types of scientific research, long-term and patient technical work is required. We do not yet completely understand the precise chemical mechanism of stone deterioration and decay, although we have now a clear idea of the conditions under which this process of spoliation is brought about.

The mechanism—physical and chemical—which is responsible for the crumbling of structural stonework is far more complicated than that which brings about the natural weathering of rocks. Natural weathering agencies, such as heat, frost, rain, atmospheric carbon dioxide and so on, cause the disintegration of natural rock formations only very slowly, taking thousands of years over the job. But when quarried stonework, after being cut and dressed, is included in a building, the same stone, which in its natural quarry would have defied the passing of a thousand years or more may, within less than half a century, show all the characteristic signs of an active decay.

*(Above) A surface photograph of newly quarried sandstone. (Left) Surface scales on sandstone. Unsightly and destructive efflorescences caused by the collection of soluble salt deposits on the stonework.*

How, therefore, does this come about? Why should stonework in its natural state be so enormously more time-resistant than the same material when it is included in the structural make-up of a building?

That, indeed, is the problem which certain branches of applied science are tackling at the present day. It is a vitally important problem, too, not only from the point of view of ensuring the reasonable permanence and safety of future building construction but, also, from the need of conserving the architectural achievements of the past.

### Atmospheric Contamination

The whole trouble underlying our present-day stonework deterioration is the impure atmosphere which is generated by our industrial towns. In the last century, smoke, acrid chemical vapours, foundry fumes and other volatile impurities were poured out daily into the atmosphere in truly enormous quantities. The more atmospheric contamination of this sort the Victorian industrialists created, the more they were pleased. Muck and money went together, as the saying was.

Conditions have improved a great deal in our times, but we have not entirely eliminated this atmospheric dirt, and it is just this

*(Above) Stage 3, where the salt crusts on the stone surface have flaked away, leaving serious pittings and indentations on the stonework.*

*(Right) The final surface of deteriorated sandstone. Crumbly, powdering at a touch, absorbent as a sponge. Its life as a structural material has ceased.*

"dirt" which, superimposed on natural weathering agencies, brings about the decay of structural stonework.

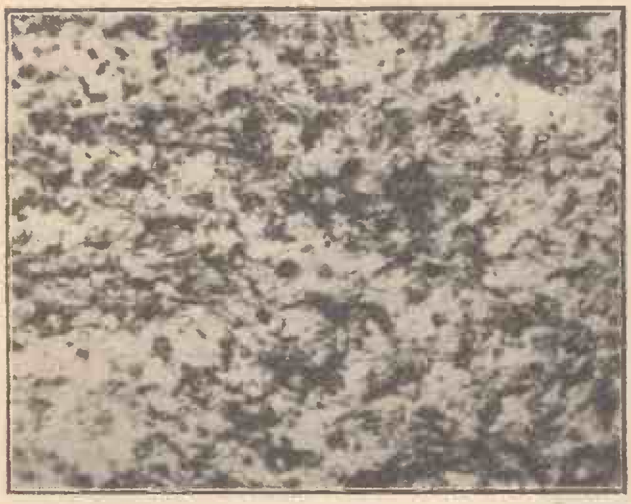
Let us examine some of the ways in which the slow cycle of deterioration goes on.

Water is the most universal weathering agent of stonework. It enters the pores and the cracks of the stonework, dissolving out the slightly-soluble constituents thereof. If the water freezes in the pores and interstices, of our big industrialised centres is, in many stresses within the material. This, for the reason that when water changes into ice it expands about 10 per cent. of its volume. Thus, the increased volume of the frozen water must be accommodated either by extrusion of the ice from the stone surface or by its projection into pores of the stone which were previously unfilled or, as a last resort, by an active distension of the stonework itself.

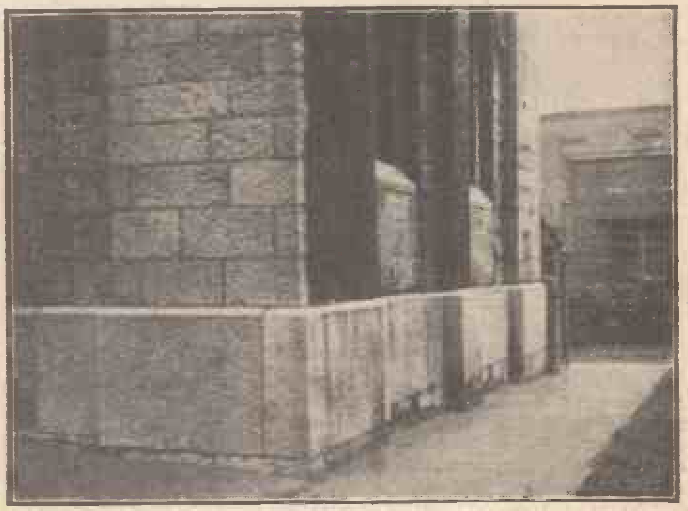
Which of these three alternatives takes place depends on many factors, including the rate at which the freezing occurs and, also, the actual nature and character of the stonework. But, in any case, the ultimate tendency is the same—that of bringing about the deterioration of the stone.

Rainwater in town atmospheres is not pure. Usually it is slightly acid. The more industrial "dirt" there is in a town atmosphere the more acid the rainwater, because smoky atmospheres contain substantial amounts of sulphur dioxide gas—that pungent, sulphur-containing gas which is among the products of all coal and oil combustion. Indeed, this sulphur dioxide gas is among

*This prehistoric Cornish Cromlech well shows that stonework away from town atmospheres remains intact for thousands of years.*



*The surface of granite (slightly magnified). Note the constituent hard grains or nodules whose unequal expansion may start the decay of the stone.*



*A limestone building, where the wall facing right is sheltered from the rain and soot has tended to accumulate. The wall facing the camera is exposed to the south-west rains and is clean and white.*

the most active of the agents responsible for bringing about the deterioration of building stones, and the fact that, on the whole, country buildings and those of small, non-industrialised country towns are far better preserved and undergo less decay than those of our big industrialised centres is, in many instances, to be attributable to the far greater preponderance of sulphur dioxide in town atmospheres of an industrial character.

The sulphur dioxide dissolves in the rainwater, forming sulphurous acid which quickly becomes oxidised to sulphuric acid, a most potent solvent and an active attacker of many mineral substances. This sulphuric acid attacks the carbonates which are present in many types of building stones, dissolving them away and changing them into sulphates which are water-soluble. The sulphates are subsequently leached-out by the rainwater and they form loose crusts on the stonework surfaces, excrescences which are not only very unsightly, but which are actually destructive, since they tend to increase at the expense of the carbonates within the stonework. That is why when any of these sulphate crusts are picked off the stonework a mass of rotting, crumbling stone is often revealed behind them.

### Sinister Sulphates

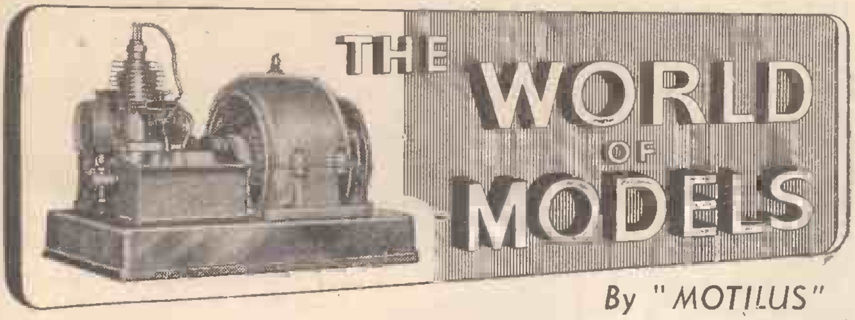
Sodium sulphate is a very common constituent of the white "growth" or efflorescence which is to be seen on stone guildings, and also on brickwork. In most instances, the sulphate is slowly removed by the rain from the brickwork and then no more is formed, the brick then having weathered to a condition of stability. With stone, however, the effects are different. Given the right conditions of atmospheric dirt and gaseous contamination, the sulphates can be produced from the stone until the whole of the stonework has been rotted through and through. Naturally, this is a process which takes a long time to accomplish, but even within a measurable period it can be very active and insidious in its results.

The coal which is burned in and around our workaday towns pollutes the atmosphere with soot and sulphur gases. We have seen one way in which the sulphur can react on stonework. Consider now, the soot. This adheres very tenaciously to the surface of the stonework, usually masking the natural colour entirely. This is particularly the case with the various sandstones, and it forms the underlying reason why the municipal buildings in the cities of the Midlands and of the industrial North frequently present such a uniformly grimy appearance. The soot enters the surface pores of the stonework and when once it has got a firm hold it can only be removed with the greatest difficulty.

It might be thought that a soot layer on a building stone would be protective, despite its unsightly appearance. This would be true if the deposited soot consisted of carbon only, but, unfortunately, this atmospheric soot is not pure, but contains traces of ammonium sulphate and other sulphur compounds. Often, it carries with it slight traces of tar acids, so that, under a soot film on a building stone, the sulphate mechanism of destruction, as described above, can still proceed. What happens is that, with the initiation of the sulphate-forming mechanism, a hard deposit, consisting of soot mixed with calcium sulphate, forms on the stonework. The skin so formed is no longer protective. It swells up and tends to blister and to flake off, revealing underneath a stone which is particularly soft and powdery. Particularly is this the case with the softer and calcareous (carbonate-containing) sandstones which have been used in industrial towns. Matters are believed to be made worse by the calcium sulphate actually crystallising in the pores of the stonework, setting up a disruptive pressure additional to that caused by the absorption and freezing of water.

It has been found that a structural sandstone can actually absorb sulphates which are present in its mortar joints or in neighbouring blocks of limestone, although the actual process of this sulphate absorption has not yet been examined. It has long been known that the contact of limestone and sandstone will, in time, result in the preferential decay of the sandstone, and the above observation offers the techical reason for this.

(*To be concluded.*)




By "MOTILUS"

## Kodak Society of Experimental Engineers Exhibition

THE biennial exhibition now organised regularly by the Kodak Society of Experimental Engineers and Craftsmen was held in the Kodak Recreation Centre, Wealdstone, on March 29th and 30th this year. Visitors on the Saturday, of which I was one, had to brave a blizzard and snow several inches deep, but this did not deter those of us really interested in model and craft work.

This year there were more exhibits than ever and standards in workmanship were high. Nearly all the exhibits were of local origin ; some were entered by individuals and others came through model engineering societies, model railway clubs, youth groups, etc., as well as those shown by members of the Kodak Society.

### Ship Models

The marine section displayed an unusually large number of ship models of different kinds, varying from a 9ft. dinghy to miniature ships in bottles, and not forgetting a model of the Kon-Tiki expedition raft. Several working model power boats were shown, sailing yachts, display models of warships, old-time sailing ships and modern cargo boats were all included. Especially notable was Lt. Cmdr. (Retd.) T. F. Richards' model of the 74-gun frigate, H.M.S. *Implacable*, which showed some fine detail work.

Locomotive models were also varied and were mostly of a high standard of finish. As well as some excellent passenger-hauling models there was quite a selection of small gauge locomotives ; also some American model railroad equipment, exhibited by Mr. Perrin, of the Harrow Model Railroaders.

Entries in the general engineering section were not so numerous, but high quality was again evident. There was a model aircraft section, which was well supported. Some original models appeared in the general mechanical class. One that attracted much attention was a scale model grand piano, complete with stool ; when the keyboard cover was raised listeners could hear the strains of Strauss's Blue Danube Waltz. Mr. J. H. Starck was the maker of this ingenious model.

### Various Handicrafts

The exhibition also included a fine display of craft work of all kinds: needlework, weaving, leatherwork, carved woodwork, oil and water colour paintings, and numerous other handicrafts.

I was sorry to learn that Mr. K. N. Harris, chairman of the Kodak Society, is to retire this year, but no doubt he will still keep in close touch with the society and its many activities.

### Model Railway Club Exhibition

In the model railway world, Easter week in London means a visit to the annual Model Railway Club Exhibition at the Central Hall, Westminster. This year I had the pleasure of visiting the exhibition in the company of Mr. J. Fournereau, owner-editor of the well-known French model railway magazine, *Loco-Revue*. French model railway enthusiasts find this large exhibition most fascinating as they so seldom see anything on this scale in France, where the model railway hobby, although growing and flourishing, has not reached the popularity that it enjoys in Britain.

A feature of this year's exhibition was the large number of working layouts on view. British Railways displayed their now comprehensive gauge 0 model railway. A large

(*Continued on page* 354)

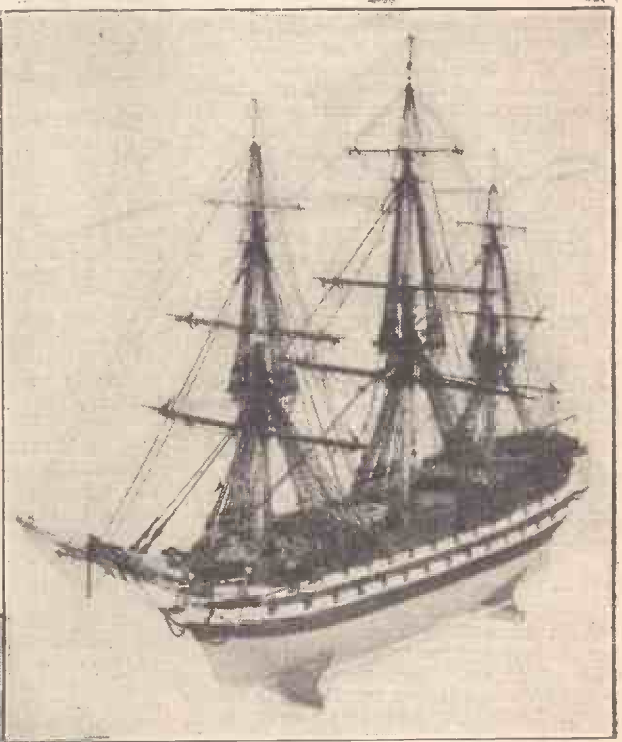


*Fig. 3.—This is a beautiful model of the 74-gun frigate, H.M.S. "Implacable," which was on loan to the Kodak Exhibition. The scale of the model was not given on its showcard but the model measured about 2ft. in length. (Photo by courtesy of Kodak, Ltd.)*

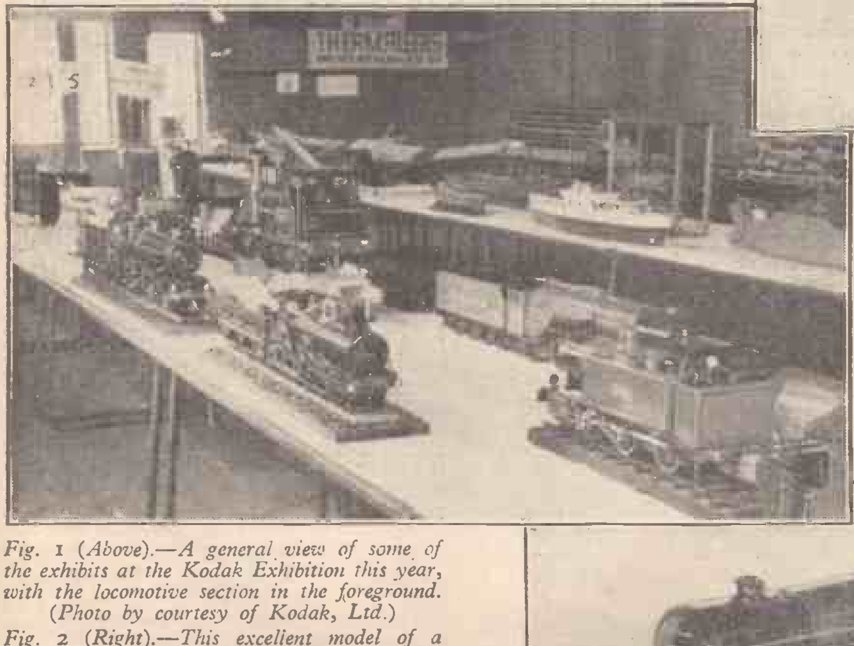


*Fig. 1 (Above).—A general view of some of the exhibits at the Kodak Exhibition this year, with the locomotive section in the foreground. (Photo by courtesy of Kodak, Ltd.)*

*Fig. 2 (Right).—This excellent model of a 4-6-2 L.M.S. "Princess" class locomotive was one of the fine models shown at the Kodak Exhibition. The model is to a scale of ¾in. to 1ft. (Photo by courtesy of Kodak, Ltd.)*


### Interplanetary Space Travel

SIR,—Your correspondents, H. H. Porritt and Dennis Urch, in the May issue of PRACTICAL MECHANICS ignore one or two points about Professor Einstein's "Relativity Theory." Firstly, the "Theory of Relativity" states that no body with any mass, i.e., matter, can attain the speed of light. Secondly, other effects occur, besides the slowing of time, as speed increases. Mass increases, and dimensions decrease, as an object increases its speed. When the object reaches the speed of light its mass should be infinite and its dimensions zero. Thirdly, and this is the crucial point, it all depends on whose time, weight and length scale these are measured. Going by Mr. Urch's analogy, which of the twins would measure the time? If time appeared to shorten, as far as the twin who travelled in the rocket was concerned, would not the time required for him to age to the equivalent of 80 earthly years of age also diminish in proportion?

I think the "Theory of Relativity" pretty well takes care of most of these apparent paradoxes that have been quoted by its name—"relativity."

By the way, even minute bodies such as electrons, travelling in vacuum, have not yet been made to approach the speed of light.—A. DARBY (Glasgow).

SIR,—The view expressed jointly by H. H. Porritt and D. Urch (May issue) regarding time in inter-stellar flight—10,000 million years in exchange for 33 years—brings H. G. Wells's "Time Machine" to life, with one great difference: there would be no return for *their* lonely traveller as he sat by the shore of a tideless sea and watched the sun die.

"Time," convenient though it may be in our human dealings, is still a purely hypothetical quantity. It depends on a sequence of changes for its existence. A strong display of energy in a certain direction gives an observer the impression of quick movement, and he subconsciously labels the sequence as "taking little time." For a weak display of energy he labels the sequence as "taking a long time." As everything in nature possesses this sequence of change in various degrees, the illusion of "time" is continually with us. Examining this sense of change we find it is caused by the interaction or disposition of one centre or nucleus of energy with, or in relation to, another. This state of affairs, with its innumerable combinations, creates for us the world we know.

If an object moves by its own energy, it expends energy; we then say it is not what it was—it is changed and it has changed position, and immediately we delude ourselves with the "before" and "after" or "time" idea. If, however, the object is returned to its former position and its lost energy is restored to it precisely as it was in the first place, then that particular object has abolished "time." The argument may be advanced that it is *not* the same because it is the *second* time the object has occupied that unique state, but if the mental energy expended by the person making that observation is reversed in similar fashion, the memory of that observation no longer exists. As the two sources of energy differ in action and position, the divergence gives us an imaginary thing which we call "time." If the two sources were exactly alike in action and position, they would form *one* entity and the myth of "time" would be cancelled out.—WILLIAM ELLWOOD (Hatfield).

### Braille Printing

SIR,—I am anxious to help a friend who has undertaken a voluntary task of Braille "printing" for blind persons.

As you probably know, *one* sheet of Braille takes a long time to produce, and in view of the fact that a number of copies will be required, it would be a great help if some form of duplicating was possible.

Can any readers help by making any suggestions as to how this would be possible? It is essential that the process be fairly simple and preferably inexpensive. — L. MORTIMORE (Pinhoe).

### Laying Glazed Tiles

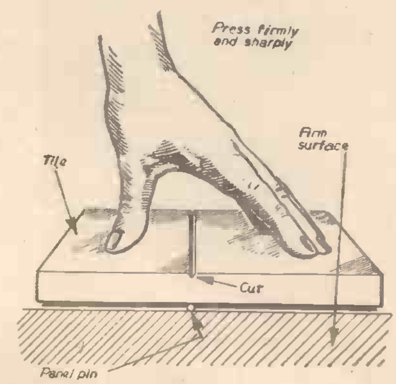
SIR,—With reference to the query on laying glazed tiles by B. Paton (April issue), I can assure Mr. Paton that without first preparing his timber the tiles would not stand up to very much traffic.

If there is to be any dampness about or heavy work, I advise the following treatment.

First, give the timbers an application of any lead undercoating and allow this to dry; then paint the reverse side of the tiles.

Next, make up to a thick cream a mixture of white lead putty and gold size.

This mixture is painted thickly on to the back of the tiles, which are then pressed gently on to the timber and allowed to set for about a week. The joints between the tiles may be filled in with plaster of paris.




*Cutting tiles by means of a glass-cutter and breaking over a panel pin.*

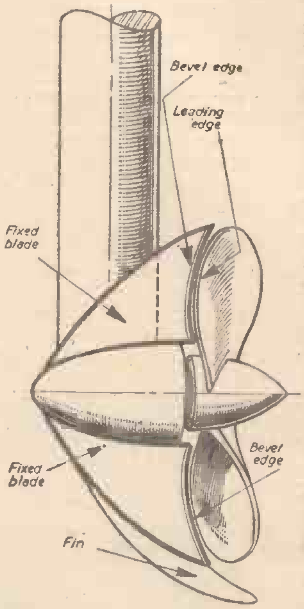
The cutting of tiles is really an easy job if you use a glass-cutter on the glazed side and apply pressure as shown in the accompanying sketch. The cutting should be done before painting.

The mixture mentioned is also used for tiling to metal or even glass.—S. WEALTHY (Liverpool).

### Motor Boating and Weed-ridden Waters

SIR,—Although I have previously offered my suggestions for a solution to the problem of motor boating through weed-ridden waters, I cannot allow G. Fleming's solution to pass without comment. Firstly, the upright supports hinged to the gunwale will in themselves tend to collect every weed in their path on or near the surface. Secondly, the speed at which a small boat (with or without a screened propeller) can travel through water, would never cut weeds, no matter how sharp the blade could be kept. The action of a scythe is very different when cutting meadow from that of Mr. Fleming's arrangement. There might be some possibility of the blade cutting if it were inclined sternwards at one side, but in my experience the very slipperiness of water plants causes them to slide off even the keenest edge, unless the knife is moved with considerable speed.

I think, therefore, that the correct approach to this problem is to study more carefully the way in which a propeller slices through the water. It appears to me that if it will slice through water, it can be assisted or modified to slice through weeds. The cutting speed necessary is ready to hand in the blades themselves. The only assistance needed can be provided by mounting suitably shaped fixed blades above and below the propeller hub, so that their trailing edges conform to the locus described by the propeller blades' leading edge. A scissor action is then achieved, such as is found in lawn mowers. It may be argued then, that the periphery speed near the hub is less than that at the tips of the rotating propeller blades, and that this in itself will cause weeds to become wrapped round the hub. This is perfectly true, but can be overcome if the weeds are guided away from this point with a conical-shaped fitting made from aluminium sheeting; its point should face forward, and the skirts shaped round the bevel gear housing, so that its mouth is a close fit to the hub, where the blades fade into the hub casting. The design of this cone will vary according to the make of motor. On many types of motor it will be unnecessary as the gear housing is already so shaped.




*General shape of the fixed blades for slicing through weeds.*

The accompanying sketch will be a guide to the general shape of the fixed blades referred to. The top one is fastened or strapped to the main shaft housing, and the bottom one is fastened to the fin. The trailing edges are bevelled from opposite sides according to the direction of rotation of the propeller. It may also be necessary under severe conditions to bevel slightly the leading edges of the propeller blades. The clearance allowed between fixed and rotating edges may be as much as 1/16in. and will still achieve remarkable results.

In conclusion, it will be clear that I cannot agree with Mr. Fleming's contention that "there must be a clear patch of water for the propeller."

I have considerable experience of this device, which is incorporated into the castings of a motor in my possession. I have never known it to fail.—W. A. P. CROWE (Dublin).

### Electrically-operated Film Screen Curtain

SIR,—With reference to Mr. S. B. Bagley's letter in your May issue regarding an electrical device for opening and closing film screen curtain, I would like to suggest the following method, as illustrated in Fig. 1.

The principle of operation is that the starting switch is switched on and the geared motor turns a pulley, thus moving curtain cord and opening the curtain, until striker "A" operates the controlling switch. This breaks the circuit and reverses motor connection for next operation.

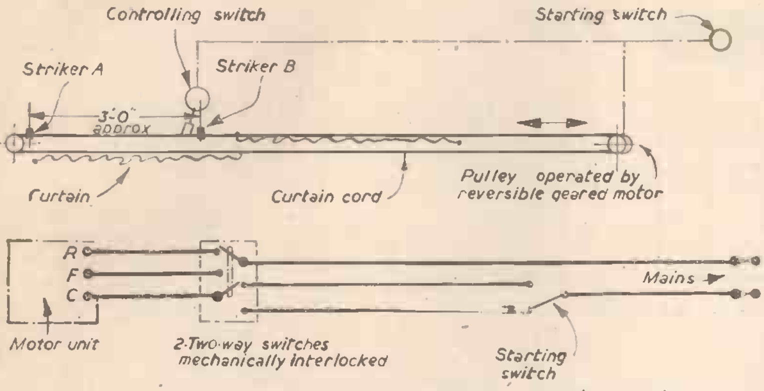



*Fig. 1.—Showing mechanical arrangements for operating curtains.*

*Fig. 2.—The theoretical circuit.*

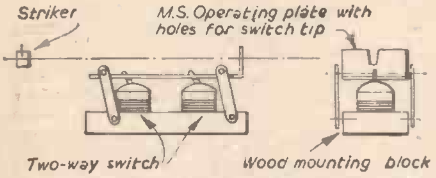



*Fig. 3.—Method for interlocking controlling switch.*

On again pressing the starting switch, the motor turns in the opposite direction, thus closing the curtain, until striker "B" switches off the controlling switch. Diagram of electric circuit is shown on Fig. 2.

Parts required:

One small reversible geared motor unit (as R.Q.H. type made by Drayton Instrument Co.) with output speed 100-120 r.p.m.

Three two-way switches (two for controlling switch and one for starting switch). A.C. only type can be recommended as they are quiet in operation.

Two striking clips.

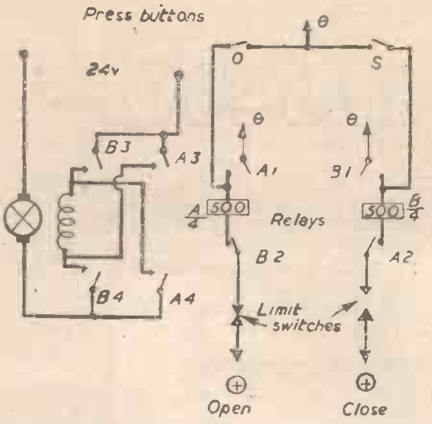
One small U-rope pulley, diameter to suit speed of opening the curtain.

Suggested method for interlocking controlling switch is on Fig. 3.

I hope this method will provide simple and satisfactory solution.—L. WORONOWSKI (Nottingham).

SIR,—I enclose a circuit for the control of curtains for a film screen which is in use here. It provides for automatic control in starting and stopping and also prevention of accidental starting of the curtains in the opposite direction once they are in motion, this being an easy thing to do in the dark.

The essentials needed are two post office type relays of about 500 ohms each, two press buttons and a series-wound motor. The leads from the field and armature are taken via the spring sets on the relays, as shown in the sketch.




*Mr. Lewis's circuit which has worked well for several months.*

Suppose that the curtains require to be opened, then pressing button "O" sends current through relay "A." Spring set "A1" locks relay "A" (so pressure on the button can be released). "A2" disconnects relay "B," thus preventing its accidental operation, while "A3" and "A4" put the motor field in series with the armature and operate the motor. At the end of the travel of the curtain the limit switch opens and disconnects relay "A," restoring the circuit to normal and also preventing the relay from operating until the curtains have been reclosed.

To close the curtains, button "S" is pressed and the above cycle is repeated on relay "B," the only difference being that the field is connected the opposite way round so that the motor reverses.

This system has been in operation for some months now and has worked very well. It leaves the operator free to operate the projector, lighting, etc., and has only a button that has to be pressed.—L. LEWIS (Sheerness).

SIR,—May I make a suggestion to help Mr. S. B. Bagley concerning his electrically-operated film screen curtain?

If the curtain is hung from the usual type of curtain rail and rollers, pulleys to suit are available with the rail. Fit one of the pulleys on the motor shaft and the other at the distant end of the other curtain. Picture cord or leather belting 3/16in. diameter should be sufficient for the drive, which passes right round a 12in. pulley. This will give each curtain a movement of a little over 3ft. ($12 \times \pi$).

The pulley could be made of wood or "Tufnol," and need not be more than ¾in. or 1in. thick, sufficient for a little more than two complete threads, in the form of a groove, to take the picture cord. On one face of the pulley screw an arm to operate two toggle switches.

I am not sure of the best type of motor to use, but I have chosen a commutator type fractional horsepower motor (about 1/20 h.p.).

The circuit is through a two-way switch in projection box to the other two-way switch operated by the arm on the large pulley, through a double pole change-over switch (D.P.C.O.S.), through the commutator, through the field and back to the supply. For a D.P.C.O.S. use an intermediate switch as used for three-way switching in house-wiring. These are no larger than a two-way switch.

I have chosen to reverse the current in the armature, which is better than reversing the field current.

Operate the switch in projection box: curtain opens. When open, it changes over the two-way switch cutting off the supply, and changes the D.P.C.O.S. ready for the motor to run the other way.

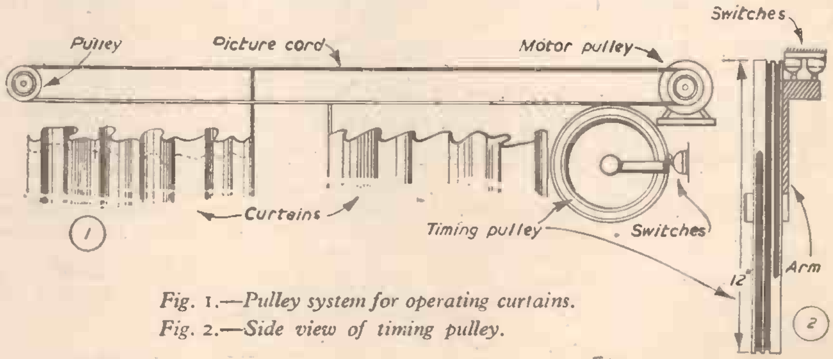



*Fig. 1.—Pulley system for operating curtains.*

*Fig. 2.—Side view of timing pulley.*

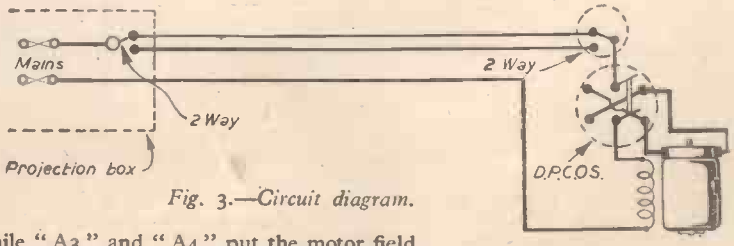



*Fig. 3.—Circuit diagram.*

Open three-way in projection box again: motor runs the other way closing the curtains, breaking two-way circuit and D.P.C.O.S. making motor ready to run the other way again.—D. W. JONES (Chester).

# Trade Notes

A Review of the Latest Appliances, Tools and Accessories

### Radio-controlled Models

THE highly educational value of model aircraft and boats is to-day greatly enhanced by the use of radio for remote control. To amplify its possibilities, Electronic Developments (Surrey) Ltd., the makers of the world famous model E.D. engines, have perfected a model boat which has successfully crossed the English Channel under its own power while being fully radio-controlled from a river launch, which followed at a distance varying between 100 yards and 1 mile.

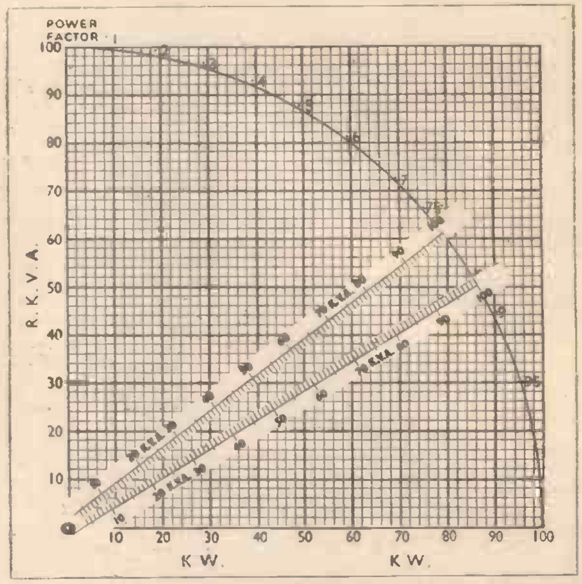
The accompanying photograph of the boat was taken the following day in Calais harbour after the successful crossing, which created world-wide interest, as all the components used are commercial lines manufactured by Electronic Developments, Ltd. The engine is an E.D. 4.5c.c. watercooled diesel, measuring 3½in. in height, and weighing 10oz. The radio equipment is an E.D. Mk. IV, 3-channel, 3-reed radio control unit. The boat, which is built of wood, is 5ft. in length with a 2ft. beam.

The use of radio with model aircraft and boats has enabled the constructor to control his craft reliably over long distances, and bring a model boat back to its place of launching. Most of the manœuvres that a full-size aircraft can do can be carried out by means of radio control of the rudder.

In addition to the diesel engines for the motive power, the firm also supply the radio control unit, kit sets, or models complete.

Further particulars are obtainable from Electronic Developments (Surrey) Ltd., 18, Villiers Road, Kingston-on-Thames, Surrey.

*Above—the radio-controlled boat after its successful crossing of the Channel.*




*Right—the chart type ready reckoner for electrical engineers. The two movable scales are of transparent plastic and enable the K.V.A. loading at any given K.W. and P.F. to be seen at a glance.*

### Electrical Engineer's Calculators

DESIGNED for the student, apprentice, maintenance electrician and electrical engineer, the purpose of these calculators is to save referring to a book of tables when making decisions on electrical calculations. They are in two types, the chart type for K.W., K.V.A., K.V.A.r., and power factor correction, and the double-sided circular calculator made in white ivorine, which is for "load current" H.P., fuse wire size dia., K.W., K.V.A., and power factor. An instruction book is supplied with each, giving worked-out examples and explaining the graduations of the scales, etc.

The prices are: disc type, 7s. 6d., and chart type, 6s. 3d., and the suppliers are Eastern Electric Service, "C" Dept., Norton Park, Edinburgh, 7.

# Club Reports

### Harrow and Wembley Society of Model Engineers

ON Wednesday, March 26th, at Heathfield School, College Road, Harrow, club members had the pleasure of a return visit of Mr. Walton, a representative of a heavy transport company. On this occasion, with the aid of a projector and appropriate films, Mr. Walton was able to show how enormous loads of varying shapes were conveyed by road with specialised equipment.

### International Radio-controlled Models Week-end at Blackpool

ON August 16th and 17th, 1952, the above Radio-controlled Models event for boats and aircraft will be held at Blackpool, Lancashire, and it will be the first joint event of its kind to be held in England, with an international contest for model boats on the Saturday (August 16th), and an international contest for model aircraft on the Sunday (August 17th). The latter event will be held on the Stanley Park Aerodrome, Blackpool, commencing at 10 a.m., and the boats contest will be held on a portion of the lake in Stanley Park, Blackpool.

Anyone interested should send a stamped, addressed envelope to the address below.

Both contests are being organised by the International Radio - Controlled Models Society, and an interesting and enjoyable week-end is anticipated.

Full particulars may be obtained from Mr. R. Lawton, 10, Dalton Avenue, Whitefield, near Manchester.

## THE WORLD OF MODELS

(*Continued from page 351*)

scenic layout in 2mm. scale made an interesting exhibit, as did also the portable 4mm. scale layout of the Buckingham branch line. The passenger-carrying railway once more proved its popularity, even for the short, straight run to which it has to be confined in the space available.

The group stands included a London Transport and a free-lance group as well as an American group, all of which added welcome variety. Other groups (G.W., L.N.E.R., L.M.S. and Southern) provided some familiar favourites as well as a number of interesting new models.

## BOOK RECEIVED

**Tropical Fish in the Home. By Douglas Gohm, F.Z.S. Published by C. Arthur Pearson Ltd. 144 pages. Price 30s. net.**

TO meet the demand of tropical fish enthusiasts in this country for a really complete and up-to-date book on this fascinating subject, the author has written this popular-priced volume. The subject matter has been treated throughout in an essentially practical manner and should appeal to the expert and beginner alike. All the interesting ichthyology is dealt with, and there are many hints on keeping and maintaining a tropical aquarium in proper condition. An outstanding feature of this invaluable book is the set of full-colour lithographic plates, showing the various groups of fish in their natural colours. In addition to these plates there are numerous black and white pictures and diagrams of the various species of fish, and of plants and accessories for the tank. The contents cover: Aquariums, Plants and Layout, Aquarium Management and How to Counteract Common Troubles, with a large section on the various groups of fish themselves, and detailed descriptions of popular varieties. The book is fully indexed, and can be looked upon as the standard British work on the subject.

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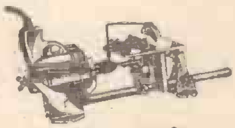

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| Building | Mechanical Engineering | Surveying |
| Carpentry | Motor Engineering | Telecommunications |
| Chemistry | Plumbing | Television |
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**EX-R.A.F. ROTARY CONVERTERS.** 24 volts D.C., input 50 volts, 50 cycles, 1 phase at 450 watts output, complete with step-up transformer 50 to 230 volts, £9/10/- each, carriage 10/-.

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

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

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**RECTIFIERS (NEW),** D.C. output 37 volts 50 amps, complete with mains transformer 230 volts A.C. input 50 cycles 1 phase output to match the required voltage for the rectifier, £15 per set, carriage 10/-.

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

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

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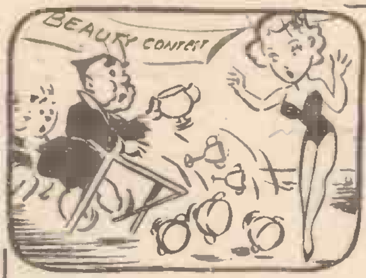
**MAINS TRANSFORMERS (NEW),** Input 200/250 volts in steps of 10 volts, outputs, 350/0/350 volts 180 m/amps, 4 volts 4 amps, 5 volts, 3 amps, 6.3 volts 4 amps, 45/- each, post 1/6 ; another 350/0/350 volts 180 m/amps, 6.3 volts 8 amps, 0/4/5 volts 4 amps, 45/- each, post 1/6 ; another 500/0/500 volts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

**Please note : All Transformer prices have been increased by 10% due to rises in cost of materials. Prices quoted in this advt. supersede all prices previously quoted.**

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*Cried EH, "With the greatest delight,*
*We award you the first prize on sight.*
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*A catastrophe!*
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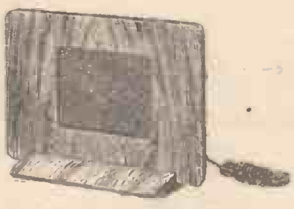

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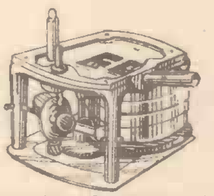
New type baffle stand with metal fret. 6in. Price 19/9. Post 1/-. Other types and sizes in stock.



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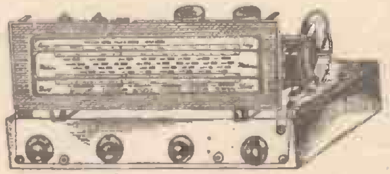

**PERSONAL RADIOS.**—Price £5/19/6, 4 v. T.R.F. receiver with choice of walnut brown or ivory plastic cabinet. Complete instructions for building this popular set, including point to point wiring instructions are supplied with the kit of parts. There is no other comparable set available to-day at this price. When ordering, please state whether you require A.C. model or A.C./D.C. model. Postage and packing 3/6 extra. Assembled ready for use, 35/- extra.

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**PORTABLE ELECTRIC BLOWERS.**—220/230 volts 220 watts. Completely enclosed, 8ft. flexible hose and nozzle, 7 yds. C.T.S. Flex. Many uses where clean, dry air is required. £8/15/-.

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| 1½in. Diam. | 2½in. Focus | ... ... | 7/6 each |
| 2½in. ,, | 3in. ,, | ... ... | 10/- each |
| 4in. ,, | 28in. ,, | ... ... | 15/- each |
| 4in. ,, | 10in. ,, | mtd. in prs. | 32/6 pair |
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| 6in. ,, | 10in. ,, | ... ... | 50/- each |

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**TALKIE PROJECTORS.**—16 m/m. B.T.H. model S.R.B. Sound and silent, complete with valves, lamps, lens, speaker, transformer, £95. As above, but sound only, £90. G.B. model L516, 16 m/m., complete with valves, lamps, lens, speaker and resistance, £75. Projection Lenses, Dallmeyer, 33 m/m. diameter mount, 50-65-75 m/m., 65/- each.

**BROMIDE PAPER.**—Glossy grades 1 and 3, 5½in. x 5½in., 7/6 per gross, post 6d. **PLASTICA** in soft, normal or hard. Double weight 12in. x 10in., 27/6 for 50, post 1/- ; 15/- for 25, post 1/-, also 15in. x 12in. soft only, 39/6 for 50 ; 21/- for 25, post 1/-.

**PHOTO FLOOD LAMPS.**—1,000 watt, 230 volt, 10/- each. Post 1/-.

**RESISTANCE MATS.**—Make ideal heating mats for Aquariums, Photographic solutions, Print dryers, etc. Mains voltage. Black heat, size 10in. x 6in. 2/6, post free.

**POWER SUPPLY UNIT** No. 7 for charging 6 volt accumulators by hand, consisting of a hand generator 6 volts D.C. at 4 amps., complete with accumulator box, automatic cut-out in large steel case, 16in. x 10in. x 7½in., only 45/- carriage paid.

**TWIN P.A. LOUDSPEAKERS.**—Reflex re-entrant type, very sensitive and directional, 8in. diam., 16in. overall. Brand new with matching transformers 4.5 to 1 and 6 to 1 Ratios. Voice coil 7 ohms. Only 75/-. Carr. and pkg., 5/-.

**ACFIL PUMPS.**—These pumps enable you to fill all accumulators on the bench with the carboy at floor level. Brand new, only 30/-, post 1/6.

**AERIAL RODS.**—12in. long, ½in. diameter. Any number of sections can be fitted together, 2/6 dozen, 6/- for 3 dozen, 11/- half gross, 20/- gross, £6 per 1,000.

**SLOW MOTION DIALS.**—6in: Scaled 0-100, reduction 200 to 1 or direct, ideal for wavemeters, signal generators, etc. Our price, while they last, 5/6 each, post 1/-.

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**(Dept. A.2),**

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Tel. : HARborne 1309.

# QUERIES and ENQUIRIES

A stamped, addressed envelope, three penny stamps, and the query coupon from the current issue, which appears on page 80 (THE CYCLIST), must be enclosed with every letter containing a query. Every query and drawing which is sent must bear the name and address of the reader. Send your queries to the Editor, PRACTICAL MECHANICS, Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

## *Concentrating Hydrogen Peroxide*

**AS I require a small quantity of concentrated hydrogen peroxide, would you kindly help me with the following queries ?:**

**Is it possible to buy a stronger concentration than the chemists' "20 vol." solution? If so, where and what strength ?**

**Is there any method of concentrating the "20 vol." solution as bought at the chemists ? If so, how ?**

**How can I make a small quantity (say, 12oz.) of concentrated hydrogen peroxide (concentration to be as strong as conveniently possible) ?**

**Are there any special precautions to be taken with concentrated hydrogen peroxide, and what is the maximum safe concentration ?—J. Fellows (Kinver).**

HYDROGEN peroxide is now available in the following concentrations: 20, 40 and 100 "volumes," corresponding respectively to 6, 12 and 30 per cent. of $H_2O_2$. You can obtain any of these "strengths" from a chemical dealer, such as British Drug Houses, Ltd., Poole, Dorset, or Messrs. Griffin and Tatlock, Ltd., Kemble Street, Kingsway, London, W.C.2. The "100 vol." material is only supplied in non-returnable ceresin bottles, since it is liable to attack glassware. The liquid must be kept cold.

Solutions of hydrogen peroxide (even dilute solutions) decompose when they are heated. For this reason, weak hydrogen peroxide of "20 vol." grade cannot be concentrated by distillation or evaporation under ordinary conditions. Concentration is best effected by placing some of the dilute hydrogen peroxide solution in a vessel surrounded by solid carbon dioxide gas ("carbonic acid snow"). The whole mass of peroxide solution will freeze. At a temperature between minus 10 deg. C. and minus 8 deg. C. small needle-shaped crystals will separate from the melting mass. The mother-liquor is then carefully poured away and the crystals are collected. They will contain a higher concentration of peroxide. The process may then be repeated and, at every repetition, crystals of higher peroxide concentration will be obtained. At higher concentrations, it will be necessary to absorb further water from the melted crystal mass by standing it in a chemical desiccator over strong sulphuric acid. By this method (presupposing a good supply of patience) it is possible to obtain nearly 100 per cent. hydrogen peroxide as a colourless, syrupy liquid with a slight bluish tinge. You will find the process described in detail in Mellor's "Modern Inorganic Chemistry" (Longmans, Green and Co.) and in other similar works on inorganic chemistry.

The usual commercial form of hydrogen peroxide is a sufficient starting point from which to make the concentrated material, but the process is lengthy, tedious and it calls for considerable chemical skill and experience.

Ordinarily speaking, the handling of high concentrations of hydrogen peroxide does not call for any special precautions. The liquid must be kept as cold as possible. It is decomposed slowly by glass and by silica. It injures the skin, producing white blisters. It cannot be distilled. It has powerful oxidising qualities. Any concentration is "safe," but a concentration below about the "40 vol." mark can be treated like any ordinary liquid provided that it is kept cool. Hydrogen peroxide at all concentrations does not keep well in contact with alkalies or with alkaline solutions.

## *Sealing a Concrete Floor*

**I HAVE an outbuilding used as a garage and wash-house and it has a concrete floor. As this appears to be continually dusty can you inform me if there is any substance that can be applied which will have the effect of "sealing" the surface and so minimising the dusty effect ? —S. Ainsworth (Purley).**

AN effective and relatively cheap sealing agent for concrete surfaces is sodium silicate (water-glass) used in the correct solution-strength. This substance is supplied, ready for use, by Messrs. Joseph Crosfield and Co., Ltd., Warrington, Lancs. It is merely swabbed over the concrete surface and then allowed to dry out slowly.

Another (much more expensive) material which can be used for the same purpose is a solution of ethyl silicate which is sold under the name of "hydrolysed ethyl silicate." This is also very effective. It may be obtained, together with literature on the subject, from Silicaseal, Ltd., Westgate Hill Grange, Newcastle-on-Tyne, 4.

Treatment of the concrete floor with any of the emulsified wax "dry-bright" liquid floor polishes, such as Johnson's "Glocoat," which are now obtainable in household stores, is often moderately effective in reducing the "dusting" of concrete floors, but the wax preparation has to be applied at frequent intervals.

## *Producing Smoke*

**I AM doing some table-top photography with a cine camera, and want to get the effect of a burning village. The model houses will be of cardboard, about 4in. high, and provision is being made in the set up for a trough of metal (invisible to the camera) to be sunk several inches in the centre of the scene in which can be burnt whatever is to create the smoke. Could you please advise on the materials which would furnish dense smoke with, if possible, a yellow or red glare ?—Gladys Gollup (Southall).**

DISSOLVE a little camphor in methylated spirit and stir in to the solution about one-eighth of its bulk of turpentine. Soak cotton wool in this solution and allow it to dry out. The impregnated material will then burn slowly with the production of black smoke.

**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.**

White smoke is best produced by burning a few grains of red phosphorus in small round tins. The red phosphorus can be diluted with sand if its smoke is too voluminous. It can also be damped with the above camphor solution if it is required to darken its smoke. In fact, by a judicious combination of the above processes you can obtain white or black smoke of any required density.

Red phosphorus is not poisonous, nor is it particularly dangerous. It is not liable to ignite spontaneously.

## *I.C. to Diesel Conversion*

**I AM interested in fitting a diesel engine in my 1938 14 h.p. car, and should be grateful if you could advise me as to manufacturers who make an engine of suitable size and performance.**

**Would it be possible to convert an existing petrol engine into a diesel by fitting a Bosch pump and fitting a new cylinder head to increase compression ratio (14 : 1 say) ? Are there any average performance figures for diesels with respect to the standard I.C. engine ?—Joseph Patterson (Co. Down).**

THERE are no diesel units in this country specially designed for small car use. The only thing we can do is to call your attention to the small diesel engines which are manufactured by Coventry Diesels, Ltd., Coventry. These are industrial diesel units, but it might be possible to convert one of the smallest size to your needs. An inquiry for particulars would be worth your while, for the manufacturers would, we think, be quite willing to advise you as to the suitability of their units.

In our opinion, the difficulties of converting an existing car engine into diesel running are so great that it would hardly pay any individual to attempt the task. For one thing the average car engine is not heavy or strong enough to permit of safe diesel operation. The obtaining and fitting of a new cylinder head to increase compression and a new Bosch pump would be a possibility, but, in our view, an expensive and, withal, an unsatisfactory job, one, indeed, which would be likely to give rise to a lot of trouble of one sort or other. In a word, you cannot expect to convert a motor-boat into a battleship, no matter how good your workmanship may be. It is the same in the case of a light petrol engine-diesel conversion. The two entities are not radically interchangeable, and any attempt to force the one engine to do the work of the other is likely to lead to disappointment and inefficiency.

It is very difficult to give clear average performance figures for diesel and car engines, since the applications of the two types are so different. Even diesel manufacturers will not be able to give you the figures you want. In general, however, the following are interesting figures:

The petrol engine converts between 20 and 25 per cent. of the heat of the fuel into useful work, whereas the figure for a diesel engine lies between 30 and 36 per cent. Hence, the diesel engine has the higher thermal efficiency. The losses in the petrol engine amount to about 10 per cent. in internal friction, 34 per cent. in cooling water and radiation and 33 per cent. in exhaust gases. For the average diesel engine, the respective figures are about 11, 31 and 24 per cent. The diesel engine is economical and it pulls well at relatively low speeds. It consumes heavy fuels, and the absence from it of electrical ignition apparatus reduces the chances of trouble. Herein are the main advantages of the diesel unit, but diminutive units of this type purely for light car use have yet to be thoroughly tried out on a mass scale.

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**12FT. ALL-WOOD CANOE.** New Series, No. 1, 3s. 6d.*
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**OUTBOARD SPEEDBOAT*** 10s. 6d. per set of three sheets.
**LIGHTWEIGHT MODEL MONOPLANE** Full-size blue-print, 3s. 6d.
**P.M. TRAILER CARAVAN** Complete set, 10s. 6d.*
**P.M. BATTERY SLAVE CLOCK—2s.***
**"PRACTICAL TELEVISION" RECEIVER** (3 sheets), 10s. 6d.

The above blue-prints are obtainable, post free, from Messrs. George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

*An * denotes constructional details are available, free, with the blue-prints.*

## *Photographic Developing and Printing*

**I WOULD like to print and develop my own films. Could you let me know the cost of the equipment needed and give details of the printing and developing process, with ordinary 120 films ?—N. G. Ryder (Derby).**

THE cost of equipping yourself for the purpose of developing and printing your own films (presumably in a small way) would be very little indeed. You would need a developing dish or two, a rinsing-water dish, a fixing dish, printing frame and, of course, the necessary developing chemicals and fixing agents, all of which can nowadays be bought ready-prepared for use. You can make a good start on 10s. or 12s. if you confine yourself to the merest essentials.

Write to Messrs. Johnson and Sons, Ltd., Manufacturing Chemists, Hendon, London, N.W.4, asking for a copy of their free developing and printing booklets, which will give you a good explanation of the process. They will also send you their lists of materials. Do the same, also, with Ilford, Ltd., Ilford, London, E. From the literature you will thus obtain you will be able to work out the cost of the equipment required, and you will have at hand a good outline of the processes of developing and printing. We are assuming that you will be able to rig up for yourself a darkroom safety light.

For your adequate understanding of the photographic process, you ought to consult an elementary handbook of developing and printing. There are literally dozens of these books available in public libraries and at various photographic dealers. They are all well written and you will have a good choice.

If you possibly can, it would be far better for you to seek out someone in your town who would give you one or two demonstrations of film developing and printing, for here an ounce of practical "showing-how" is worth a ton of book reading.

## *Concrete Mix*

**IS gravel obtained from a London garden suitable for making up concrete ? By digging down about 2ft. I can get this gravel, which is very stony with a yellow sandy earth attached. The River Effra is reputed to run under our gardens. If it is suitable would I also have to use sand, and also, would you give me the proportions to use with the cement ? I want to make a foundation for a portable concrete garage.—J. Gray (Herne Hill).**

THE grit which you have discovered on your property would have to be well washed with water before using it for concrete-making in order to rid it of adhering soil. Otherwise, it would be well suitable for the job, since it will probably be old river grit. The individual particles of the grit should be about ¾in. across, and the particles should not be rounded, but should have fairly sharp angles in order to provide good keying points for the concrete.

A suitable concrete " mix " for your purpose would be :

| | |
|---|---|
| Portland cement .. .. | 1 part (by measure or bulk) |
| Sand .. .. .. | 1 part |
| Fine filler .. .. .. | 1 part |
| Grit .. .. .. | ½ part |

The sand used should not be seasand, since the latter invariably contains salt, which is detrimental to the mixture. The fine filler may constitute almost any very fine mineral material of a finer particle-size than the sand used. For this purpose, stone or brickdust may be used or anything of an equal fineness. It is advisable, also, to include in the mixture a small proportion of coarse grit or broken stones, the average diameter of these particles not exceeding one-half of the depth of the concrete to be laid. Working on these lines, you will obtain a dense, heavy concrete of good strength and endurance. The above proportions may be varied to some extent, but it is essential to use sufficient fine filler to fill up the minute spaces between the sand grains and the grit particles. The mixture must also be adequately slaked with water so as to produce a mass which is thoroughly wetted. A heap of it should just stand up without actually flowing.

## *Making " Mastic " Waterproofing Pointing Material*

**(1) PLEASE inform me how to make my own " mastic." It is to be used to seal cracks and gaps between wooden window frames and the brickwork.**

**(2) Is water-glass (used for preserving eggs) sodium silicate and can it be mixed in with cement and sand to render it waterproof ? If it does not fulfil this waterproofing function, can you please tell me what I can use ? Would it be advisable to use this waterproof mortar for pointing between the bricks ?—Alec Day (Redcar).**

(1) THE usual building material known as " mastic " is an iron oxide residue containing manganese which takes the form of a fine dark red powder. It is mixed to a paste either with water or, better still, with raw linseed oil, in which condition (particularly when mixed with oil), it rapidly hardens and forms a very efficient gap and crack-sealing agent for use in ordinary household and structural repairs. It must not be confused with asphalt mastic which is entirely a bituminous compound and which is incapable of cold application. The so-called mastic which is a red lead mixture has not the same properties and we are not surprised to learn that you have used this without success, since it has the trick either of hardening too rapidly and becoming brittle or of not hardening at all. The mastic which you require is the ordinary one obtainable, fairly cheaply, from average paint dealers, colour shops and builders' merchants.

(2) Water-glass is composed of sodium silicate. It is a chemical compound of somewhat indefinite and variable composition. It takes the form of a water-white liquid of high viscosity which can be thinned down to any extent by the addition of water. When exposed to air it absorbs carbon dioxide and gradually becomes opaque. Hence, when mixed with sand, and other inert materials, this reaction tends to go on so that the medium stiffens up and becomes cement-like. The cement thus produced, however, has little strength and tenacity. It could not be compared, for instance, with an average mixing of Portland or the other high-power cements. As an egg preserver, however, water-glass is a very satisfactory agent. It is used, too, as a medium for, mixing certain paints, colours and other dry materials. Cement and sand will not, in themselves, render water-glass waterproof. Water-glass requires several weeks exposure to air before it becomes immune from dampness and thoroughly waterproof inherently. Furthermore, it is always undesirable to place between brickwork a cement or other medium which is excessively dense, since this procedure frequently results in a slow deterioration and crumbling of the brickwork. For this reason, also, it is not even desirable to point ordinary Portland cement between brickwork. Brickwork is best kept in good condition by pointing it with ordinary mortar containing a high proportion of sand and we strongly advise you to adhere, in principle, to this procedure and practice.

## *Correcting pH Value of Soil*

**PLEASE tell me a method of determining the acidity or alkalinity of a soil and compost, i.e., the pH value, the correct pH value being between 7.5 and 8.5. What is the best method of correcting the soil and compost if it proves incorrect either way ?—D. Platt (Darlaston).**

WE take it that you realise that the pH value of a substance is an expression used to denote its *active* acidity or alkalinity. A pH value of 7.07 represents perfect neutrality. Figures above this represent alkalinity. Below it, they denote acidity. Most pH values are determined by colorimetric methods. A quantity of the soil or compost is shaken up in a test-tube with distilled water. The liquid is allowed to settle, and one or two drops of an indicating liquid are added. The resultant coloration then very accurately gives an estimate of the pH value required.

The best indicating liquid for all-round, general-purpose pH value determination is the " Universal " indicator which is prepared by British Drughouses, Ltd., Poole, Dorset. Incidentally, this firm will supply you with lists of pH determination apparatus and indicators. They have also special equipment of handy size for soil pH determinations, and a most interesting technical booklet on " pH Values : What They are and How to Determine Them."

If the pH value of a soil or compost is too low (i.e., too acidic) work limestone, chalk or lime into the soil; if it is too high (i.e., too alkaline), work peat into the soil in order to render it more acid.

## *Astronomical Telescope Reflector*

**I INTEND to attempt the making of a 6in. astronomical telescope reflector, as described in " Practical Mechanics " for March, 1948, and shall be obliged if you will answer the following queries :**

**(1) Can you give me the addresses of firms where I may obtain round glass blanks suitable for telescope mirrors ; also polishing rouge and fine grinding materials ?**

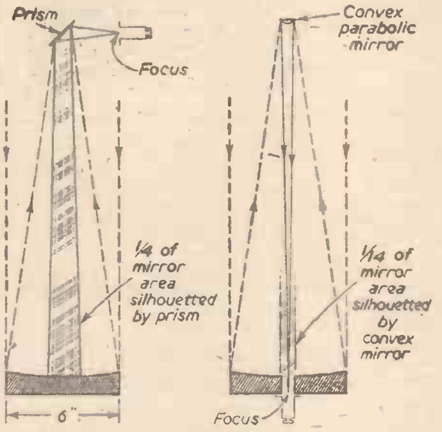
**(2) Is it a fact that the eyepiece of a reflecting telescope is, fundamentally or otherwise, a microscope, and would an ordinary microscope serve this purpose ?**

**(3) Is it possible to use a convex parabolic mirror in place of the usual prism arrangement, as this would seem to have certain advantages ? (See accompanying sketches.)**

**(4) How is the initial rough grinding undertaken ?—W. B. Gilmore (Manchester).**

(1) GLASS blanks can be obtained from Messrs. T. W. Ide, Ltd., Glasshouse Fields, Ratcliff, London, E.1. Abrasives and polishing materials from Mason & Gantlett, Ltd., Menistor Optical Works, Hall Road, Norwich.

(2) The eyepiece of a reflecting telescope is not comparable to a microscope ; a microscope, or for that




*Diagrams showing a prism and parabolic mirror in a reflecting telescope.*

matter a telescope is an optical system consisting of objective (producing a real image) and eyepiece, which converts the objective image into, usually, a virtual image. Other types of eyepieces produce real images. A microscope used in place of a telescope eyepiece *would* magnify enormously the original objective image ; unfortunately it would also magnify the imperfections of the objective, this factor alone making a microscope an unsuitable eyepiece. There would also be ruinous loss of light due to the magnification plus the multiplicity of optical surfaces.

(3) In both Cassegrainian and Gregorian types of reflecting telescopes perforated primaries and small convex secondary mirrors are used in place of the Newtonian prism. Another system which increases magnification whilst reducing silhouetting employs a Barlow achromatic negative lens.

(4) Briefly, the method of grinding the concave surface of a reflector (PRACTICAL MECHANICS, March, 1948), is as follows : a glass disc, equal in diameter to the mirror disc, is used as a tool. The mirror disc, wetted with coarse carborundum and water, is stroked across the tool ; the direction is changed each stroke, and the mirror disc rotated. The tool is usually secured to a post, so that the mirror-maker can walk slowly round it as the strokes change direction. This operation generates a concave depression in the mirror disc, and a corresponding convex in the tool. The coarse ground concavity is smoothed by using successively finer grits, and finally polished with rouge.

## *Removing Cellulose from Cars*

**PLEASE let me know the quickest and best means of removing cellulose from cars for recellulosing, or is this necessary when there is a good surface and when old paint work is sound ? I am using sandpaper at the moment for this work and have tried a sanding machine but the latter is leaving surface too rough.—William Fitz (Co. Down).**

IT is not necessary to remove cellulose paint or enamel from an already cellulosed surface, provided, of course, that the surface is in reasonably good condition. If it is thought desirable to do so, the old cellulose should be removed by means of softening with a paint-stripping composition, followed by gently scraping off the softened paint. Paint-stripping preparations designed specially for removing cellulose paints, enamels and varnishes may be had from any paint stores, or you can make a preparation for yourself according to the following formula :

| | |
|---|---|
| Paraffin wax .. .. .. | 10 parts (by weight) |
| Benzol .. .. .. | 35 " " |
| Methylated spirits .. .. | 30 " " |
| Acetone .. .. .. | 5 " " |

The paraffin wax is gently melted over a water bath. The molten wax is then thinned down to a dilute solution first by the benzol and then by the acetone. Then slowly stir in the methylated spirit, which will precipitate the wax as a voluminous cloudy mass. This is the paint-stripper. It is brushed on to the old paint left for a few minutes, after which the softened paint is then gently scraped away.

## *Denture Moulding Material ; Hair-setting Lotion ; Hairdressing Cream ; Hand Cream*

**I WISH to make up a small quantity of a plastic material with consistency similar to putty, and which will harden fairly quickly. It is to be used on dentures. The idea is to spread the compound on ill-fitting dentures, which will then be pressed into position in the mouth to get the correct moulding, taken out and left to harden.**

**The materials used would have to stand a fair amount of wear and tear in the mouth and in cleaning.**

**I also wish to make up the following :**

**(2) Hair-setting lotion.**

**(3) A hand cream.**

**(4) A hairdressing cream (white type).—S. H. Phillips (Nr. Birmingham).**

OBTAIN from Portland Plastics, Ltd., Wear Bay Road, Folkestone, Kent, a quantity of their " Portex Universal Cement," which is a transparent material based on polyvinyl chloride. Pour a quantity of this into a small dish or saucer and work into it slowly a quantity of dry whiting until you have a material the consistency of putty. This material will be quick-drying and will have all the properties which you desire. If you would prefer a slower drying cement, make use of a solution of 20 parts of polyvinyl acetate in 80 parts of warm methylated spirit. Polyvinyl acetate can be obtained under the name of " Gelva Resin No. 7," from Shawinigan, Ltd., Marlow House, Lloyd's Avenue, London, E.C.3.

(2) The following is an excellent formula for a hair-setting lotion of the average type :

| | |
|---|---|
| Quince seed .. .. .. | 15 oz. |
| Water .. .. .. .. | 5 gallons. |
| Borax .. .. .. .. | 5 oz. |
| Perfume .. .. .. | 2 oz. |
| Benzoic acid .. .. .. | 1½ oz. |
| Alcohol or rectified spirit .. .. | 5 oz. |

Boil the water, add the quince seed and allow to stand overnight, then strain through a fine mesh. Dissolve the benzoic acid in the alcohol and add to the resulting solution.

A hair-setting lotion of a different type can be made according to the following formula :

| | |
|---|---|
| Gum tragacanth (powdered) | 0.2–0.5 gram. |
| Glycerine .. .. .. | 5–10 c.c. |
| Alcohol or rectified spirit .. | 1 c.c. |
| Water .. .. .. | 90 c.c. |

Dissolve the powdered gum tragacanth by soaking and stirring in the hot water. Strain the resulting solution through a fabric mesh, then stir in the glycerine, rectified spirit and also perfume if desired.

(3) The following is a formula for a hairdressing cream of the white wax type :

| | |
|---|---|
| White wax .. .. .. | 10 parts (by weight.) |
| Liquid paraffin .. .. | 125 " " |
| Borax .. .. .. | 1 " " |
| Water .. .. .. | 14 " " |

Allow the white wax to dissolve in about 60 parts of the warm liquid paraffin, then stir in the remainder of the liquid paraffin, also warm. Dissolve the borax in the warm water. Add the resulting solution to the previous solution of white wax and stir the cream thus formed very thoroughly.

(4) Hand cream of the " cold cream " type is prepared as follows :

| | |
|---|---|
| Spermaceti .. .. .. | 125 parts (by weight.) |
| White wax .. .. .. | 120 " " |
| Liquid paraffin .. .. | 500 " " |
| Borax .. .. .. | 5 " " |
| Water .. .. .. | 110 " " |

Dissolve the borax in the hot water and the spermaceti and white wax in the heated paraffin, to which should also be added whatever perfume or odiferous oil is required for the cream. Keeping the paraffin solution as hot as possible, add the borax solution to the latter in a slow stream with rapid, preferably mechanical, stirring. If mechanical stirring is not available, a rapidly agitated fork may be used. The resultant product will be a white cream which will tend to thicken considerably as it cools down to normal temperatures.

Please note that this skin cream is one of the theatrical or pharmaceutical types. It is not a cream of the " cosmetic " or " vanishing " type, which creams are usually based on stearic acid. If you desire a cream of this nature, perhaps you will write to us again.

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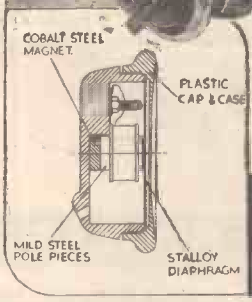


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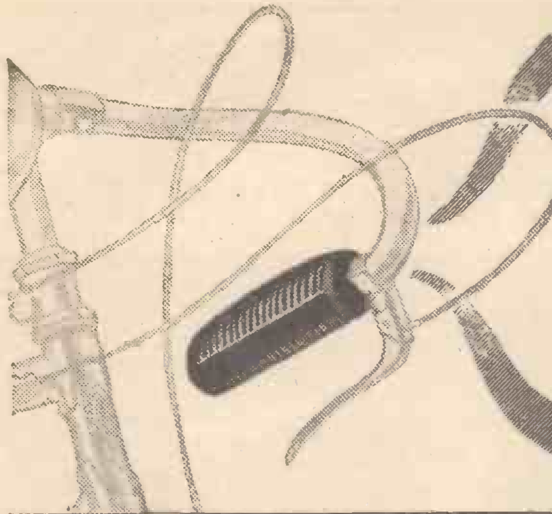

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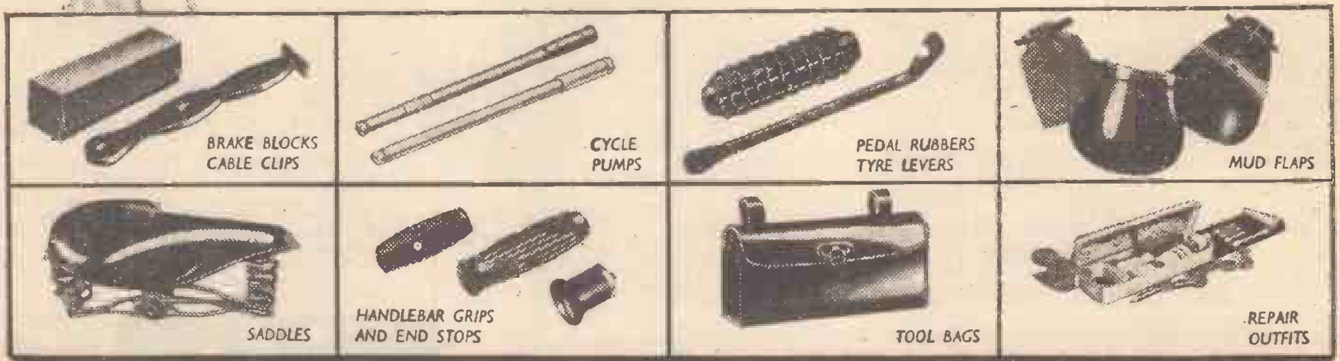


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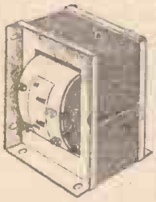

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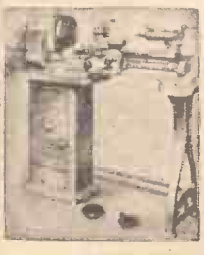

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THE Cyclist
Editor: F. J. CAMM
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# Comments of the Month

By F. J. C.

### R.T.T.C. Climbs Down

FURTHER vindication of the B.L.R.C. policy on mass start racing was forthcoming when, by 40 votes to 6, after discussion lasting two hours, the Road Time Trials Council, at its May meeting, lifted the ban on mass start road racing. It is true that its decision rather hints at a fault but hesitates dislike, is willing to wound but yet afraid to strike. In other words, it is afraid to admit that during the past ten years its attitude, like that of the N.C.U., towards mass start racing has been wrong. Events have certainly proved the policy to be wrong for none of the gloomy prognostications as to what would happen when traffic became more dense have come to pass. The decision of the R.T.T.C. is couched in cowardly phraseology. Its lifting of the ban is an endeavour to placate its members into believing that whilst it still dislikes mass start it has been forced to approve it against its will. The motion carried by the council is:

"That this National Council of the Road Time Trials Council though unconvinced of the desirability or wisdom of holding mass start cycle races upon the public highway, and still believing that serious harm to the sport and pastime of cycling might result from such promotions, does not desire to precipitate further disagreements in the cycling world at this stage, and is therefore prepared (subject to satisfactory agreements being concluded) to withhold its opposition and review the position again at the next annual meeting.

"That for the period June 25th, 1952, to January 31st, 1953, the following wording be substituted for regulation 48:—

"No member of an affiliated club shall be associated as a competitor or official with an event on the public highway in the Council's area of jurisdiction in which riders of two or more machines start simultaneously, save where such event is promoted under the rules or regulations of an organisation with which the Council has an agreement."

If the Council is unconvinced it must be unconvincible. There is an air of pique about the resolution because they have been beaten. Ten years is a fair testing period and no "serious harm to the sport and pastime" has occurred. On the other hand, mass start has brought an enormous amount of beneficial publicity to cycle sport, and it is time that the R.T.T.C. realised that the hole-in-the-corner hide-and-seek method of time trials, so vigorously supported by silly old fogies is passing.

The resolution creates an anomaly. Whilst it allows members of affiliated clubs to ride in mass start events, such must be promoted by bodies with which the council has agreements. The Council formerly had an agreement with the N.C.U. but it expired on June 25th, from which date the N.C.U. proposes to run mass start racing on the highway. Let us not be afraid of that word *racing*, and let us forget that hole-and-corner evasive term "in line," which does not deceive anybody into believing that mass start races are not races.

Unless a new agreement can be reached between the N.C.U. and the R.T.T.C. the latter's resolution is rendered nugatory and abortive. Whilst the R.T.T.C. does not intend to promote mass start races its resolution can throw a spanner into the works. Preferably the R.T.T.C. should come to terms with the B.L.R.C. and ignore the N.C.U.

The resolution means that the B.L.R.C., the newest of the racing bodies, has forced the hand of the two older bodies and caused them to commit a complete and ignominious *volte-face*.

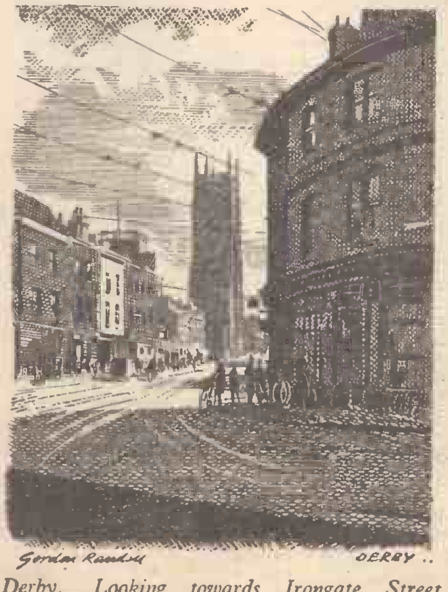
### N.C.U. Rules for Mass Start

THE N.C.U. has already framed provisional rules for the control of mass start races on the road. Fields must be limited to 40 riders for events held under a centre permit and 60 riders for races promoted under a national permit. A club must apply to the centre for permission to hold its event at least eight weeks prior to its proposed date and the application must be accompanied by 15 copies of the course details. The centre committee will then send a representative to inspect the course and if his report is satisfactory full details of the race will be forwarded by the centre to the police authority, six weeks before the event is due to take place. If no objections are received within a week from the police the centre will be free to proceed.

Machines must be tested before the race starts and they must be fitted with two efficient brakes and a *bell*. No rider may use a machine which has not been tested and sealed. The organisers of the race must provide suitable transport for the Chief Commissaire and at least two assistants.

Of course, the N.C.U. requires some publicity out of mass starts! Having hated it and done its best to kill it, it wants the public to know that it is in favour of it, indeed, is proud of it. To this end all official cars must have a windscreen label and a sign of at least two square feet in area on the back bearing the magic words: "Cycling Road Race Under N.C.U. Rules. Official Car." Promoters of the races must take out a public liability insurance policy for a minimum of £1,000 per accident. Riders must obey all road signs, traffic lights and any police signals as well as those given by race officials.

At the moment of going to press the position of the B.L.R.C. is precisely what it always has been—the real controlling body which has sponsored and developed this form of racing in this country. Any attempt by the N.C.U. to usurp the powers of the B.L.R.C. will be strenuously resisted and, on that score, they may rely upon our vigorous support.




*Derby. Looking towards Irongate Street and the magnificent Cathedral Church of All Saints. The tower dates from 1509. In the Cathedral, on the right-hand side of the nave, is the wonderful tomb of Bess of Hardwicke, architect of the first Chatsworth House.*

### Eileen Sheridan

EILEEN SHERIDAN recently broke the W.R.R.A. London to Portsmouth and back record. She took 7h. 12min. 26sec. for the out and home journey of 128 miles, thus beating the standing record by 2min. 48sec. The previous holder was, of course, Marguerite Wilson, who previously had held every one of the W.R.R.A. records.

### Accidents

AS we go to press we have received the figures for road accidents which occurred during the month of March. In that month 13,977 persons were injured on the roads of Great Britain, 336 of them fatally. This is a reduction of 2,465 in the total and of 68 in the killed for the same month in 1951. There was a marked improvement in the figures for all classes of road user except those for pedal cyclists. Pedestrian casualties fell from 5,010 to 4,131, a drop of 879. The number of children killed and injured was 2,897, 414 below the figures for March, 1951. Following a reduction of over 1,000 in the casualties for February, the all-round improvement in the figures for March encourages the thought that the rise in road casualties since the end of 1948 has been arrested.

# An In-line Derailleur "Four"

## Converting a Tri-Velox 3-speed Gear to a 4-speed

By W. HILL

MASSED start road racing, mountain time trials and Continental touring have all emphasised the desirability of some form of multi-gearing on bicycles. The manufacturers gradually responded to the need and bicycles are now available with change speed mechanisms which give the rider a choice of three to ten different ratios. The gear described below was developed to provide a four-speed gear for use on a lightweight tandem but, of course, it can be used on a solo machine if desired.

No tandem four-speed hub gear is manufactured and the objection to the usual type of derailleur four-speed was the excessive misalignment of the chain when in top and low gears, particularly when fitted to a short wheel base machine. This problem was overcome by modifying a standard Tri-Velox A-45 type hub, which maintains correct chain alignment on every gear. The alterations are not difficult to carry out and it is a job which can be done by anyone with a slight mechanical knowledge. The original gear has been used for over 5,000 miles and has not given a minute's trouble. Later, another model was made and fitted to a new tandem; this hub is still in regular use and like the prototype it works perfectly.

Fig. 1 shows a section of the modified hub and it will be seen that the freewheel body is not screwed to the hub, but is free to slide axially on splines on the hub shell. This is contrary to usual practice, as with the derailleur the *chain* is moved on to the selected sprocket, but in the Tri-Velox the spockets move into line with the chain which is held in constant and correct chain line by the sprockets on the jockey system.

When the control lever is moved, the operating chain slides the axle key in a slot in the axle. This key is in contact with the flat face of a thrust washer, which, in turn, slides the internal sleeve in the bore of the hub. (See Fig. 1.)

The internal sleeve has a dual purpose. First it transmits the lateral movement via the two keys to the free-wheel body and secondly it prevents the ingress of dust and water through the hub slots when in the lower gears. This sleeve, whilst it can be moved laterally in the hub, is also free to revolve with the hub around the axle as there is a clearance provided between the inner and outer thrust washers. The return movement of the freewheel is made by the return spring which is situated between the screwed cup and the sliding sleeve.

To convert from three speeds to four, extra movement of the freewheel must be provided, also a slight re-arrangement of the sprockets is necessary, so that the distance between them is less. The parts which require attention are as follows:

1. The hub shell.
2. The freewheel keys (2).
3. The sliding sleeve nut.
4. The axle.
5. The sprocket packing ring.
6. The sprockets for low, third and top gears.

Though this appears a formidable list the alterations are not difficult to carry out, in fact most of them can be done in a few minutes with a file.

### Dismantling

The first job is to dismantle the hub, and those who are not familiar with it should follow the instructions below, in the order given. First the cone on the gear side should be unscrewed, the axle partly withdrawn and the dust covers at either end of the hub gently levered out with a screwdriver so that the balls and axle can be removed. Next unscrew the right-hand cup which has a right-hand thread. This is best done by using a flat piece of metal that will fit in the slot in the cups. The metal should be held in the vice with about $\frac{3}{4}$in. protruding and the hub located on it. By rotating the wheel in an anti-clockwise direction the cup will unscrew, and when this is removed the return spring can be taken out. The slot in the sleeve nut will then be visible. This sleeve nut is removed in a similar manner to the hub cup and when this has been done the freewheel keys will fall out and the freewheel will slide off the hub shell.

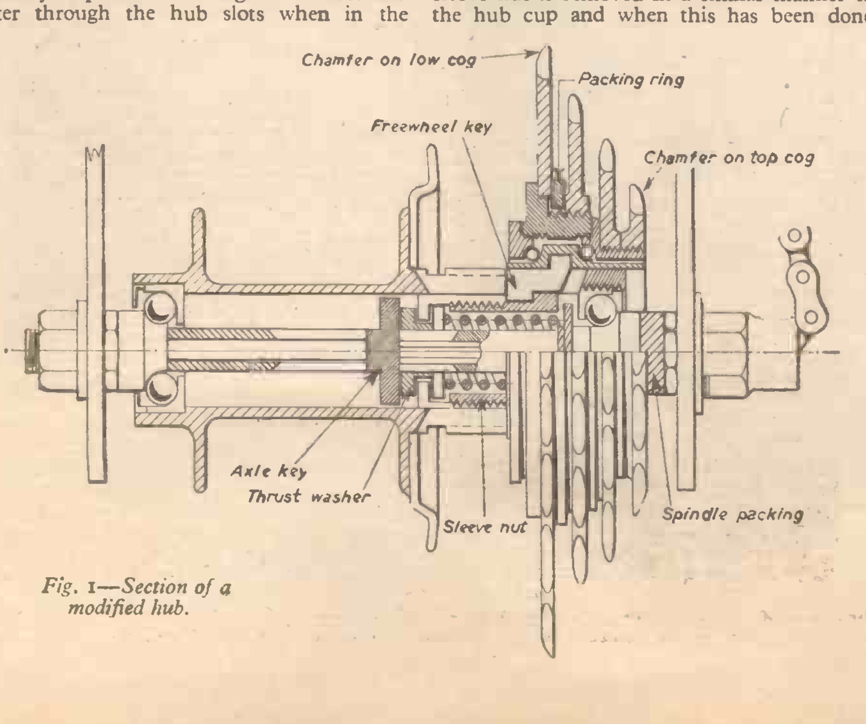



*Fig. 1—Section of a modified hub.*

The sprockets are best removed with the freewheel in the hub, as this makes it easier to hold. Do not use a hammer and punch to unscrew the sprockets: use two chain wrenches, one wrapped round the low gear and the other on the cog to be removed. The low gear sprocket is located on splines and will slide off the freewheel body when the middle sprocket has been removed. When the dismantling is completed, work can be commenced on the modifications.

### The Hub Shell

Starting with the hub shell (see Fig. 2), the centre slots must be filed so that the end is just flush with the back of the screwed cup. That is $\frac{1}{8}$in. from the end of the hub. Make sure that the freewheel keys will slide freely right up to the end, or the gear will not change easily into low gear. Do not, however, make the slots wider than is necessary.

The axle should be dealt with next and all that is required here is to extend the slots in the axle 5/16in. farther towards the control end of the axle (see Fig. 3).

As with the hub slots, the axle key must slide freely right to the end when the control chain is pulled. It is best to re-assemble these parts and test before assembling into the hub.

Fig. 4 shows the sleeve nut and the modifications necessary so that the nut does not foul the screwed cup when pulled into the low gear position. This can be done either in the lathe or by filing, and when it is down to size the slot in the end should be recut with a hacksaw and thin file so that it can be properly tightened up on assembly.

The two keys (see Fig. 5) which connect the sleeve to the freewheel body must also be cut away to give the extra clearance. The sketch is self-explanatory.

### Spacing the Sprockets

Tri-Velox sprockets are spaced at 5/16in. centres, but this is too wide for the four-speed and the distance ring which fits between the low and the second sprocket must be reduced in thickness to 3/32in. This is best accomplished in a lathe, but it can be done by grinding or filing. Great care must be taken to ensure that both faces are parallel or the low gear will not turn true.

There only remain the sprockets to alter to complete the hub parts. The low gear sprocket should have its teeth chamfered by grinding at one side. This has the effect of moving the points of the teeth from the centre of the sprocket to a point closer to the next sprocket, thus assisting the chain to climb on to the low gear cog when the control lever is operated. The second sprocket needs no alteration as the thinner packing ring allows it to screw nearer the low gear sprocket.

Third gear sprocket is a standard Tri-Velox top gear cog with one flange ground off completely and 1/16in. ground off the other. This screws on to the freewheel with the flat face against the shoulder at the end of the thread. Finally the top gear is another similar top gear cog with one flange ground off and the teeth chamfered slightly as shown in Fig. 1. This sprocket is fitted with the flat face and chamfers facing outwards.

When assembled on to the freewheel they

(*Continued on page 76*)

# AROUND THE WHEELWORLD

By ICARUS

### Hammersmith Bridge

HAMMERSMITH BRIDGE, much used by cyclists, is to be closed (if it is not already closed by the time these words appear in print) for essential repairs. There is no indication as to how long the repairs will take, but it will certainly be many weeks.

### Another Blonde Bombshell?

EILEEN SHERIDAN'S successful attacks on Marguerite Wilson's London to Portsmouth and back record suggests that she intends to storm the citadel so long held by the "Blonde Bombshell." Of course, Marguerite's records have a lot of time to be knocked off them before they are put on the shelf for all time. This reminds me of the fact that during the war I was nearly arrested as a spy when I assisted on one of her successful attempts on record on the Bath road. I was measuring a particular number of yards from a particular telephone post as her turning point when I noticed a crowd gathering, including the local p.c. The latter approached me and wanted to know why I was taking such careful measurements on a Sunday evening, and when I told him that I was awaiting the arrival of a lady on a bicycle he seemed unconvinced. Fortunately, within a matter of minutes, Marguerite arrived and silently turned. Had she punctured and, therefore, abandoned the race it might have taken some time to convince the local police of my good intentions. Anyway, it seems fairly obvious that petite Eileen Sheridan is well on the way to securing the place at present held by Marguerite. I understand that it is unlikely that the latter will attempt to defend her records.

### French Olympic Riders

THE French are far from optimistic about their Olympic riders . . . and this from the nation that took the lion's share of the 1948 Olympic titles.

Their great triumph in '48 was winning the 4,000 metres team pursuit race, when, in the final, they completely demoralised the favourites, Italy. The Italian team broke up under French pressure, and France went on to win in 4m. 57.8s.

Various French teams and combinations have been tried out for this year, but without success. Veteran Paul Ruinart, who runs the Velo Club Levallois, which has produced so many Olympic winners in the past, is urging the French federation to take his club's team intact, Andrieux, Prosdocini, Wisinki and Leidier. Unfortunately, just as in London, cycling "politics" largely influences selections, and Papa Ruinart is not the power that he was.

France won the '48 Olympic road race with Jose Beyaert, but doubts if she can find another winner this year. French amateur road races this year have produced a bewildering variety of results, and the selectors, in sheer desperation, propose to pick the team by allocating points for places on races run, and hope that the six men chosen will shake down at short notice into a coherent team.

### Tour de France

BRITISH cycle makers have once again missed a grand opportunity for publicity in the famous Tour de France, the month-long cycle race which started at Brest on June 25th, and finishes in Paris on July 19th. With the need for exports of bicycles more urgent than ever, a British showing in this race—the shop window to the world as far as racing bicycles are concerned—deserves both Government and industrial support.

Crack teams from every country in Europe are competing, and foreign cycle makers are spending fortunes on these teams, hoping for a win.

Granted that a British team, in its first year of competition, wouldn't stand an earthly chance of winning, but there's more to it than that. For instance, in the recent Warsaw-Berlin-Prague race (over 14 days), a British team, mounted on British machines, won. Ian Steel, the British winner, rode from start to finish on the same bicycle, despite the terrible road conditions. The Belgian team sustained four broken frames en route. What better proof than this of the superiority of British made bicycles? It could be repeated, to even better effect, in the "Tour."

With an Australian team at present in Europe, a combined British-Australian team could have been entered in the Tour, resulting in world-wide publicity for both men and machines.

### British Competitors

JACQUES GODDET, editor of *L'Equipe*, the French daily newspaper that runs the Tour, has assured me, time and time again, that he will take a British team whenever it is offered. Only one thing he asks is that the British riders prove their merit by competing in a few French classics early in the season.

### National Sprint Championship

COMPLETELY ignoring international conditions, National Cyclists' Union are putting on their 1,000 metres national sprint championship (July 5th at Herne Hill, London) with "two-up" matches. That is, the closing rounds will be fought out with only two riders in each match, as against three riders in Olympic and World Championship races.

N.C.U. excuse is that they are committed to a policy of pressing for "two up" in international racing, and therefore they must back up their arguments by running their own championship "two up." They ignore completely the fact that the public don't like two-up racing, with its inevitable crawling tactics, and the "thrilling" spectacle of riders standing still, motionless, for minutes on end. They ignore completely the overwhelming vote abroad in favour of three-up racing. In other words, the N.C.U. are, as usual, backing a dead horse.

Not that it will make the slightest difference to the result of the British championship. I can't see Cyril Peacock, of the Tooting B.C., losing, no matter what the conditions.

But the point is, if our riders are to compete successfully abroad in Olympic and World events, they should get in as much racing as possible in this country under identical conditions, and the technique for racing "three up" is far different from "two up."

### Olympic Games

THE Olympic Games start in Helsinki, from a cyclist's point of view, on July 28th, and the events comprise four track events (1,000 metres sprint, 2,000 metres tandem sprint, 1,000 metres time trial and 4,000 metres team pursuit), and the road race, over 116 miles.

British selections for the Games are not known at the time of going to press, and in any case are not likely to be finalised until after the national sprint championship, which will be held at Herne Hill, London, on July 5th.

Trials innumerable have been held, and the net result has only been to confuse the

*Beaconsfield—with its wide high street flanked with old houses and inns. The sketch shows the end of the village looking down the Oxford Road towards Holtspur.*

issue. In the sprint, Cyril Peacock, of Tooting B.C., seemed a cert selection . . . only to be beaten by Lloyd Binch in what were claimed as the "final" trials early in June. Tandem trials have given even more confusing results, but the shot-gun wedding of Alan Bannister and "Shinty" Gray (forced into partnership by the Olympic Training Committee) may well prove to be our best, and even possible Olympic winners.

For the 4,000 metres team race, riders have been combined, changed, sacked, promoted, until they are dizzy. In May, one combination was found capable of beating the Olympic record for the distance. Were they at once seized upon and groomed up for Olympic selection? No, two riders were picked and two fired.

Can it be, as many would-be Olympic riders claim, that you have to belong to the "right" club before you can catch an Olympic eye?

Only in the 1,000 metres time trial has form held consistently good, with a clear-cut result which even the N.C.U. cannot ignore. Don McKellow, of London, has proved a clear best at the 1,000 all through the season.

### Olympic Training Committees

JUST to complicate Olympic selections still further there is a clash in the N.C.U. between the two committees concerned. Olympic Training Committee runs the trials, swapping riders as they think fit. But actual selections for the Olympic Games will be made by the Racing and Records Committee who, in former years, have not always seen eye to eye with the Training Committee.

### A Suggestion for the R.T.T.C.

NOW that the uneasy agreement between the R.T.T.C. (the controlling body for time trials) and the N.C.U. has come to an end, I suggest that the former approaches the B.L.R.C. and concludes an agreement, leaving the N.C.U. in the position in which it put itself when it treacherously abandoned all forms of road sport half a century ago. The League and the R.T.T.C. between them could control the two branches of road sport and resist any attempt by the N.C.U. to "muscle in." It would not require a high degree of statesmanship on the part of both bodies to conclude such an obvious arrangement and to turn the tables on the N.C.U. by "proclaiming" (excuse me using this word, but the N.C.U. likes terms like "dissident bodies," "amnesties," and similar legal claptrap) any races promoted by it. It has not been friendly towards the R.T.T.C. and it has asked for complete isolation and ostracism by both of the other bodies. Why give it a further chance to do what it has done so many times before? It has completely upset the world of cycle sport for all these years out of a spirit of jealousy and fear, thinly endeavouring to disguise its real attitude by pious expressions of concern for the sport. An example of a missed opportunity occurred in connection with the recent Warsaw-Berlin-Prague race. They were offered in the early part of this year an opportunity of sending a team over, but they turned it down because the organisers wanted the team to travel at its own expense. It is rather amusing to find that the B.L.R.C. seized the opportunity of sending a team and found that the organisers bore the cost and provided them with a daily allowance as pocket money! What went wrong here?

### B. and B.

A CORRESPONDENT complains of the price he was asked for staying a night at a "recommended" hostelry. He was not allowed a towel, and because he wished to rise early breakfast was out, so was the early morning call and the use of an alarm clock. When I have investigated similar complaints before I have been told by proprietors that they wish to discourage cyclists because their behaviour and general rowdiness annoys the other guests. Cyclists who wish to rise early in order to take part in a time trial are not always considerate of guests who wish to sleep on, and seem concerned with nothing else but their own sport. Little wonder, therefore, that in order to freeze them out, the prices are put up and the service is poor.

My experience of the so-called "recommended" houses is that they should be avoided at all costs. Their accommodation has seldom been investigated and their service is usually very poor. In these days of rising prices cyclists cannot object to increases in price for B. and B. They get a good deal for nothing, and some of them, I understand, are not averse from stealing the soap and the towels!

## AN IN-LINE DERAILLEUR "FOUR"

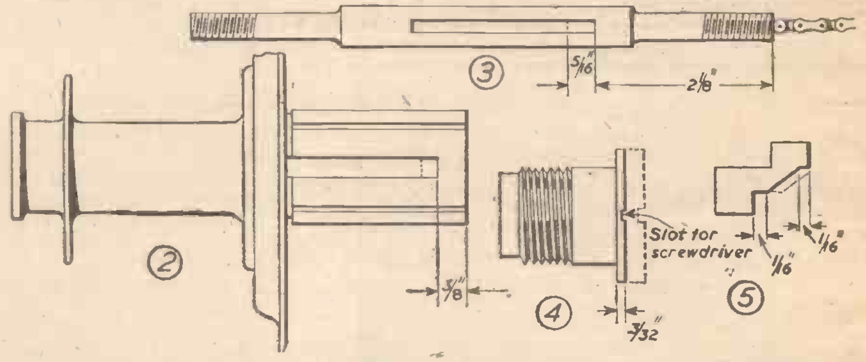
(*Continued from page 74*)

should appear as shown in Fig. 1. Make sure that the low gear cog is fitted the correct way round, that is with the chamfer facing the spokes.

### Assembling the Hub

First assemble the control chain, axle key and indicator rod in the axle, screw on the left-hand cone but do not lock up. Make sure that the key will move the full length of the slot. Next put a little grease on the large thrust washer and stick the washer on to the end of the sleeve. Place the small thrust washer inside the sleeve and insert the sleeve in the hub with key slots opposite those in the hub. Slide the freewheel on to the hub, making sure that the key holes in the freewheel coincide with the slots in the hub, and place the freewheel keys into position, using a little grease to help to hold them in place, with their projections located in the holes in the freewheel body. Carefully insert the sleeve nut and tighten up. The freewheel must slide backwards and forwards freely when the nut is tight.

The return spring should be fitted next, and then its end cap before screwing in the right-hand cup. This cup must be screwed up very tight as serious damage to the bearing surfaces will take place if it works loose. Put a little grease in both cups and then turn the hub over so that the freewheel side is facing downwards. Place nine ¼in. balls in the left-hand (fixed) cup and thread the axle sub-assembly through the hub. Adjust the cone on the axle so that when it is pressed hard against the balls the freewheel is moved 1/32in. away from the hub spoke flange. *This is very important.* Now hold the axle in position with the left hand so that the balls cannot fall out and turn the hub over so that the freewheel is uppermost. If the wheel is placed on the bench the axle will be held in position whilst the distance collar, balls and cone are fitted. The distance collar fits between the end of the cone and the return spring and prevents the spring from rubbing on the back of the cup when the hub rotates. If the instructions have been carried out correctly the freewheel should overhang the end of the hub by 5/16in. when the control chain is pulled to its limit. After this test, the dust caps and locknuts should be fitted and an extra packing washer 7/32in. thick added to the axle on the freewheel side, to give clearance for the extra movement of the freewheel. The spokes should be adjusted so that the wheel is central over the locknuts and extra packing. This will mean that the spokes on the chain side will be straighter up than those on the opposite side. This is known in the cycle industry as a "dished" wheel.




*Figs. 2, 3, 4 and 5.—Showing extended slots in hub shell and axle, reduced sleeve nut head and freewheel keys.*

### The Control Lever

Any friction type derailleur control lever will work well with the gear described provided that it is of the single wire type. The nipple at the control end of the Tri-Velox 3-speed wire should be removed and replaced with one to suit the new control.

Finally, here are a few hints on fitting the gear to the machine:

1. The rear fork ends must be the correct width to accommodate the slightly wider hub.
2. The fork ends must be equidistant from the centre line of the machine.
3. Fit the control and wire before fitting the chain and jockey system and adjust the wire so that the low gear sprocket just clears the spokes when in top gear.
4. When this position has been found move the lever into the low gear position (i.e., tight wire) and then fit the jockey system so that the jockey arm is vertical and the guide sprocket is in line with the low gear cog. Any adjustments must be made by removing or adding to the packing washers on the jockey arm spindle *not* by bending the bracket or adjusting the wire.

Chain length and tension is important. The chain should be long enough to allow the guide sprocket to come close to the low gear sprocket when in low gear. Tension should be just sufficient to prevent excessive slackness when in top gear.

Most derailleur gear troubles are caused through incorrect fitting, but if the foregoing points are borne in mind when fitting the gear, it will work perfectly, and should provide the user with many miles of enjoyable and trouble-free cycling.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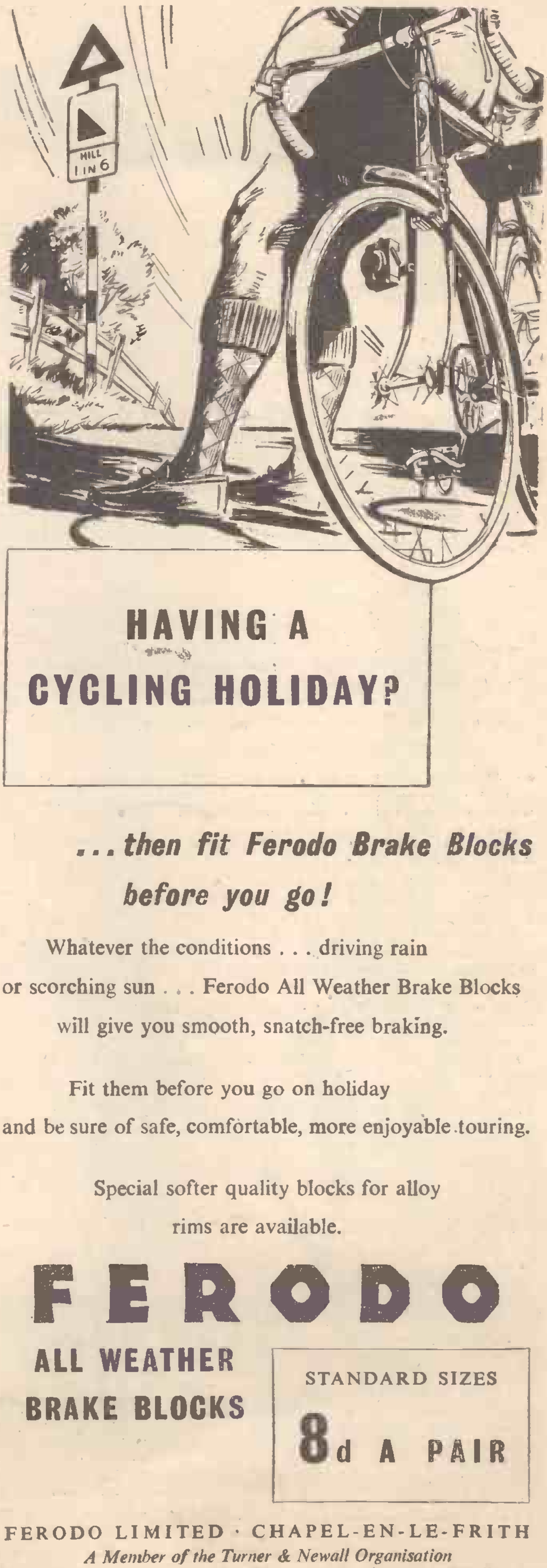
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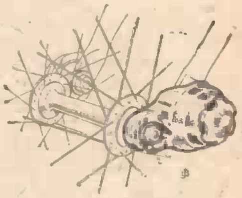

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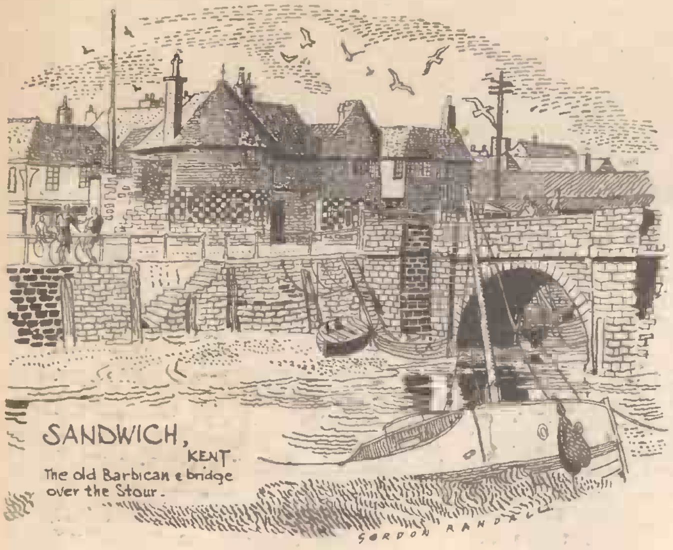
# Wayside Thoughts

By F. J. URRY




### The Sacrifice

THIS year it looks as if I shall finally fall to the blandishments of my family and go to Ireland for the holiday by car, but to be candid I don't want to for I know I shall be bored. The arguments used by my relatives to reduce me to their way of thinking are marvellous. In addition to the familiar one of "You're old, Father William," are the more subtle ones of "the much greater stretch of country we can visit," "that we can carry everything we need, including a complete picknicking outfit, and if the storms drive up, as they probably will, we provide our own shelter." All of this may be true from their point of view, but my contention still is that when you take a car you take the town and the town feeling along with you; you cannot escape that impact; and although you may see a lot of country you often fail to really observe it, to become intimate and to mix with the people and that to me is part of the joy of travel. No doubt it is the next best thing to cycling, but because it is only half alive in the sense of activity I shall miss something vital.

### The New Hub

SOON the Sturmey Archer Company will be re-introducing the tri-coaster hub, to be known as the T.C.W., combined with a 3-change gear in the wide ratio. It was in 1908 that the tri-coaster was first marketed. It was always a favourite form of change gear and brake combined among many British tourists, and I have heard during the years of its non-production numerous folk deplore the fact that it had disappeared. It found its greatest popularity in the Canadian and Continental markets, which is the reason why its reappearance in Britain will be delayed. It is a new design, for the brake has now been housed in the ordinary 3-change hub shell, while weight is within the total of a change hub and a rear alloy brake. Here, then, is braking power and gear change simplicity in one component, and I imagine it will be popular with tourists, especially Continental tourists. In this connection I recollect the advice of "Kuklos"—the late Fitzwater Wray—who, when he discovered the muscular springs of youth had lost something of their erstwhile temper, said he found great benefit from a wide ratio S.A. hub by using the high gear as his normal 72in., and then two lower ratios as the ideal means of keeping to the saddle when the desire to walk was not in him. When you think of it in touring terms it is not at all a bad idea, for who needs a higher ratio than 72in. for ambling over this delightful land, or any other you fancy? High gears are for a racing lad, you and I as wanderers do not really need them, and in most cases are far more comfortable pedalling—with plenty of ankle action—than pushing. This lesson is not easy to learn among the young and vigorous, but it is just as well to keep in mind for the later years when the trick to roam is far more important than the trick to roam swiftly.

### The Lucky Ones

I HAVE not noticed any diminution of motor-cars on the roads since petrol rose to 4s. 3½d. per gallon in spite of the published comments that the increase would gravely affect the individual who can only just afford to run a car. I suppose it does, yet I seem to see a lot of old crocks still making the miles at the week-ends. Personally, I am sorry about any increases in the costs of travel or holiday-making because I like both; and even my limited use of rail, to put me in the best position to make the most of my limited physical powers, adds more than a trifle to expenses and on top of that are the rising prices of accommodation. Still, I get off very well because I am a cyclist, for my bicycle is in being and it costs me no more to run to-day than it did a decade ago, or at any rate merely a trifle in tyre, chain and brake-block replacements. No, we cyclists have little to complain about in the matter of travel expenses, and the remarkable thing is that more folk are not alive to this side of the question of costs. Bus and train fares are up, and may go higher, but these rises pass us by, and the fact that I dodge them also keeps me fit for reasonable perambulations in the best of company. I know some folk say they could not possibly use a bicycle for the daily journey—the traffic is too heavy. Yet I do, and enjoy it, and my daily riding includes ten miles of the heaviest traffic in the Midlands. Use, I suppose, is the answer, and what a fine reason that is never to give up the daily journey, a sure money saver and a begetter of health; for, while I love my "free" riding and touring, be it known that I am a utilitarian in the complete sense of that term, and should be sad and sorry to ever fall from that habit of grace.

### Let us Beware

IT is a pity that so many people think cycling is outdated as a method of travel, and only valuable to work off the high pressure of youth. When you come to analyse that notion it is just a form of snobbery induced by idleness, for, whatever people do in the future of the world, the bicycle will still be with them as long as roads run. The U.S.A. has done its best to kill cycling as an adult pastime by writing it down in the social scale and making an article so designed and equipped as to simulate a motor-cycle, often enough including the noise as well. Their market was wide open for the British type of bicycle, and the Americans wise enough to buy them have found a quiet solace in the pastime. Indeed, the British invasion has roused the U.S.A. makers to demand a much heavier import duty on our machines, a demand made by manufacturers who know nothing about the finer points of the machine or the pastime. In this age of power, when everyone is in a hurry to rush from place to place and merely glance at the beauty, there is some danger we may fall into a similar error were it not for the vitality of the clubs and the athletic wisdom of our youth. What I should like to see is an upsurge of middle- and old-age cycling, an interest in sight-seeing and absorption amid the quietude of remote places where the whirr of machinery seldom penetrates; something of the joy of the walker but eased and made simple for the elderly. Here it is, ready to hand, with all the snags overcome long ago, for the possession of the modern well-equipped, made-to-measure machine is really an instrument of wandering, trebling walking speed, and giving—without consciousness—that need of exercise which grows more important as the years mount.

### Health and Dignity

THERE, then, is the desire, and I think it is up to all of us to propagate it. Some folk will say what is the use, we are in the age of the motor-car and people by and large are inherently lazy and desire their pleasures presented, not earned. There is a lot of present-day truth in such a statement, but it leaves out of count one important factor—health. If a man is whole, he cannot be fit without the aid of exercise. If you consider that to be an over-statement, think of the folk you know to whom it applies, and let the lesson sink home. I'd rather be fit and poor than flabby and full of this world's goods, for I can then greet the dawn and the evening with the joy of freedom and a fine feeling of well-being instead of finding difficulty in rousing myself to any activity needed for the pursuit of pleasure. There is no ideal about it, it is within the compass of the vast majority, young, middle-aged and old, but despite the number of cyclists vast numbers are still uninterested. I wonder why? I have gathered so much joy from my cycling, it often passes my comprehension why so many folk look upon it with the studied notion they would be lowering their dignity even to attempt the proof of my assertion. Is there dignity in the possession of money, and, more important, is dignity more pronounced in the man who travels by the power of his body, or in he who whisks round in a self-propelled perambulator? I think the question needs no answer. "We cannot go so far," people say. Yet, is the pleasure of roaming in distance or observation? Again, unless all the philosophers are wrong, there is only one reply, and at the end of the story the answer is cycling.

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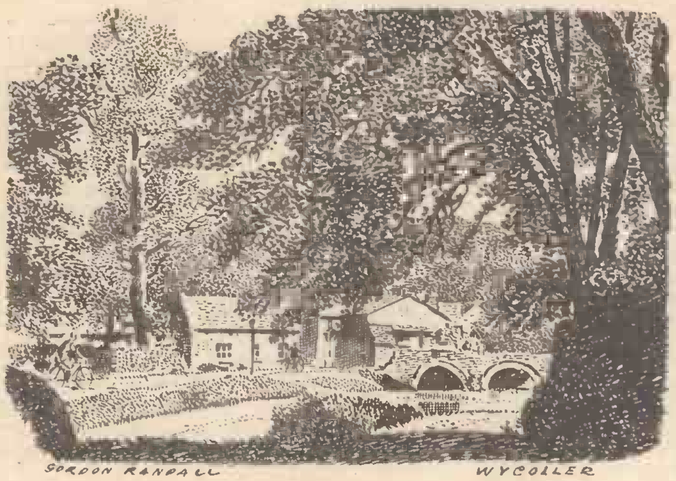
# CYCLORAMA

By H. W. ELEY



GORDON RANDALL WYCOLLER

A remote and lovely village lying near the N.E corner of Lancashire. The village has two very ancient bridges - one a primitive long single stone, the other shewn in the sketch a two arch of rustic masonry.

## Cycling M.P.s and Peers

CYCLING has always been a truly universal pastime, restricted to no one class of the community, and it is interesting to note the recent questionnaire sent out by a London club, in order to ascertain how many of our present Members of Parliament are enthusiasts for the wheel. So far, I gather that six names have been collected, Mr. Norman Dodds (Dartford); Mr. Tom Fraser, formerly Parliamentary Secretary to the Secretary for Scotland; Mr. Ernest Marples, Parliamentary Secretary to the Ministry of Local Government and Planning; Mr. John Parker (Dagenham); Mr. Alec Spearman (Scarborough and Whitby); and one peer, Lord Wilmot. I have little doubt that this short list will grow, for I am sure that among all our present M.P.s there are many who remain faithful to the bicycle, and who are regular riders. Maybe some of my readers know of others?

## The Problem of Steel

IT appears that the somewhat drastic cut in steel supplies for motor-cycles, during the second quarter of the year will mean a reduction in supplies of machines for the home market of some 50 per cent. The manufacturers are hopeful that this will enable them to maintain last year's record export figure of £12,217,102—always provided, of course, that export markets are not closed to them. This is an illustration of how the home consumer will perforce have to suffer in the cause of exports; but as exports are of paramount importance, nobody should grumble.

## Lush July

NOW that July is here, we have high summer indeed; I like this full summer month, when the countryside is lush and green, and the big trees spread their green arms like canopies across the lanes. Come August, and the green freshness will begin to wane, and the peak of summer will be passed. Now, when I take my walks abroad, all is rich and bountiful, and I love to wander in the woods, and over the common, and spend lazy moments by the stream where the brilliant dragon-flies flit about like meteors in the summer sun. Noon-day is hot, and if one has walked far, the sign of the inn is welcome indeed! If I start my morning ramble early and cut over the common where the gorse blooms like fire in the sun, I can make the village of Long Hursley by about half past eleven, and good it is, at that hour, to enter the cool tap-room and sip a tankard of Staffordshire ale, and talk for a while with men of the land. Our conversational topics are varied . . . dogs, and horses, and crops, and guns, and the waywardness of "Government"—but it is all very friendly, and I always enjoy my rest-by-the-way at the "Cock and Magpie." It was the poet Shenstone who wrote of the "warmest welcome at an inn" . . . and how right he was!

## Tyres . . . Tyres . . . Tyres

BRITAIN made more than 100 tyres for export *every minute* of a 45-hour working week during the year 1951. This is "great going"! The 1951 total of 14,654,848 tyres is more than 2,000,000 up on 1950, which was, until then, a record year. When one muses upon the small beginnings of the pneumatic tyre industry, and the romance of its growth, these figures are most impressive. Between six and seven million tyres, directly exported, brought in the huge sum of £29,929,350. This figure relates to outer covers only, and a figure of £2,630,216 must be added for inner tubes. Truly, in "the world of wheels," Britain is by no means down and out!

## Derbyshire Dialect

ALMOST every week, I add to my collection of Derbyshire sayings and words, and I toy with the pleasant idea that one day I shall be able to compile a little book on the subject. These good folk of my neighbourhood have some quite unusual words in their vocabularies, and the other day, chatting to a villager, I noted "rammel"—a word used to denote a lot of "junk" in a shed. Now, I had not previously heard that expression, and I fancy it must be peculiar to the county. There is also "duffel"—a word used to indicate that one is flustered or bothered about something. "All in a duffel" means, in this pleasant land of lead-mines and stone walls, to be in a state of flurry or bewilderment. I have not met with the expression elsewhere, so down it goes in my "dialect note-book"! Every English county has its own appealing words and expressions, and it will be a sad day when our national language becomes standardised, the man from Durham speaking exactly like the man from Sussex, and there being no difference between the soft speech of the Devonian and the lovable twang of the Cockney. I am all for differences and variations, and find them the charm of England and her shires.

## Fan Mail

I COULD not, in truth, like the film stars, claim that I receive a "fan mail," but the fact remains that I am fortunate in being the recipient of many letters from readers of "Cyclorama." I always welcome these friendly notes about cycle touring, and the sights and sounds of the countryside, and the romance of the rolling English road. The other day, my post-bag contained a letter from a cyclist who is an enthusiast for "homely Hertfordshire," and he wrote very interestingly about ancient St. Albans, rightly claiming it as one of the very oldest towns in Britain. He referred to the days of the Roman occupation, he reminded me of the martyrdom of Alban, and evidently knew a great deal about the great abbey church, which is one of the finest medieval buildings in England. My good correspondent also knew something of that very ancient inn—"The Fighting Cocks," built on the site of the old watergate of the abbey. Of course, there are many who claim that "The Fighting Cocks" is THE oldest inn in all England, but I have never found convincing proof of this claim, and am well content to know that it is ancient and venerable! My correspondent referred to pleasant Bishop's Stortford, the birthplace of that great Empire builder, Cecil Rhodes. He was born there, in the vicarage, in the year 1853. Personally, I never visit Bishop's Stortford without having a vision of Rhodes in South Africa, and I see that lonely tomb hewn from the granite of the Matopo Hills—the tomb of the man of epic achievement, and yet who could say, as he lay dying, "So much to do . . . so little done." Thank you, my good cycling friend from Hertfordshire!

## Rain and Rainbows

HOW I love a walk in the rain! How good to feel July rain on one's cheeks, and hear the gurgle of it in the ditches and little brooks! Some folks, when it rains, close their doors and fly to the delights of the fireside. Personally, I take my stick, whistle for my dog, and go for a long tramp over the fields. There is sweet refreshment in rain; there is benison for the fields and crops; there is joy in the tang of the rain in one's face. Then, after the rain, comes the rainbow, gorgeous in hues, and majestic in its shimmering arc, and, when one gets home, how good then to get into dry clothes, light a pipe, and spend an hour before the fire with a book! Be thankful when the windows of heaven open, and the blessed rain comes down!

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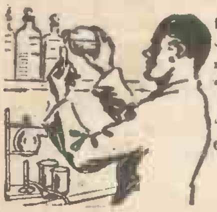

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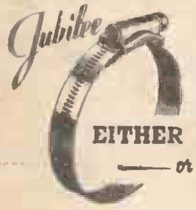

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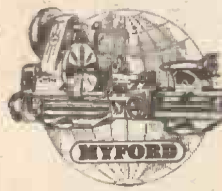


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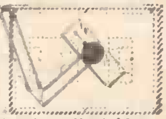

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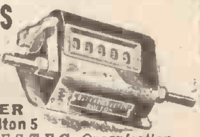

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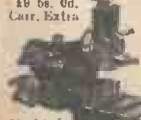

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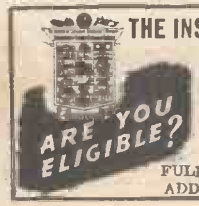


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