26

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NEWNES

PRACTICAL MECHANICS

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JUNE, 1956

EDITOR: F.J. CAMM

1,000 H.S. Inserted Blades Expanding Reamers, 21/32"-23/32", 16/- ; 11/16"-¾", 17/6 ; ¾"-27/32", 17/6 ; 27/32"-15/16", 18/6 ; ⅞"-31/32", 18/6 ; 15/16"-1 1/16", 20/- ; 31/32"-1⅛", 22/6 ; 1 1/16"-1 3/16", 27/6 ; 1 3/16"-1 11/32", 32/6 each.

200 Slotting Cutters 2¼" dia. ⅛" thick, 1" hole, 5/- each.

500 Sets Hex. Die Nuts. Sizes ¼", 5/16", ⅜", 7/16" and ½" Whit., B.S.F., American Car thread or 26 brass thread. These sets are in a neat case. Present-day value over 30/- per set, to clear 15/- per set any thread. Two sets 28/6, four sets 55/-. Also ⅝" and ¾" in Whit. and B.S.F. only, ⅝", 5/- each ; ¾" 6/- each, 10/- per pair.

1,000 H.S. Morse Taper Shank End Mills. No. 1 shank ¼" 5/-, 5/16" 5/6, ⅜" 6/-, ½" 6/6, also No. 2 shank 9/16" 10/-, ⅝" 11/-, ¾" 12/-, ⅞" 12/-, 1" 15/-. Also straight shank H.S. ¼" 3/-, 5/16" 3/6, ⅜" 4/-, ½" 5/-, ⅝" 7/6, ¾" 10/-, 1" 12/6 each.

700 Circular Split Dies, 2½" dia. cutting 9/16", ⅝", 11/16", ¾", ⅞", 1" B.S.F. thread complete with die stock, 42/- per set, actual value over £6. Also ⅝", ¾", ⅞", 1" Whit. and ⅜" and ½" gas thread, complete with die stock, 42/- per set. Any size dies, 7/6 each, die stock, 10/- each.

1,000 H.S. Jobber Twist Drills, 5/32" 10d. ; 3/16" 1/2 ; 7/32" 1/10 ; 15/64" 2/- ; 9/32" 2/9 ; also 25/64", 27/64", 29/64", 31/64", 12/- for four, 3/6 each.

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500 High Speed Side and Face Cutters, 2½" dia., 1" hole, ¼", ⅜", ½" thick, 10/- each ; 3" dia., ½", ¾" thick, 15/- each ; 3½" dia., 5/16", ⅜", ¾" thick, 17/6 each ; 4" dia. ¾", 1" thick, 25/- each. All 1" hole.

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2,000 Straight Shank End Mills, size ⅛", 5/32", 3/16", 7/32", ¼", 5/16", list price 30/- set, handy bargains, 15/- set, also ⅜", 7/16", ½" ditto 12/6 set, all in makers' wrappings.

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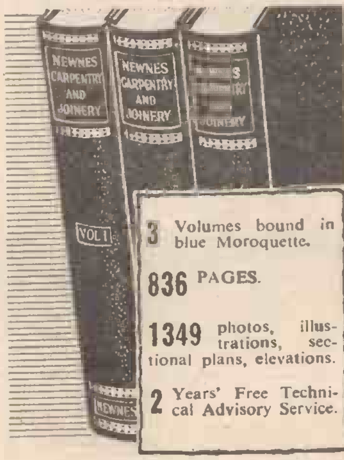

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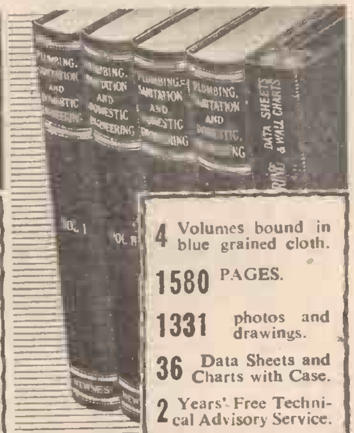

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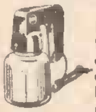

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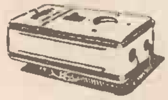

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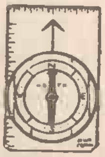

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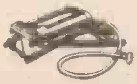

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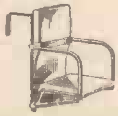

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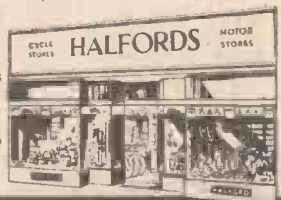

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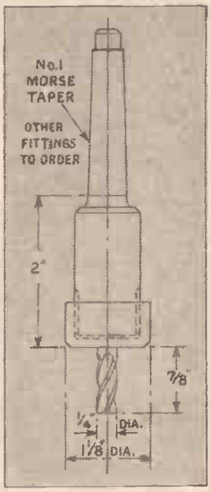

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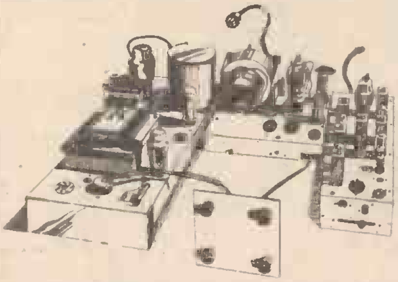

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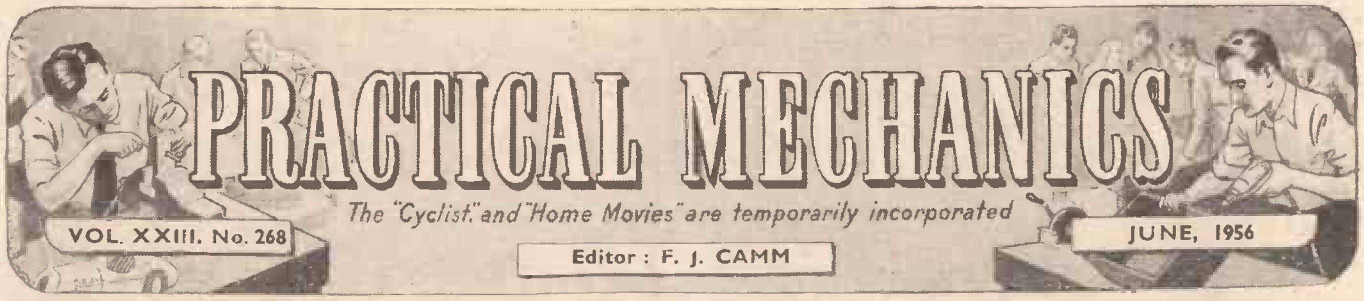

FAIR COMMENT

By

The Editor

Flying Saucers and Fairies

READERS know my views on flying saucers. I have stated that there is no evidence that a flying saucer has landed at any time in any part of the world—that is to say, evidence acceptable to those scientifically trained to accept evidence. There are many unscientifically-minded people who will cry, *Ben trovato !* at the mere sight of some object in the sky which they have not seen before. I have been singularly unconvinced by all of the literature I have read concerning flying saucers, and quite unimpressed with the qualifications of some who claim that flying saucers (by this I mean interplanetary flying saucers) are an established fact. I am, therefore, pleased to note that the *Daily Mail*, in a recent article, dismissed all the talk and all the evidence concerning flying saucers as utter nonsense. In saying this, it must not be presumed that I think that interplanetary travel is impossible, nor that those on other planets will not try to visit the earth.

Whenever I have challenged the flying saucer theorists to open debate they have fought shy of it. Adamski was unable to visit England for his lecture at the Albert Hall, at which I was to be present, because of illness, and spiritualist Lord Dowding did not accept a challenge I issued in these columns to him to a public debate. He now leaps from flying saucers and spiritualism to fairies with facile agility. In a recent lecture to spiritualists he informs us that he believes in fairies and that the fairies are very upset because we do not believe in them. He went on with bland self assurance to tell us that fairies started off as a tiny spot of light and gradually grew, until they became about 12 in. high. He admitted that he had never seen a fairy himself, but he knew a friend who had fairies at the bottom of his garden, and Lord Dowding takes toys for them to play with. He also said that he believed in gnomes—the little bearded fellows of our story books. Of course, as children we are taught to believe in fairies, but disillusionment soon comes. Children soon learn not to believe in fairies, Father Christmas or circus posters. Fairies are childish beliefs and ephemeral ones at that !

It is ridiculous and dangerous for men such as Lord Dowding and others without scientific qualifications but a mere belief, to promote such silly doctrines, which are quite unacceptable to scientists who, whilst preserving open minds, in view of the miracles of today, yet know how to differentiate between the possible and the impossible.

As far as flying saucers are concerned, it is possible for anyone to promote a theory concerning them. They could be caused by experiment with a new form of searchlight—invisible from the ground, but the beams from which become visible on the target by means of radar harnessed to the beam.

I have received a letter from the Australian Flying Saucer Research Society, and the Secretary tells me they have obtained "conclusive proof in Australia that these objects do exist and that they are not secret weapons or aircraft of this or any other country on this planet." They do not say what conclusive proof they have, but naïvely go on to say "we cannot yet prove whence they do come, how they are propelled, the nature of their occupants, if any, and the purpose of their visit." They merely say that everything points to an interplanetary origin and a peaceful mission.

He then goes on to split hairs by stating that I should distinguish between evidence and proof. But proof is evidence, and evidence is proof, and I do not agree with him that there is plenty of evidence which would be acceptable in a court of law, including the sworn affidavits published in Adamski's book. Affidavits, however, are not incontrovertible evidence. A man may swear an affidavit that the moon is made of green cheese, and he may genuinely believe it, but that is neither proof nor evidence. Unless rebutting evidence can be produced, an affidavit is accepted for what it is worth—you either believe it or you do not. Some sworn statements need not be accepted even if they cannot be denied. A man may swear that he has seen a ghost. It would be impossible to sue him for perjury, even though you know he is lying, because it is impossible to prove that he is lying.

There is a little bit of fact mixed with a large amount of hallucination, auto-suggestion, science-fiction and plain hoax, about a great deal of the flying saucer reports. The protagonists point to the miracle of television, forgetful that it is only a reflection of what you see that is taking place in a studio. Solid bodies cannot exist in thin air. It is noteworthy that experienced scientists such as our own Astronomer Royal discredit flying saucers.

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Making an Efficient PRINT WASHER

A Piece of Apparatus which Ensures that Each Print is Thoroughly Cleaned

By H. A. ROBINSON

THE purpose of washing photographic prints is to remove all traces of hypo so that the pictures will be permanent, and this can only be done if the water can swill around the prints individually and the hypo-impregnated fluid be taken rapidly away.

Prints in a bowl may well lie in a solid block at the bottom and so remain hypo-laden. Also, the water

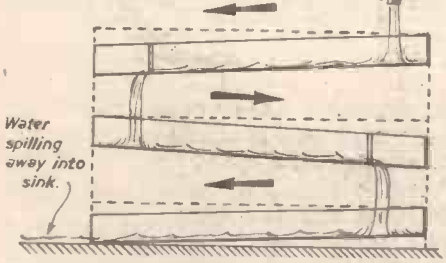


Fig. 1.—The general principle and direction of water flow.

from the tap, if the container is deep, can flow in and out without reaching the lower depths.

The washer shown here eliminates all danger of prints not being properly washed, for the water flows *sideways* over them. Thus clean water is always coming in, while that which is hypo-laden is swiftly drawn away. How the water flows is shown in Fig. 1.

First the trays (1), (2) and (3) are made as Fig. 2. Trays (1) and (2) are the same size, but the lower tray (3) has the base 2in. longer. The sides (d) are all the same lengths, being 12in. long and 1in. deep, ¼in. wood being used. These are fastened to the base (e) by a series of short pins (the base overlapping the sides) and spaced by the three pieces (a), (b) and (c) going across.

Complete dimensions of the pieces are as follows :—

(a) 5½in. x 1in. x ¼in.
(b) 5in. x 1in. x ¼in.
(c) 5in. x 1in. x ¼in.
(d) 12in. x 1in. x ¼in.
(e) 10in. x 5½in. x 3/16in. for trays (1) and (2).
(f) 12in. x 5½in. x 3/16in. for tray (3).

The cross-pieces (b) and (c) have four semi-circular openings taken out of the lower edge, as Fig. 3, so that the water may flow away readily without reaching the tops of the divisions (as shown in Fig. 4), and the size of the openings should be adjusted if necessary to assure this. If the water flows over the tops of the divisions it may carry the prints with it, but by always draining away from below the prints are kept safely in their particular compartment.

The trays made, they are fitted between the four uprights (A) (see Fig. 2 to the left). For the lower end, these are 7in. x 1¼in., and for the higher end of the washer 7½in. x 1¼in. Any ¼in. or ⅜in. material will do for them.

Some little care must be taken in setting the trays between the uprights, for each tray must have a ½in. drop towards the one end and be staggered as indicated in Fig. 1 so that the end of one comes over and within the end of the one below. Trays (1) and (3) slope in the same direction, tray (2) in the opposite way. The middle tray is also fitted in the opposite way round to the other two so that it receives water spilling from the end of the tray above and empties into the one below. Fig. 2 gives the measurements to work to to obtain the required conditions.

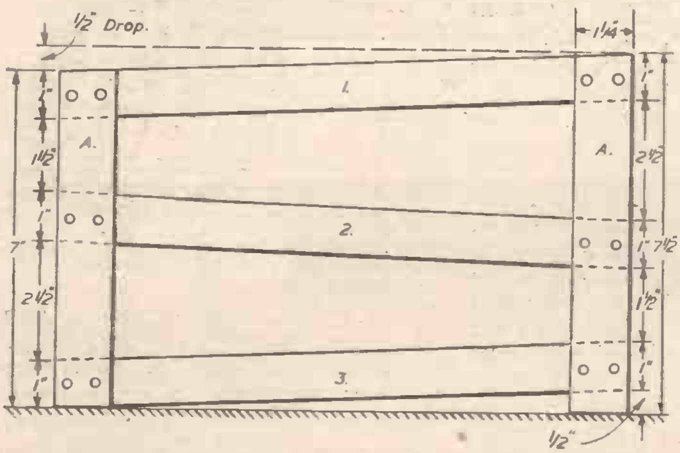


Fig. 2.—Details and dimensions of the frame and tray angles.

The parts are held together by 7/16in. brass or copper screws ; other metals might rust and cause trouble. There are two screws at each point of contact and it is as well to drill a little first to eliminate any danger of splitting. As the trays slope in the reverse direction they lock, and the washer becomes a very rigid article.

The washer can be left in plain wood, but it is much better to give it one or two coats of a commercial water-proofing preparation.

In use the prints are evenly divided between the basins, and the washer is placed in a sink under the tap so that the water falls on to the upper end of the top tray or on the draining board, the water being fed by a short length of rubber hose. The flow is adjusted so that each basin fills without water tending to run over the dividing walls.

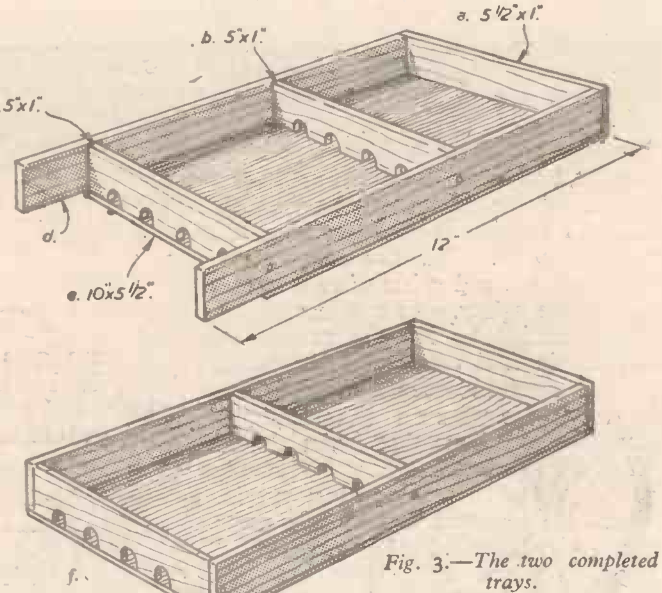


Fig. 3.—The two completed trays.

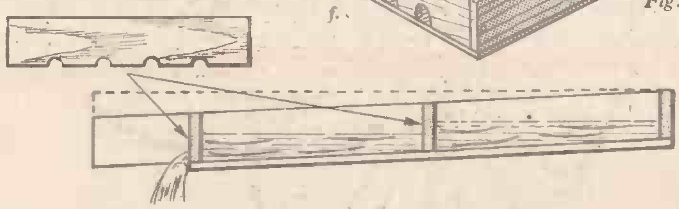
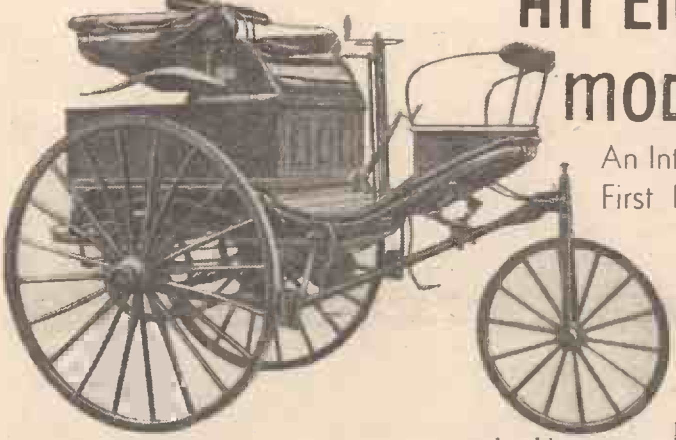


Fig. 4.—The water should flow away without rising above the dividing pieces.

The washer as described is for quarter-plate, 3¼in. x 2¼in., 2¼in. x 2¼in. and similar sized prints, though postcards can be dealt with in the two basins of the bottom tray. Should it be desired to make a washer for, say, whole-plate enlargements, the overall instructions still apply.

AN EIGHTH SCALE MODEL OF THE BENZ CAR



An Interesting Replica of the First Practicable Motor Car

Made by

F. J. CAMM

READERS may remember that I recently made a one-eighth scale model of the first pedal-driven bicycle—the Macmillan—and also a one-eighth scale model of the first practicable motor bike—the 1895 Werner—the latter gaining first prize in the A.C.U. International Model Competition organised in 1954. The models were exhibited at the Cycle and Motor Cycle Show of that year at Earl's Court. To complete the trio of firsts, more recently I have made a one-eighth scale model of the first practicable motor car—the 1888 Benz, and I show some illustrations of it on this and the following page. The model is accurate in every particular and it is, of course, a working model.

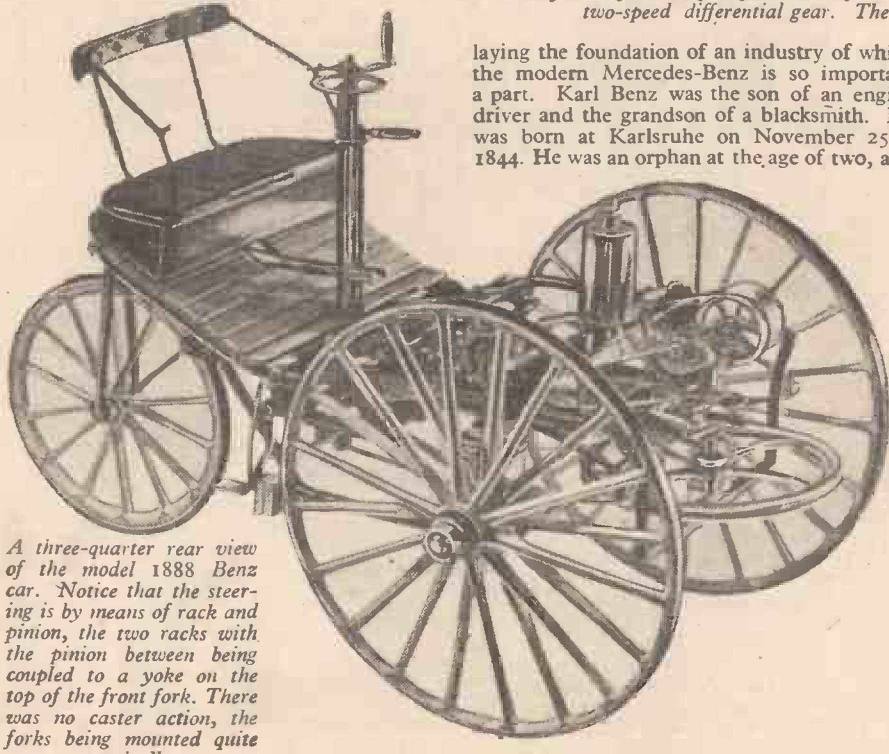
Although Karl Benz made a motor car in 1885 it was a failure. It was in 1888 that, after considerable experiment and failure, he demonstrated his three-wheeler. I am not forgetting the Daimler motor car which was made in 1886, and is now on show at the Munich Museum, and although the car here shown dates back to 1888, it really sprang from the 1885 model, thus beating Daimler by one year. The Benz is of great historical importance. The original is in the Science Museum at South Kensington, and it was from this machine that the drawings were made (by permission of the museum authorities) from which I built my model.

Karl Benz was a pioneer of the motor car, and to him must go the credit of building the first successful petrol-driven car and of laying the foundation of an industry of which the modern Mercedes-Benz is so important a part. Karl Benz was the son of an engine driver and the grandson of a blacksmith. He was born at Karlsruhe on November 25th, 1844. He was an orphan at the age of two, and as a young man secured employment in one or two engineering factories in Germany.

He set up a small workshop in a back street in Mannheim in 1874. In this shop he produced a few stationary gas engines and in 1880 went into partnership with another man and founded the Mannheim Gas Engine Company. In spite of opposition from his partner, Benz experimented with a motor car engine designed somewhat on the lines of his gas engine. When the partnership was dissolved in 1883 two others put fresh capital into the company. Benz had produced a design for a mechanically propelled car and the experimental model was completed at the beginning of 1885. This machine may still be seen in the Deutsches Museum in Munich.

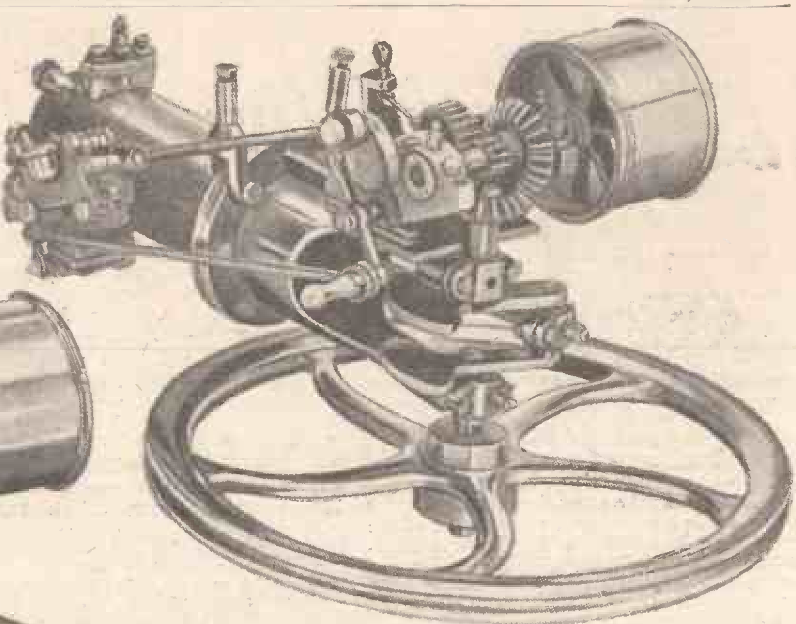
A three-quarter front view of the chassis of the model of the 1888 three-wheel Benz car, with single cylinder, four-stroke, water-cooled engine, with horizontal flywheel. At 250 r.p.m. the engine develops 2 h.p. The wheels are iron-tyred, and the drive was by belt from a pulley driven by the crankshaft, the belt driving on to a combined two-speed differential gear. The model was made by Mr. F. J. Camm.

As in his earlier model, it will be seen that the engine has an open crankcase with screw-down lubricators attached to the bearings and that it is turned over so that the flywheel is horizontal. It was, of course, a crude affair. The flywheel was very large and the r.p.m. very low—250 to be exact—at which speed it developed about 2-3 h.p. Although it was the first car it had a differential gear, electric ignition, water cooling and a mechanically operated inlet valve. All engines prior to this had made use of automatic valves which were opened by the suction of the piston. The engine is of the four-stroke water cooled type, placed horizontally over the rear axle; the drive to the rear wheels was by means of block centre chain from the countershaft, which incorporates the differential gear and the two-speed gear inside a series of three pulleys, the outer two containing the gears and the centre one the differential. The single cylinder has a bore of 116 mm. (4.57in.) and a stroke of 150 mm. (6.3in.), and when running at about 250 r.p.m. develops 2 h.p. The upper end of the vertical crankshaft

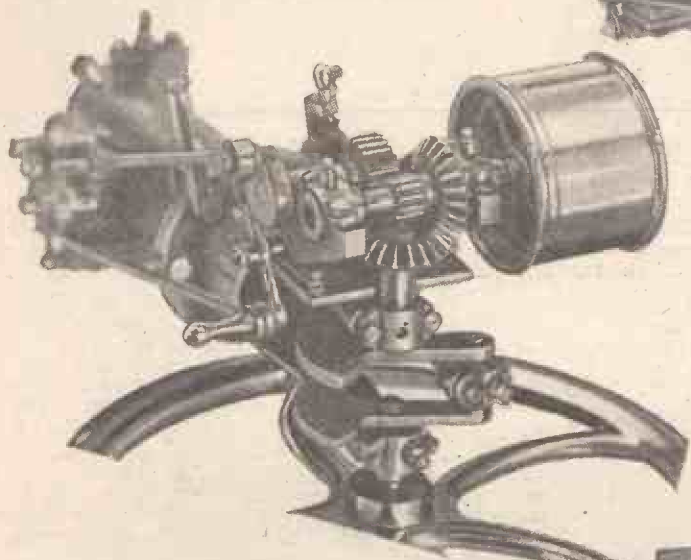


A three-quarter rear view of the model 1888 Benz car. Notice that the steering is by means of rack and pinion, the two racks with the pinion between being coupled to a yoke on the top of the front fork. There was no caster action, the forks being mounted quite vertically.

carries a bevel gear which drives another bevel having the same number of teeth on a horizontal shaft carrying the belt pulley. A parallel half-speed shaft carries the cams for operating the valve gear and the make and break mechanism for the ignition. The petrol-air gas mixture was supplied by a surface carburetter and the ignition by dry battery and spark plug. The engine pulley is connected by a belt to fast and loose pulleys



A view of the power unit of the model. This is a working model. It will be seen that two types of valve are employed—slide and poppet. The crankshaft drives the driving pulley through bevel gearing, which also drives a half-time shaft and operates the make-and-break mechanism and the two valves by means of a cam.



A close-up of the valve gear.

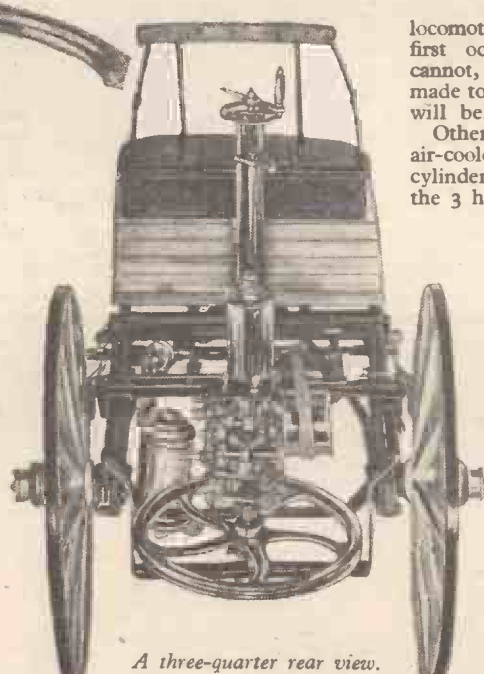
on a countershaft which is divided as explained above. The ends of this countershaft carry sprockets, which drive the rear wheels. The two-speed gear to the countershaft is chain driven. Wooden brake blocks, as fitted to horse-drawn carriages, were used, and they were applied by means of a brake lever through a linkage, to the bottom end of which a pinion and circular rack were fitted. The pinion was fitted to the bottom end of a shaft, running inside the brake lever and which was turned by a handle at the top. When the handle was turned a shifting gear would shift the belt from one gear through the loose or neutral pulley to the other gear. The central position was, of course, used when the brake was applied to disconnect the drive from the wheel. The rear driving wheels are 49.5in. diameter and the front steering wheel is 30in. diameter. The wheelbase is 5.17ft. and the wheel track 3.87ft. The car ran at about 10 and 5 m.p.h. in the two gears respectively. Benz made a four-wheeled model in 1897 and this may be seen at Byfleet, Surrey. I have faithfully copied every detail of the car to one-eighth scale and the illustrations taken with the body removed will give some indication of the degree of realism which has been achieved. Many of the parts had to be built up to avoid the necessity for making patterns and castings. Some of the pieces are, of course, a watchmaker's job. The wheels are felloe-built with shrunk-on tyres.

These three models will be exhibited from time to time at exhibitions where this journal is represented and I hope, as I find the time to spare (!), eventually to make a model of the first locomotive, the first aeroplane and the first ocean-going steamship. The latter cannot, of course, for obvious reasons be made to one-eighth scale, but all of the others will be.

Other early motor cars are the two-cylinder air-cooled four-wheeled Lanchester, the two-cylinder four-wheeled Panhard of 1894 and the 3 h.p. Benz, 1900.

It seems a pity, as I have remarked on more than one occasion, that the Science Museum has not organised an annual competition for scale models, with the right to acquire such models as would enhance the coverage of their own exhibition. It is possible to gain a fair idea of scientific and mechanic development from a visit to the Science Museum, but most of the exhibits are the full-size originals and considerable space would be necessary to exhibit full-size versions, whereas with models a complete coverage of scientific development could be housed in a building much smaller than the present museum.

There are sufficient model-makers in this country to ensure an adequate entry of models in the various classes.



A three-quarter rear view.

A rear view of the body. The two swing doors enclose the power unit.

A front view of the body.

CONSTRUCTING A THERMOGRAPH

An Instrument for Recording Temperature Variation

By M. H. O. HODDINOTT

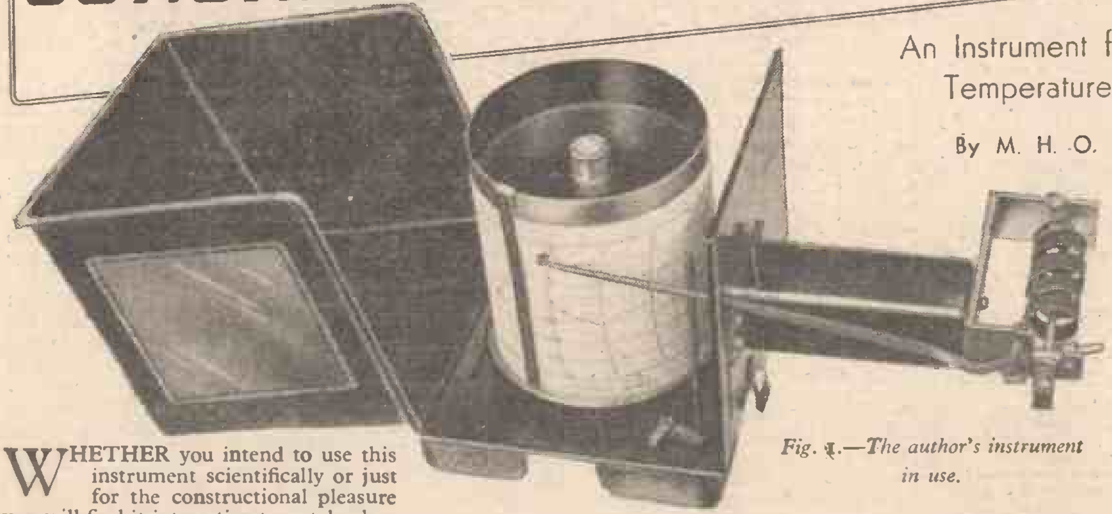


Fig. 1.—The author's instrument in use.

WHETHER you intend to use this instrument scientifically or just for the constructional pleasure you will find it interesting to watch when in action. Basically it is a recording thermometer and its movement depends on the bending with temperature of a bi-metal strip, consisting of steel and brass welded together. The instrument is used extensively in meteorology, but it has a wide scope where it is necessary to have a temperature record.

The main parts of the thermograph are a steel case, with an openable cover, housing the chart drum and motor, and outside the case an arm on which the sensitive element and mechanism is mounted. The link between these two is the pen arm. The general layout can be seen from the photograph, Fig. 1.

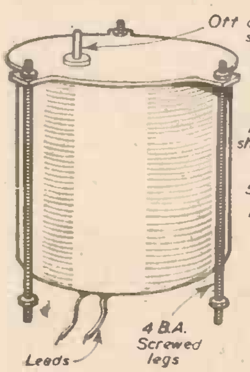


Fig. 2.—Model S7 motor showing mounting.

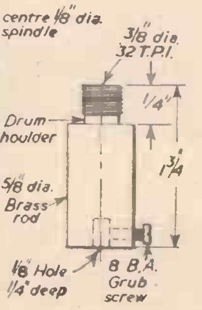


Fig. 3. Drum coupling.

The Drum Motor

Two methods of driving the drum are available to the constructor, electric or clockwork. Although the clockwork is more portable, it is also more expensive, as the drum and clock unit will probably have to be bought complete. This can be obtained from Messrs. Short and Mason of Walthamstow.

The electric method is much cheaper and furthermore gives some interesting work on drum construction. Unfortunately the charts as printed have a rotation period of about seven and a third days whilst the motors are only made for seven-day rotation. This snag can be overcome by reducing the diameter of the drum to the seven-day portion of the chart, and more detail is given about this later.

These seven-day synchronous motors can be obtained from Messrs. Sangamo Weston, Enfield, Middlesex. They cost about 30s., are practically damp-proof, an essential point for outdoor use, and are robust for continuous running without attention. Their construction is simple, being a cylindrical body with a mounting flange at the spindle end. Their consumption is about three watts and they can be obtained for low voltages if required.

To mount the motor three 4 B.A. screwed rods are required, 2½in. long. They should be fitted into the holes in the motor flange in such a way that they act as legs supporting the motor, spindle uppermost (Fig. 2). The spindle of the motor is ⅛in. in diameter and ¼in. long, and it is slightly offset from the centre. A coupling is therefore required to mount the drum to it. This should be made of about ⅝in. diameter brass rod, drilled and shouldered, etc., as shown in Fig. 3. The exact diameter of this coupling does not matter except that anything less than ⅝in. tends to make the shoulder small. The threads at the top need not be 32 to the inch, but a fine one does ensure accurate securing of the drum. Finally a knurled nut to fit the coupling should be made.

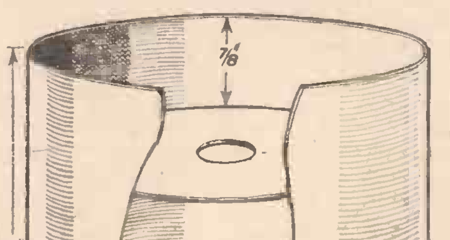


Fig. 4.—Details of the drum.

The Drum

The size of the drum depends, of course, on the chart to be used and the constructor is at liberty to take his choice of the many types and ranges available. The dimensions given here will, however, be for charts numbers 4329 and 4330 (summer and winter range of air temperatures) printed by the Meteorological Office, and also obtainable from Short and Mason.

As already mentioned the motor rotation period is less than the chart marking. To overcome this the charts can be overlapped to take up the extra hours so that only seven days are exposed.

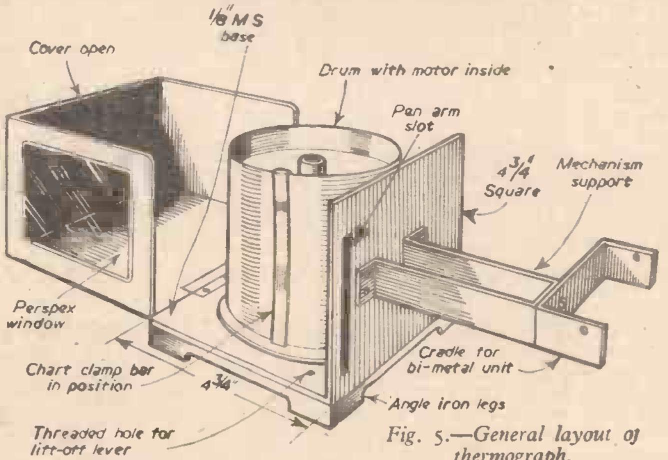


Fig. 5.—General layout of thermograph.

To make the drum obtain a piece of 18g. brass, copper or, as a last resort only, steel and cut it to 11in. by 4in. Roll it carefully until the two ends are just past meeting. By careful adjustment it will be possible to arrange that these two ends will just close under their own springiness. Make sure that the edges butt exactly as they are to be soldered. From another piece of the sheet metal cut a circular disc to such a diameter that it will just fit inside the drum when the two ends are held together by a binding. If a lathe is available the disc should be cut on it and then a ⅜in. hole drilled in the centre. From a further piece of metal cut another disc 3¾in. in diameter and mount it by soldering screws to it on the lathe faceplate. Set the tool in ¼in. from the outer edge of the disc and cut into it until a ring of metal comes away, ¼in. wide and 3¾in. outside diameter. This is to be used as a shoulder against which the bottom edge of the chart will rest.

Assembly

Ensure that the binding around the drum is secure and insert the inner disc to a depth of ⅛in. from the top edge. Rest the whole drum on the flange ring making sure it is central with just under ⅛in. visible on the inside and outside of the drum. With great care solder up the joints, beginning with the drum itself, then the flange and finally the inner disc. Use

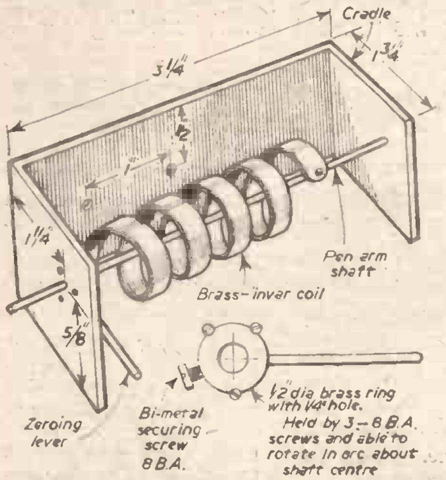


Fig. 6.—Bimetal mechanism and zeroing lever.

a high tin solder which will have a narrow setting range and help in preventing a general collapse of all the joints.

A suitable flux for this job can best be made up on the spot. Add about two tablespoonsful of zinc chloride to half a cup of warm water. Allow this to dissolve and add about half a teaspoonful of ammonium chloride and hydrochloric acid to the cup. Stir up with a non-metallic spoon. If it is necessary to store this flux put it in a bottle with a plastic or cork top. It will corrode metal and destroy the flux. As a source of heat use a bunsen burner. The ordinary soldering iron will not provide enough heat to solder such an area of brass. If the joints are a little rough then a file and emery paper must be used to clean them up. If properly done they should be almost invisible.

When all the soldering has been completed, cut a small slot in the flange ¾in. long and 1/16in. wide to receive the chart clamping bar (Fig. 8). This should be made of slightly springy brass with the hook at the top end capable of being fitted over the top of the drum when the bottom is in the slot in the flange. By having a slight curve in it, it will clamp the two ends of the chart to the drum.

The Case

The general outline and dimensions can be seen from Fig. 5. It should be made of ⅛in. M.S. plate 10in. long and 4½in. wide and bent to the shape shown. The base and right-hand fixed side are all made from one piece.

The cover is made of light gauge steel (biscuit tin thickness) with a window added. The edges of the cover can either be rolled over or have ⅛in. brass wire soldered on to strengthen them. The hinge is soldered to the cover and screwed to the base. The legs can be made from one piece of angle iron ½in. wide and 18in. long. Cut 90 deg. segments out of one leg every 4½in. along it. When it is bent it will form a square, the upper faces being held to the underside of the base by four 4 B.A. screws. The additional cutaway as shown in Fig. 5 is only to improve the appearance.

A slot should be cut to allow the pen arm to move up and down as shown in Fig. 5. The easiest way to do this is to drill a line of ¼in. holes, starting from a point 1in. from the base and 3/16in. in from the front edge. The line of holes should be continued for 2¾in. When complete they can be amalgamated into a slot by cutting with a saw blade.

The mechanism support is made from a strip of 1/16in. by 1in. M.S. 9in. long and bent as shown in Fig. 5. The screws for securing it to the case are two 4 B.A. drilled ⅝in. apart and screwed into tapped holes in the case. The end face of the support is also drilled 4 B.A. clearance to receive the bimetal unit.

The Bimetal Cradle

This unit is made up of a cradle holding the pen arm shaft and bimetal element (Fig. 6). The cradle should be made of 6¾in. of 1in. by ⅛in. brass strip and bent into the shape shown. The two 4 B.A. clearance holes drilled on the long side should correspond with those drilled in the end face of the support. Finally drill two ⅛in. clearance holes in the short sides exactly opposite one another in the position shown in Fig. 6. These are to carry the pen arm shaft. Clean and polish both these holes.

The pen arm shaft can now be made from ⅛in. brass rod. About 4in. will be required and it should also be polished.

The Bimetal Element

In view of the relative ease with which the range of movement of the bimetal can be controlled, no rigid specification is necessary. The bimetal coil used by the writer was made

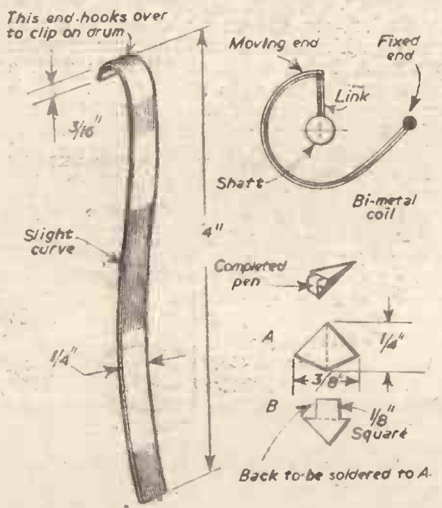


Fig. 8.—The chart clamping bar. *Fig. 7 (Top).—Bimetal levering explained. Fig. 9.—The pen.*

of 12in. of brass/invar strip, ⅜in. wide and 1/32in. thick coiled on a ½in. former with the brass on the outside. When coiled the overall length was 2½in. This bimetal strip is advertised by a firm in PRACTICAL MECHANICS.

It will be appreciated that the thickness of the strip does not affect its range of movement so that any thickness can theoretically be used. In practice, however, if it is much thinner than 1/32in. the weight of the pen arm tends to uncoil it. The mounting of the coil may provide some difficulty, particularly at the moving end. It should be slid over the shaft in between the cradle arms (see Fig. 6) and the back end secured to the shaft with a 10 B.A. screw. The front end should be secured to the zero setting lever by means of a 6 B.A. screw (see Fig. 6, B).

Setting the Range

It will be appreciated that if one end of the coil is held firm then the other free end will rotate in a circle with variation in temperature. If this free end is fixed to the shaft then the shaft will rotate, but the amount of movement can be governed by the distance the link with the bimetal is from the *centre* of the shaft. This point will be more clearly seen by reference to Fig. 7. By taking the link further away from the centre the shaft rotates less for a given amount of movement of the bimetal, but if it is brought nearer to the centre then the same amount of movement will produce a larger rotation of the shaft. By this simple piece of leverage a very large variation in range can be obtained, though it must be borne in mind that in practice the amount of force available also varies with the distance.

Using the bimetal coil as described it should be linked about 1/16in. from the surface of the shaft. The exact position will have to be found by trial and error. If this piece of instrument work is a little too tedious, increase the length of the spiral to obtain a larger movement and accordingly make the linkage on a larger scale by being farther away from the shaft.

Pen Arm and "Lift-off" Lever

Most of the dimensions can be seen from the diagrams. Both items are made entirely of brass. The pen arm (Fig. 10) swings freely on two 8 B.A. screws, each having a pivot point tip, to lower the pen-to-chart friction. The pen itself can be made by cutting brass foil to the shape shown in Fig. 9 and soldering the joints. The lift-off lever is made of a 4in. piece of ⅛in. brass rod soldered into an "L"-shaped piece of ¼in. brass (Fig. 11). The part is fitted to the case with a 6 B.A. screw having a spring washer underneath. When changing the chart the pen should be lifted off by the rod when the shorter leg of the lever is pushed to the left.

The finish of the instrument should be in black and clear cellulose, preferably sprayed on. Polish and lacquer the brass parts and give the steel parts several coats of black cellulose paint.

Wiring

If the electric system is used then care must be taken with the wiring, especially if the instrument is to be used out-of-doors or in a damp place. Seal the entry holes in the motor case for the wires with electrical sealing compound, and fit a tag for the earth wire on to the motor case. Do not rely on a rough connection to the thermograph frame—connect right on to the motor. As the

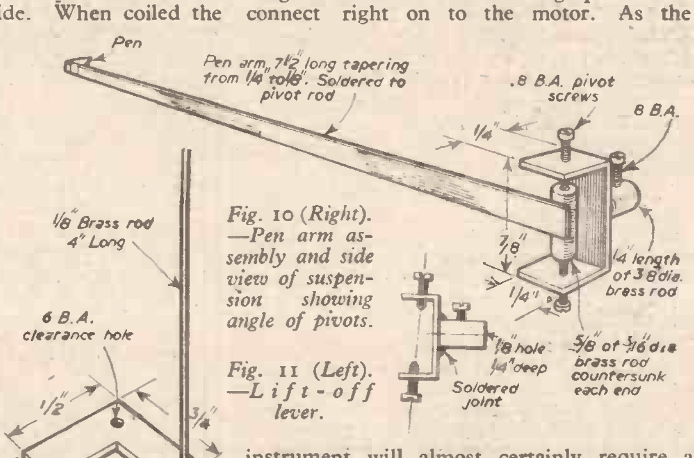


Fig. 10 (Right).—Pen arm assembly and side view of suspension showing angle of pivots.

Fig. 11 (Left).—Lift-off lever.

instrument will almost certainly require a detachable coupling fairly near to it to disconnect it from the mains, make sure regulation watertight plugs and sockets are used. If a low-voltage motor is used then the danger of shocks will be reduced, but it will be necessary also to earth one side of the low-voltage supply.

A Simple Episcope

Make this Fascinating Projecting Device for Under £2

By S. SIMPSON

AN episcope is an apparatus for projecting a picture on to a screen, but whereas the usual projector requires light to be passed through a transparency (slide, film, etc) the episcope throws light reflected from opaque objects, such as photographs, stamps, coins, etc. The completed episcope is shown in Fig. 1.

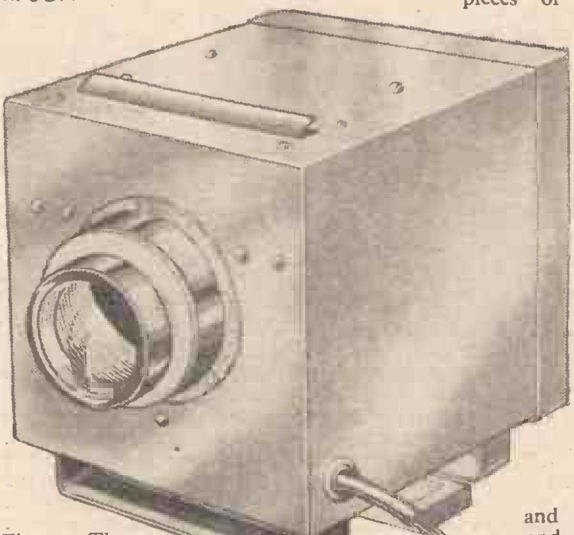


Fig. 1.—The completed episcope.

Materials

The materials used are fairly inexpensive, the total cost being somewhere in the region of £2. Many of the items come from the kitchen salvage and the list appears below:

1 biscuit tin, with lid, approximately 9in. x 9in. x 8in.

1 dried-milk tin or similar, $4\frac{1}{2}$in. dia.; the part required is the bottom 1in.

1 "Ovaltine" tin or similar, $3\frac{3}{4}$in. dia., with an opening to take a push-in lid, $2\frac{7}{8}$in. dia.; the top 3in. is required.

1 square of carpet underfelt or similar material, 6in. square.

2 pocket mirrors, approximately 4in. x $2\frac{1}{2}$in.

1 wood strip, 12in. x 3in. x $\frac{1}{2}$in. thickness.

2 pieces of thin "picture" glass, $3\frac{1}{2}$in. x $2\frac{1}{2}$in.

2 strips of "Rexine" or similar "American" cloth, 3in. x 1in.

2 miniature bayonet-cap lamp holders, batten fixing.

2 12-volt, 36-watt car headlamp bulbs.

1 9in. focal length plano-convex lens. The one used by the writer is $3\frac{1}{2}$in. dia., including mounting rim, supplied as part of the lens.

1 surface-silvered mirror, $4\frac{1}{4}$in. x $3\frac{3}{4}$in., with backing mount. This and the lens was obtained from English, of Brentwood (see the columns of this journal).

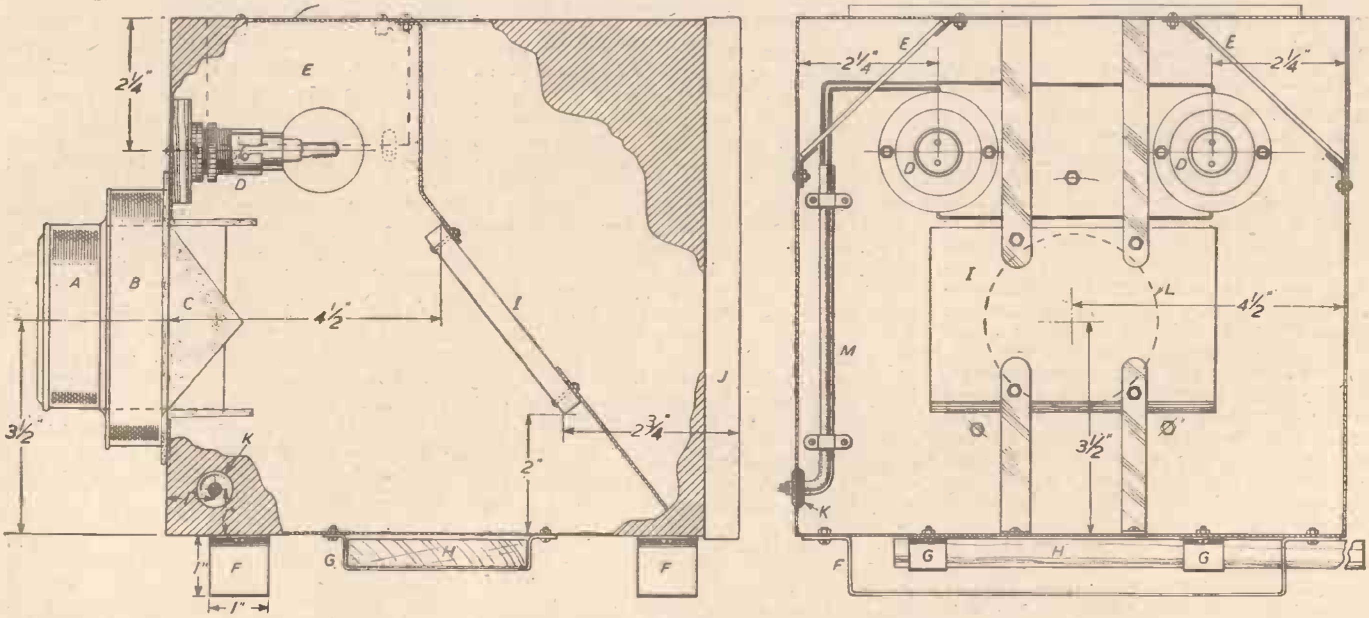
A piece of black cartridge paper, sundry pieces of aluminium, screws and nuts, together with several feet of twin circular rubber-covered cable, complete the requirements.

A source of low-voltage A.C. is required for lighting; the article on "Low-voltage A.C. Supplies" which appeared in the December, 1955, issue of PRACTICAL MECHANICS describes a method of using a discarded transformer for this purpose.

Keep the mirror covered in the wrapping in which it was received after examining it for damage; do not finger the surface. The same care must be taken of the lens.

Preparing the Tins

Clean up the biscuit tin, removing all paper from outside and inside. Treat the "Ovaltine" and dried-milk tins similarly. At 3in. from the lip of the "Ovaltine" tin make a pencil mark around the circumference and cut off this part; lay the rest aside meantime. True up the cut edge of the "Ovaltine" tin, or lens-holder as we will now call it, and reshape the holder truly



Figs. 2 and 3.—A side elevation and rear view, showing interior construction. Key: A—Lens holder; B—Lens guide; C—Lens supporting felt; D—12 volt 36 watt car headlamp bulb and holder; E—Pocket mirror; F—Case supports; G—Slide support; H—Picture-carrying slide; I—Reflecting mirror; J—Case lid; K—Cable grommet; L—Position of lens holder; M—Supply cable.

circular. Take the dried-milk tin and mark around the body 1in. from the bottom, then cut away the surplus, retaining the bottom part. This is the lens-guide and should be reshaped to circular form if necessary.

An aperture has now to be cut in the bottom of the guide into which the lens-holder will fit. Perhaps the easiest way to do this is to place the guide on a flat surface, bottom upwards, then place the lens-holder's cut edge on the upturned guide bottom, measuring carefully at four diametrically opposed points to ensure that the holder is placed truly central, then marking the guide with a soft pencil around the body of the holder.

Now cut away the inner material up to ¼in. from the inscribed pencil line. Do this carefully, it makes the lens so much easier to adjust in use. When the circle has been cut away take a pair of square-nosed pliers and gently turn the cut edge outwards, working around the circle and easing up the lip a little at a time. Try the lens-holder into the aperture; it will probably not fit at the first attempt, but successive operations will result in a lip which allows the lens-holder to slide nicely over a flat surface (see Figs. 1 and 2).

From the scrap left over from the lens-holder cut three strips approximately 1½in. x ½in. Drill these at ⅜in. from one end to take a 6 B.A. bolt; now bend at right angles ½in. of the undrilled end of the strip. These strips are soldered to the inside of the body of the lens guide at points 120 deg. apart; their purpose is to secure the guide to the face of the biscuit tin, or "case," on which work can now begin by cutting out an aperture which is ¼in. larger than that of the lens holder (not the guide, please note). Details are shown in Fig 3.

Cutting the Carpet Underfelt

Cut out a felt disc which is 1in. greater in diameter than that of the lens guide, then, with sharp-pointed scissors, pierce the centre of the disc and make a clean cut, equal in length to the radius of the lens-holder, towards the circumference of the disc. Now make a similar cut diametrically opposite to the first and then a third and fourth each at right angles to the first and all radiating from the centre. The lens arrangement can now be assembled and the holes drilled to secure the lens guide.

Fit the lens into the lens-holder by pushing it down into the body of the holder until it seats firmly against the lip which formerly held the lid of the "Ovaltine" tin. Do not touch the glass of the lens during this operation if it can be avoided. Finally, line the inside of the holder with cartridge paper in order to stop reflection from the bright metal. Now lay the case on an even surface, with the aperture which has already been cut facing upwards. Place the piece of carpet felt over the hole. Fit the lens-holder into the lens guide and ease the lens-holder through the carpet felt; this requires a little patience and it may be necessary slightly to elongate the slits in the felt. When the holder has been passed through, ease the guide down on to the case, then position it so that the lens-holder is quite perpendicular to the case. It will be found that the felt and the guide, if correctly cut and shaped as described, form a nice sliding fit which keeps the lens-holder quite firm.

Carefully mark through the holes in the strips which will hold the guide; if assistance is available, the drilling and securing by small bolts and nuts can be done without removing the assembly; this is preferable as it is more difficult to insert the lens once the guide has been fastened down.

Illumination

The floodlighting of the object to be projected is obtained from two 12-volt 36 watt car headlamp bulbs of the double-contact type and this is the next step to be undertaken. Position one of the lampholders with its terminals vertical behind the face of the case so that the centre of the lampholder disc is at a point 2½in. from the left side and from the top of the case. Pencil around the area occupied by the holder and also through the fixing holes, then repeat the performance on the right side of the second holder. Low down on the left side cut a hole to accept a rubber grommet suitable for the size of connecting cable to be used between the episcope and its lighting transformer. The position of the hole should be about 1in. from the front face and from

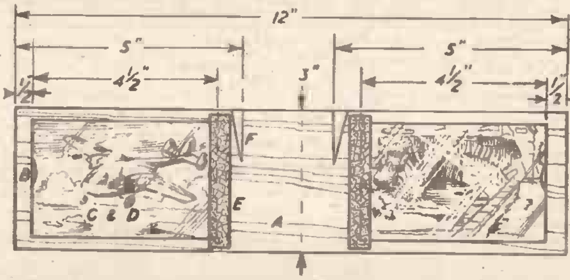


Fig. 4.—Details of picture carrier. Key: A—Wood slide, ¾in. thick; B—Thumbnail lift; C—Recess for picture; D—Glass cover; E—American cloth hinge; F—Registering mark.

the base of the episcope. Feed 2ft. of the cable through the grommet into the case, lead it up to the nearest lamp position then horizontally to 1in. beyond the area of the second lampholder. Mark the cable with a pencil just short of the first lamp then split the outer insulation up to this mark thus exposing the two leads. Cut the red lead, leaving sufficient to connect into the upper terminal of the first holder. Now cut the black lead leaving enough to connect into the upper terminal of the second holder; the spare piece of red lead should be long enough to connect the two lower terminals and you then have both holders wired in series with the connecting cable.

The holders can now be fitted to the case with a distance piece inserted to avoid pinching the wires.

Picture Holder

The slide which holds the picture to be shown is made from a strip of wood 12in. by 3in. by ½in. thick, cut to the details shown in Fig. 4 and fitted with glass panels to keep the picture flat (the heat tends to curl the picture if exposed for a considerable time). The registering marks should be of a vivid white so that they can readily be seen in the dark; they enable the operator to centre the picture in the picture aperture before uncovering the lens. In the base of the case cut an aperture 3in. by 4in., the 4in. measurement being across the width of the case; the front edge of the aperture is 3in. from the front of the case and the side 2½in. from one side. Shape the two holding brackets to suit the thickness of the slide so that it moves easily to and fro when placed in position, then fit the brackets one on either side of the picture aperture, see Figs. 2 and 3. At this stage the two feet should be shaped and fitted; their position is clearly shown also in Figs. 2 and 3.

Some form of top ventilation is required and this is achieved by making a 7in. cut along the width of the case just above the bulbs of the lamps, then bending the cut edge upwards at an angle of approximately 30 degrees.

Lighting Mirrors

To concentrate the light on to the picture two mirrors are fitted, one above each lamp; these are placed at an angle such that the maximum light is cast on to the slide. The position is best obtained with the lamps lit, but care is necessary as the lamps get quite hot. Having noted the optimum position, the mirrors are fitted with small clips bolted through the case, as shown in Fig. 3.

Reflecting Mirror

The final step in construction is to fit the reflecting mirror. The means of support will depend on the type of mirror obtained; in the writer's version two brass strips of ½in. width were bolted to roof and floor of the case and the mirror bolted to these through the metal backing provided with the mirror. The position, however, can definitely be stated and is shown in Figs. 2 and 3. When fitted, the complete optical system can be checked by placing a photograph in the slide, slipping it into position and by looking through the lens front you should see the picture almost filling the mirror. If the picture is low or high in the mirror some adjustment to the mirror support will be necessary, but be careful to get your line of sight quite centrally into the lens before making changes.

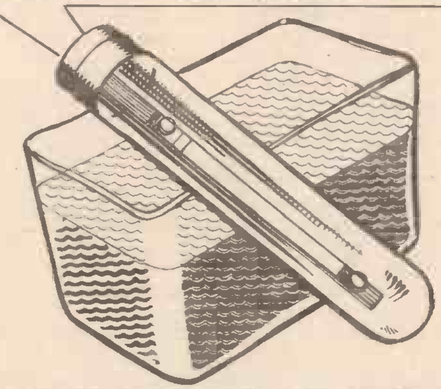
If all is well, fit a covering of black cartridge paper into the inside of the case lid; a spot of adhesive will hold it in place. A cartridge paper surround for the picture aperture should also be fitted (very neatly, since it will be seen on your screen).

Finally, fit the lamps and the case lid, and the episcope is ready for use. It should be set up at about 10ft. from the screen (a white tablecloth does very well) and must be quite firm. Connect the cable to the lighting transformer and connect the transformer to the supply mains when the lamps should light and the reflection of the empty picture aperture be seen on the screen. Move the lens-holder gently in or out as required to bring the aperture sharply into focus, then place a cover over the lens to cut off the light during the loading of the slide; a handkerchief hung over the "nose" of the lens is perhaps best since it obviates the risk of moving the lens out of focus.

Lift the edge of the glass plate on the slide, slip the picture into the slide recess and lower the glass. Push the slide into place and watch for the registering mark appearing on the other side of the case. When it is parallel and just clear of the case, uncover the lens; the picture, almost in focus, should be on the screen. A slight touch should bring it into sharp relief.

A final word; the lighting on this model is very low compared with a professional episcope (72 watts as against 500 watts); for this reason, use pictures which have plenty of light and shade, whether coloured or not and for difficult objects such as old coins, it is better to get closer to the screen and make do with the rather smaller picture with its greater brightness.

Aquarium Thermostats



Constructional Details for Three Separate Types—External Fitting and Two Kinds of Internal Fitting

By P. MAGINNESS

THERE are three types of thermostats in general use for the control of temperature in an aquarium; these are external and internal fitting, the latter being in two forms, submersible and outside control. All three types are dependent on the property of a bi-metal strip bending with variation in temperature and operating a simple switching device which interrupts the flow of current to the heater on increase of temperature. In order to ensure a clean, quick make and break at the contacts it is necessary to have either a magnetic or mechanical snap-action switch to prevent trembling of the contacts when about to open or close, causing arcing, which results in sticking of the contacts and radio and T/V interference.

The magnetic type of snap-action switch is described as it is the easiest to obtain, and the simplest to construct. These thermostats may be made in a very short time with the simplest of tools and for a cost of no more than 2s. 6d. for all the materials. A number of these models have been in constant and reliable service in my fishhouse for over 12 months.

Submersible Type

A small piece of insulating material such as Paxolin or Perspex is cut 5in. × 5/16in. × ⅛in.

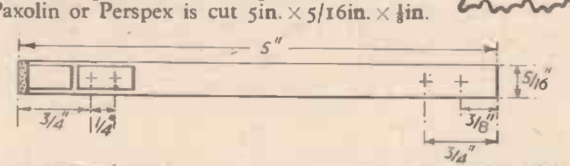


Fig. 1 (Left).—Drilling dimensions for insulating base.

Fig. 2 (Left).—Side view of submersible type showing connections.

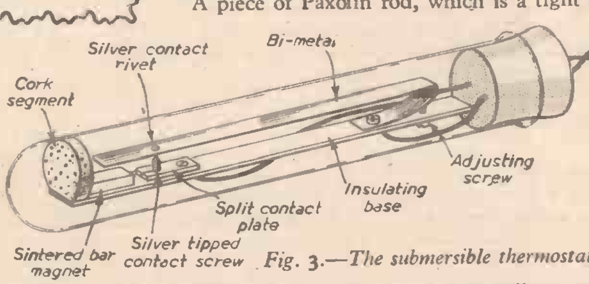


Fig. 3.—The submersible thermostat.

and holes drilled as in Fig. 1. The split contact plate is then fastened with a small nut and bolt in position, as shown in the completed diagram (Fig. 3). The small magnet is stuck down with Bostik or similar adhesive, touching the contact plate and ¼in. from the end of the insulating strip. The bi-metal strip, 6in. long, is drilled ¼in. from one end for the fixing bolt, and ¾in. from the other end for the silver contact rivet. The strip is now gently bent to the shape shown in Fig. 2, having first ascertained the direction in which the strip bends when gently warmed. The silver contact rivet is pushed through the hole and gently domed over to fix it securely in position with the flat head on the underside; care must be taken not to distort the flat surface of the rivet. The bi-metal strip can now be mounted on the insulating strip by means of a small bolt passed through the holes already drilled and tightened securely. The head of the contact rivet in the strip should be directly over the point of the silver-tipped contact screw in the contact plate. If, through some slight error, this is not so, gentle bending of the strip will be required.

In order to adjust the thermostat for temperature variations, it is necessary to have a small setscrew to increase or decrease the amount of bend in the bi-metal strip. This is most conveniently situated at the end of the insulating support below the bend, the position not being critical; the nearer to the bi-metal fixing screw, the more delicate the adjustment. As this screw is only needed for the initial setting and is not to be repeatedly turned, it is sufficient if a short bolt is threaded through the base, as shown, to bear on the bi-metal strip. This completes the operating portion of the thermostat.

Obtain a Pyrex test tube 6in. × ⅝in. and a rubber bung to fit; if possible, one of the capped type which seals the outside of the tube. The two leads to the thermostat are taken through the bung, making a tight fit; this is perhaps the most difficult part of the construction. If access to Drikold or dry ice is possible it simplifies matters, the bung being frozen in a mixture of Drikold and methylated spirit and, when hard, drilled with conventional drills of an appropriate size. If this method cannot be used the bung may be "drilled" with a hot wire, and whilst the holes are still warm and soft the wires are pushed through. When the rubber cools and solidifies, the wires will be found to be securely held in place and quite watertight.

One of the wires is cut off close to the bung and soldered to the bi-metal fixing bolt on the underside, the other wire continues along the underside of the base and is soldered to the bolt holding the contact plate. A small piece of cork or similar material is stuck to the end of the insulating strip, of such a size that the strip is suitably positioned in the tube when it is enclosed. All that remains now is for the glass tube to be pushed home on to the bung, ensuring that the wires do not foul the bi-metal strip.

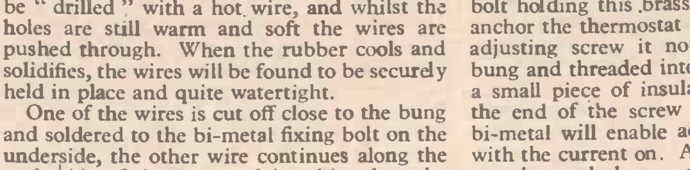
Outside Adjustment Type

Although the foregoing thermostat will function in a satisfactory manner, it is often desirable to alter the temperature range for breeding, or sickness, etc., and it is hardly practicable to have to strip down the thermostat in order to readjust it. The answer is to have an external means of adjustment; this is quite a simple matter.

The actual construction of the working parts of the thermostat are identical to the previous model with the exception of the base, which is made ½in. longer to allow for the fixing of the adjusting screw in the alternative position. For ease of construction it is preferable to use a Pyrex tube 6in. × ⅞in., or 6in. × 1in., to allow more room for fixing the assembly to the bung.

A piece of Paxolin rod, which is a tight fit in the end of the tube, is cut and drilled to the shape shown in Fig. 4, the diameter of the holes being determined by the size of bolts. If this material is not available then wood well treated with shellac to prevent absorption of water is quite satisfactory.

To the end of the insulating strip of the thermostat a small piece of angle brass, with a nut soldered over the hole, is attached. (Brass curtain fittings may be utilised.) This is for the adjusting screw which will bear on the underside of the bend of the bi-metal. The bolt holding this brass in place also serves to anchor the thermostat base to the bung. The adjusting screw it now passed through the bung and threaded into the brass angle-piece, a small piece of insulating material fixed on the end of the screw where it bears on the bi-metal will enable adjustments to be made with the current on. Alternatively, the thread may be made longer and a small knob fixed outside the bung.



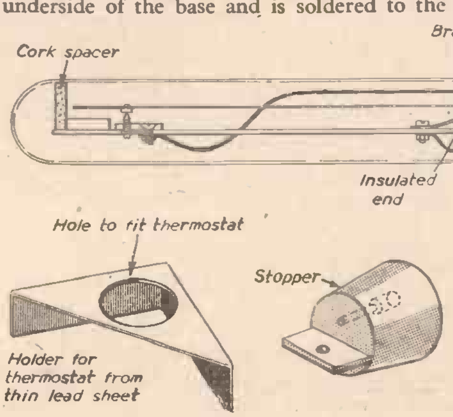


Fig. 5 (Above).—External adjustment thermostat. Fig. 4 (Left).—Holder and stopper.

To complete, it is wired up in a similar manner to the submersible type, and a piece of thin rubber tubing is stretched over the bung and end of the tube to hold it securely in place and ensure that water will not creep into the tube. Note that this thermostat is not submersible and the water level must not exceed the rubber seal; also, condensation from the cover glass must be prevented from dripping on to the top of the bung. A simple holder as shown in Fig. 4 will conveniently hold it in position.

External Thermostat

This type (Fig. 6.) is the most dependable of all three, having the advantage that it is never in contact with water and is easily accessible at all times. The base is of ¼in. wood and is cut to approximately 7in. × 2in.; and drilled for the setting screw and also with a small hole to enable the contact screw to be adjusted with a small screwdriver. The insulating strip carrying the thermostat elements is raised on two blocks about ½in. thick and the bi-metal, this time straight, is supported at one end on a further distance piece of ¼in.

A brass strip with a soldered nut is attached a short distance from the fixed end of the bi-metal for the adjusting screw which protrudes through the wooden back sufficiently far to enable a small insulated knob of the wireless variety to be fixed to it. The thermostat is wired up as before, the wires passing through the base at a convenient point.

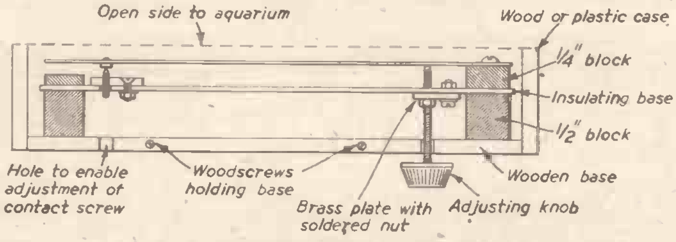


Fig. 6.—The external thermostat.

A wooden frame, ¼in. thick, is made approximately 1¼in. deep so that the base of the thermostat will fit nicely inside leaving between an ⅛in. and ¼in. clearance between the thermostat bi-metal and the glass side of the aquarium when it is fixed in position. This frame is drilled so that wood screws may be inserted into the edge of the base to hold it in place. The frame is then fastened with Bostik to the glass side or back of the tank. The thermostat may be readily removed, if necessary, by loosening the screws and withdrawing the base complete. If so desired the wood may be advantageously replaced with plastic for the case, so making a much neater job.

Adjusting the Thermostats

Adjustment of the finished thermostats presents little difficulty, but requires a certain amount of patience and a reliable thermometer. In the case of the first two models which may be placed in a water bath decide on the average temperature at which you wish to maintain the tank and heat a water bath to a temperature of 2 deg. lower, place in the thermostat and allow it to equilibrate for several minutes. Adjust the setting screw, so bending the bi-metal until the contacts just close. Gently raise the temperature of the bath until it is slightly higher than the average temperature, leave for several minutes and the contacts should open. If they do not do so it means that the sensitivity of the thermostat is not great enough for this range. The sensitivity may be increased by screwing the contact screw further in, so decreasing the pull of the magnet, a very slight turn may be all that is required. The thermostat should now be checked again in the water bath. It may be found necessary at first to slightly bend the bi-metal to bring it within the range of the adjusting screw. A small torch bulb and battery in series with the contacts provides a ready means of ascertaining when the contacts are open or closed.

The outside-fitting thermostat is most conveniently adjusted on the aquarium itself, or on the outside of a similar container, care being taken that the temperature is changed very slowly to allow the thermostat to equilibrate itself.

There are two types of bi-metal sold by Technical Services Co., Hi-flex and Standard. Whilst the former is much more sensitive it is much thinner and may be prone to distortion in time due to the repeated flexing, the greater flexibility may also be a disadvantage in that any tendency to sticking of the contacts may be more noticeable. The latter bi-metal makes a more robust job and the slightly less sensitivity is of no consequence as a slight temperature range is beneficial to the fish, and sensitivity of the order of 2 deg. C. is easily obtained.

These thermostats are suitable for a maximum loading of 150 watts with the contacts described, larger contacts would increase the capacity. Radio and TV. interference, if experienced, can be easily suppressed by the normal small condenser across the contacts, and as close to them as possible. Wiring is best carried out by use of P.V.C. wire. It must be remembered that the bi-metal is live and with the exception of the third model, and the second if the adjusting screw is insulated, no adjustment should be made whilst the thermostat is connected to the mains.

PARTS LIST AND SUPPLIERS

The Technical Services Co.

Bi-metal, Hi-flex, 6d. per ft. Standard, 6in. length, 1/-.
Sintered bar magnets, 9d. each.
Fine silver rivets, Ref. 124, 2/9 doz.
Split contact plate, 3d. each.
Silver-tipped contact screws, 7 B.A., 4/- doz.

Govt. Surplus Radio Shops

Paxolin or similar for bases.
Radio knob for external thermostat.

Griffin and George; Vicsons, Ltd.

Test tubes, 6in. × ⅝in., for submersible type, about 3d. each.
Test tubes, 6in. × ¾in. or 6in. × 1in., for outside adjustable type, 4d.
Rubber bungs to fit, 3d. each.
P.V.C. connecting wire (mains insulated).
Assorted small nuts and bolts.

Hints on the Feeding of Fish

Providing a Varied Diet

By I. W. BRASSINGTON

WHETHER tropical or cold-water fish are the main interest the type of food given should be varied as much as possible. Tropical fish in particular need a proportion of "live" food.

Live Foods

Tubifex worms are small red worms about 1½in. long, and are found almost anywhere in the bed of a stream or pool. They bury their heads in the mud and wave their tails in the water and a large colony will give the shallow water at the edge a reddish tinge. When collected and washed, they roll themselves round each other into a ball and stay like that in the jar of water in which they are kept, until they are fed to the fish.

Daphnia (water-fleas) are one of the most nutritious fish foods and, in my experience, certainly the most popular. Be on the lookout for a shallow pool, partly covered with green algae, and where cow droppings are likely to have formed a rich breeding ground for microscopic pond life on the bed of the pool. If daphnia are present, you will see them as a green or brownish cloud in the water. Fig. 1 will help you to identify them and you may expect them to be a little larger in size than the knob of a pin.

Micro-worms are very good for young fish. These are tiny white worms, a constant supply of which can be kept in the form of a culture, using oatmeal as the growing medium. The first culture is usually obtained from an aquarist (by post, if necessary), who nearly always supplies full printed instructions for continuing the culture.

Daphnia and Tubifex are also obtainable from your local supplier.

Chopped earthworm is another excellent form of "live" food. Choose the thin red ones and chop these finely with a razor blade, then put them into your net or into a piece of muslin and swill under the tap before giving to the fish.

Fig. 1.—A sketch of the Daphnia *(water flea).*

Dry Foods

Bemax is full of nourishment but should not be used too frequently. There are also a large number of prepared foods in cartons and jars, and I have always made a point of keeping at least three different makes of dry food in stock.

High on my list, too, are tinned herring roes, fresh roes, raw or fried fish and foods of that sort, all of which can be used to make a change from the more commonly used ones.

Frequency of Feeding

The question of how much and how often to feed is a matter of observation. I generally feed morning and evening and to begin with it is suggested that the fish are watched very closely as the food is given to them, a little at a time, until they tend to become disinterested in additional offerings. This avoids having a lot of uneaten food floating around after the fish have had their fill.

Fish must not be overfed and this cannot be over-emphasised because of the danger of uneaten particles of food, remaining unseen behind rocks and collecting in hollows in the gravel, where they will quickly form deadly sources of pollution. However, by following the suggestions in the last paragraph you will very quickly learn to tell what is the correct amount to feed, and should there be any doubt remember that fish may be left unfed for as long as two or three weeks at a time!

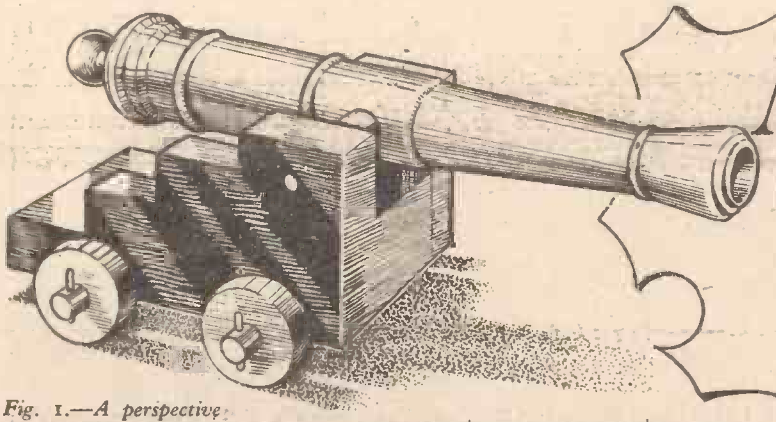


Fig. 1.—A perspective view of the completed cannon.

Making an OLD TIME CANNON

A Handsome Mantelpiece or Bureau Ornament

By JOHN DENVER

THE old time cannon shown in Figs. 1 and 2 by no means represents a type from history, nor has there been any attempt to add the elaborate chase work which those implements of war carried on both the barrels and carriage, but it is still a rather unusual decorative gadget. The work

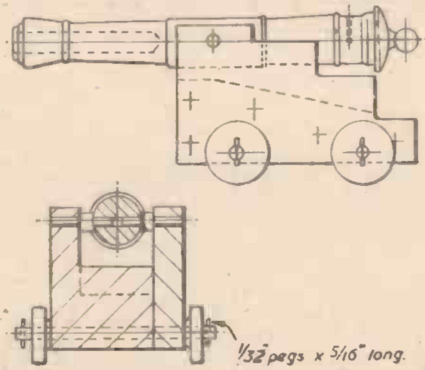


Fig. 2.—Side and rear elevations of the cannon.

needed is neither great nor complicated, and readers with a small centre lathe can construct a batch of these with a view to presenting them to friends as birthday presents.

The dimensions included on these drawings make up a size which is convenient for the average mantelpiece or sideboard, and the materials needed are generally obtainable from the scrap box.

Brass is the best metal for the barrel, and a bar 1in. diameter by 6in. long is suitable. The outline is nothing more than a series of simple turning operations, as can be seen from Fig. 3, and the easiest way to machine this detail is to centre and drill the 1/4in. diameter hole at the muzzle end, leave an extra 1/8in. at this point and centre the bar deeply, then use this as a steady while carrying out the remaining operations. Turn as far as possible, but before releasing the chuck jaws, face off that surplus material from the front end. Reverse the barrel in the soft jaws and finish the radial end and ball. Finally, drill the trunnion hole and the tiny fire hole at the rear end—countersinking the latter slightly as Figs. 2 and 3 show.

If a good true hole can be made with an 1/8in. drill for the above trunnion hole this is satisfactory, but as noted on the sketch, reaming is advisable. Do, however, make sure it enters exactly on the centre line, because failure to do this will undoubtedly give the assembled barrel a poor appearance. Avoid sharp corners where the three small "flanges" occur—gun barrels seldom if ever have sharp corners.

There is no real need to drill the 1/4in. diameter hole much deeper than 1 1/2in., as shown in Fig. 3—it takes longer, the hole invariably runs out of true when so deep, and it also reduces the bearing surface for the trunnions. Provided a hole is drilled deep enough to ensure that the end is not visible the illusion that it continues for the full depth is retained.

Highly polished barrels are seldom seen, even in museums, but this type of finish is usually preferred to a dull-plated one, so remove every tiny tool mark with the aid of a piece of fine but well worn emery cloth. A drop of machine oil on the latter gives the best finish, and when this has been carried out to your satisfaction, give the outside a thin coat of clear varnish.

The Carriage

Though metal would make an excellent carriage, wood is chosen because it is easier to work and is in keeping with the prototypes. Two pieces are required, and the best method to make the outline (shown in Fig. 4) is to

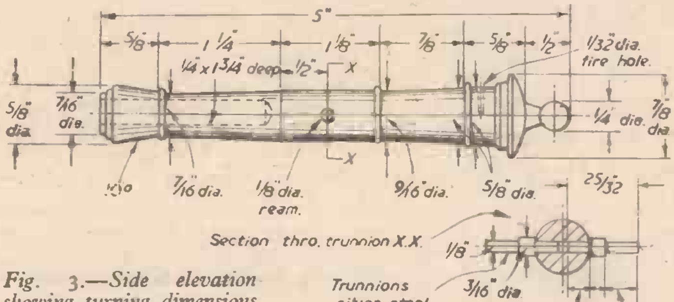


Fig. 3.—Side elevation showing turning dimensions of the barrel

secure them together, back to back, while that work is in progress. Next, saw and chisel the angular cut which eventually provides the clearance for the barrel, carefully sandpaper all the edges and faces and give two coats of flat paint.

Set the two blocks back to back again and drill the trunnion holes—use a slightly smaller drill than an 1/8in. diameter, because there is always that tendency for a drill to cut a little larger when used in wood. A No. 32 drill .116in. diameter is suitable, and should make a nice tight fit when the actual barrel trunnions are assembled.

Slip the barrel with the trunnions in place between the two pieces of wood and tighten up the screws; making sure that they are driven well down into the countersinks. The work of turning the trunnions is not described, as this is a simple job, but see that the shanks which enter the barrel are a tight fit. A light drive fit is preferable, but take care not to mar the varnished surface during this operation. Trunnion dimensions are given in Fig. 3.

The barrel must not see-saw up and down in the carriage or cradle—this would look ridiculous, and it cannot occur if the width of the 7/8in. gap between the two pieces of wood is made to size. Thus, when the screws are tightened up the 3/16in. diameter flanges on the trunnions bite into the wood a little, and this is sufficient to prevent the barrel swinging up and down. The above remarks concerning the tightness of the trunnion holes also should help overcome this problem, but the indentation of the wood by the flanges is an additional precaution. It would not prove very awkward to hold the barrel permanently level by incorporating a block at the rear end immediately underneath the fire hole, and inserting a small screw about 6 B.A. through this into the barrel, again from underneath. When the screws in the carriage are finally driven home, the screw holes should be filled and the whole surface given a further coat of paint.

The Wheels and Axles

These are very simple parts to make, but care should be taken on assembling the axles to the cradle to ensure that they fit tightly in their respective holes. They should not be a drive fit, however, as this will assuredly crack the wood which is, as Fig. 5 shows, a trifle thin at that point. The wheels can spin freely on the axles, and when drilling the cross holes for the tiny pins, restrict the lateral movement to about 1/64in. on each wheel—the clearance depicted on these drawings is

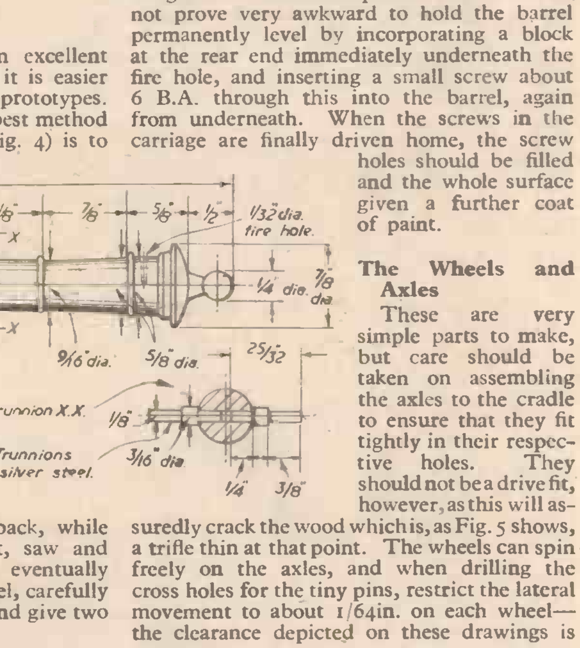


Fig. 4.—Details and dimensions of the carriage.

exaggerated in an endeavour to show it clearly.

General Notes

If cannon balls are required, old balls taken from a discarded ballrace are suggested as this overcomes the problem of actually turning them on the lathe. Paint them black, and make a tray just large enough to take three balls stacked close together. A spot of adhesive prevents them rolling about, and you can then stand another ball on top of these in the traditional manner. As the barrel bore is ¼in., this is also the diameter of those balls.

If it is decided to mass produce these cannon, make up a series of tinplate templates for the barrel profile as these are an excellent guide during the turning operations. They also ensure that in a " pair " as ornaments, the barrels are uniform. An error of only 1/32in. on a length will appear much worse when there is another for comparison. In making these templates, work from the flat front face as this is the best location.

Similarly the cutting of the steps on the cradle is simplified if a marking out template is made. Alternatively one could make the template from say ⅛in. plate and use this as a filing jig, both pieces of wood being held in a vice for this work. I mention filing because

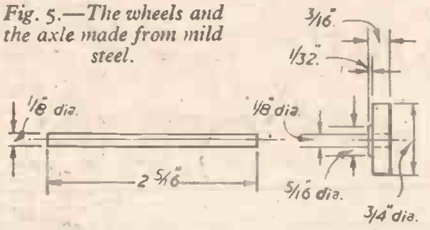


Fig. 5.—The wheels and the axle made from mild steel.

I must admit I find it easier to use this tool for the final cut than a chisel.

If it is desired to black the barrel in preference to applying the clear varnish the following gives good results.

Make up a solution of a ¼lb. of copper sulphate in one gallon of water, and strong ammonia solution is added until the green solid matter is nearly dissolved leaving a deep blue solution with a slight sludge at the bottom.

This solution is heated in a clean enamel saucepan with a lid to retain the ammonia fumes, to just below boiling point, and then the barrels are immersed. Keep moving them about low down in the solution until the desired colour is attained ; remove them and give each a thorough wash in clean water. Dip them in a solution of caustic potash and water—2½ oz. to 1 gallon—and follow this process with another wash in running water. The barrels have now assumed a deep black colour, if the time factor has been closely observed and the washing properly carried out.

If something a little more ambitious is required, double these dimensions—the cannon produced is a rather massive and imposing affair, well worth a place in the hall or lounge to catch the eye of anyone who enters.

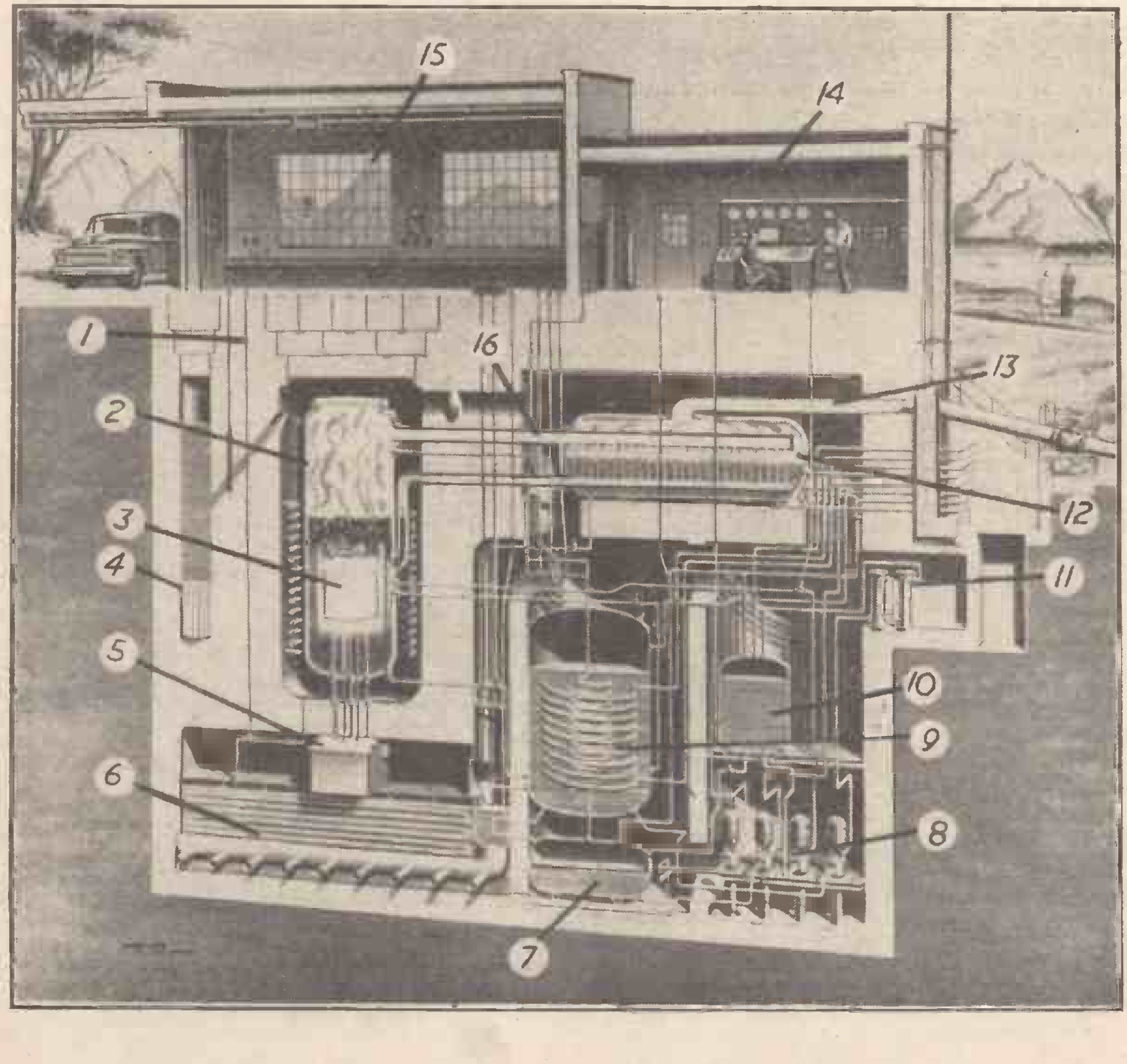
Anglo-U.S. Atom Power Plants

MITCHELL Engineering, Ltd., of London and Peterborough, England, and A.M.F. Atomics Inc., of New York (a subsidiary of the American Machine and Foundry Co.), have completed plans jointly to design and construct nuclear power plants in the Commonwealth and other countries.

This is the first agreement of its type in the atomic energy field and the first practical expression of the United Kingdom and United States policy of encouraging the peaceful applications of atomic energy at home and abroad.

The progress in nuclear power applications made by the two countries has made it feasible for practical and economic power plants to be supplied to those parts of the world where the cost of power generated by nuclear fission will be less than the cost of power now obtained by using fossil fuel. The result will be, it is hoped, the development of industry and agriculture.

It is thought that the type of reactor that has been developed, and which is shown in the photograph, will be of particular use to the South African market as it will overcome the problems of hauling coal and oil over long distances. Two of the biggest mining corporations are investigating the project, probably for use in remote areas. A point of particular interest to South Africa is that the reactors can be operated on natural uranium which South Africa supplies to the United States in large quantities.



Special consideration has been given in the design to the problem of operation by engineers rather than by scientists, and after 12 weeks' training in the United States, a trained engineer would be fully competent to operate the plant at all times with a specially trained team from the two companies paying periodic visits to replace the fuel.

Mitchell Engineering, Ltd., will supply the atomic power plants wherever they are needed and will have the advice of A.M.F. Atomics Inc. who will design and supply the reactors and their components.

KEY

1. Concrete containment. Stainless steel linings.
2. Reactor vessel.
3. Uranium fuel rods.
4. Fuel rod storage tank.
5. Reactor controlling mechanism.
6. Containment quench tank.
7. Sump tank.
8. Pumping units.
9. Blow down vessel.
10. Demineralised feed water tank.
11. Demineralisers.
12. Heat exchanger.
13. Secondary steam pipe leading to turbo-alternator.
14. Control room.
15. Fuel handling room.
16. Primary steam loop.

Improving a POWER SAW

Widening the Scope of a Well-known Saw Kit

By ARNOLD E. BENSUSAN

AS supplied by the manufacturers, the Wolf Cub No. 5 Saw Kits are ideal for ripping battens and boards of small width.

However, a few alterations to the basic design will greatly increase the range of the equipment and enable the user to carry out work of larger and heavier characteristics than hitherto. Two such modifications are described below.

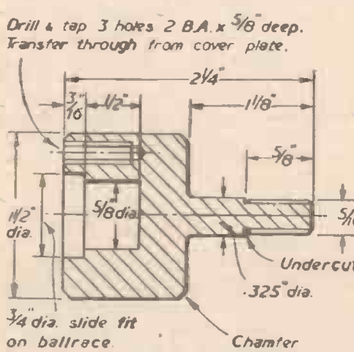


Fig. 1.—Details of the housing.

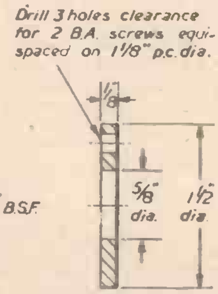


Fig. 2.—The cover plate.

Arbor Bearing

In its original form the saw has a circular blade fitted to a ¼in. diameter arbor gripped in the power drill chuck and supported, at its free end, on a hardened steel centre mounted in a pedestal bracket. The slenderness of the arbor and the necessity for greasing the centres before starting work, coupled with the need for frequent inspection and regreasing, prompted the writer to devise the unit described here.

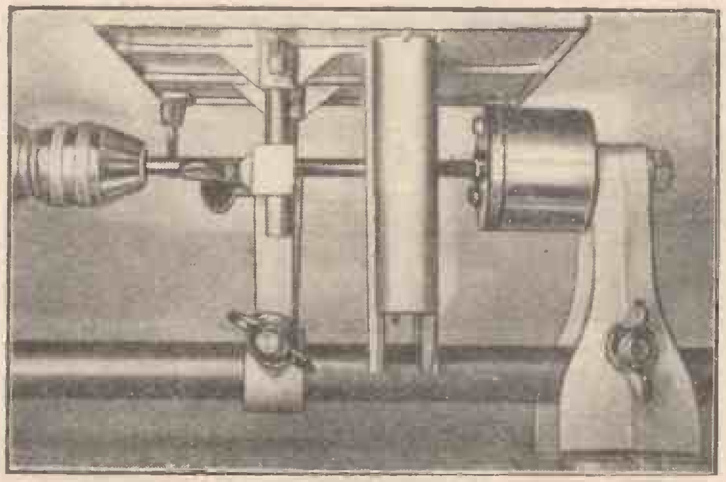


Fig. 3.—The arbor bearing.

The replacement unit is built around a small ballrace, and any one of the following types will be found satisfactory in use and of suitable size for the housing shown in Fig. 1—Hoffman C.S.1 or S.1 or Skefko E.E.2. All these ballraces have the following dimensions: ¼in. diameter bore, ¾in. outside diameter and 7/32in. wide outer race. The width of the inner race is immaterial. The Hoffman C.S.1 has the advantage of cover plates preventing dust penetrating the bearing.

There are two special components to be turned from mild steel bar. The housing replaces the male centre in the pedestal, but as the thread in the latter is of unusual diameter and pitch it is as well to use this purely as a location for the plain shank of the housing. A nut and washer added at the rear of the pedestal locks the housing firmly in position. Precise concentricity is not important as a fair degree of adjustment is provided at the drill end of the apparatus.

The ballrace is a sliding fit in the housing and is retained by a cover plate secured by three 2 B.A. ⅜in. long screws. The slight gap between the mating faces of the housing and the cover plate (Fig. 2) ensures that the outer race is held rigidly in position.

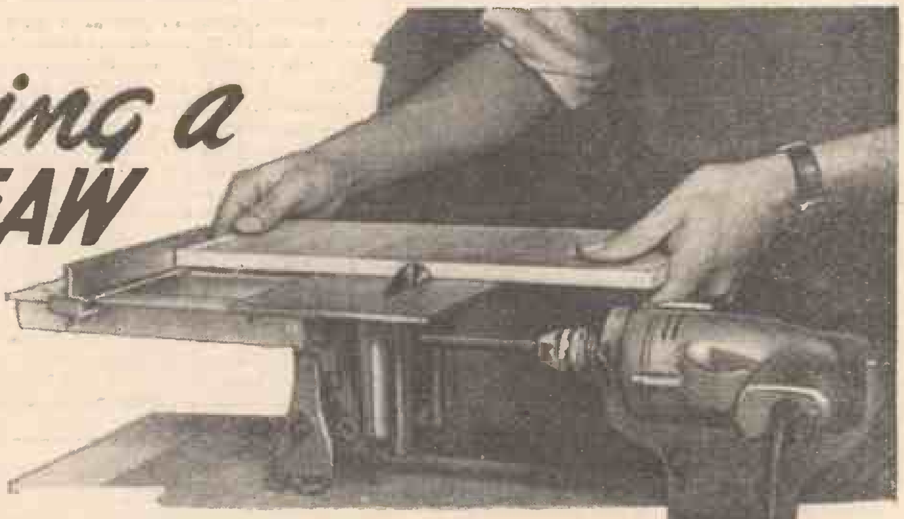


Fig. 5.—The new table in use.

The Assembly Procedure

With the saw blade already in place, slip the cover plate on the arbor and follow it with a ¼in. B.S.F. nut. Follow this with the ballrace and a second nut. Lock the two nuts up to the ballrace so that the assembly is as close as possible to the end of the arbor. Slide the ballrace in the housing and screw down the cover plate. Lock the entire unit to the pedestal as previously described and continue the assembly of the kit as before. The complete arrangement is shown in Fig. 3.

The parts may be painted, or any of the usual plating finishes may be applied. Alternatively, the steel is easily blued by the burnt oil method and will then have adequate corrosion resistance.

Extension Table

This extension table enables panels of large dimensions to be cut with the saw and, working to the figures given in Fig. 4, an offcut of about 9½in. maximum width may be produced. All the parts can be made from 1in. x 1in. x ⅛in. aluminium alloy Tee extruded section, although by varying the design 1in. x 1in. x ⅛in. angle could be used. Approximately 2ft. 6in. of the material is required and the cost is only a few shillings.

Two 9in. lengths are cut and joined together at one end by a 3⅞in. length. Two 2 B.A. tapped holes are made in each end of the cross-member to line up with the countersunk holes in the side rails. To ensure accuracy it is advisable to transfer the holes through from one part to the other, using a smaller pilot drill. Two staggered 2 B.A. tapped holes at least 1in. apart are placed in each rail at the free end and these are transferred through to the existing saw table.

The holes in the table should be counter-

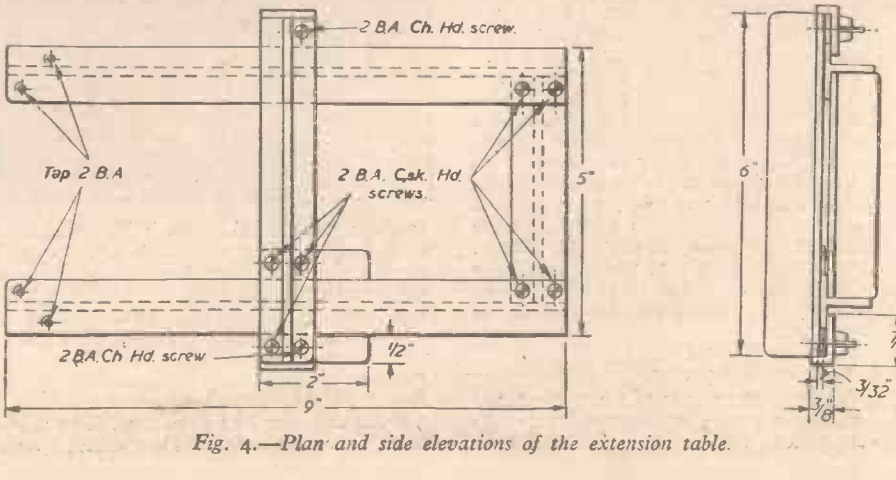


Fig. 4.—Plan and side elevations of the extension table.

sunk in the top face so that the screws used to secure the extension will lie slightly underflush. The small edge web at the underside of the table and a slight amount of other local thickening up on the same side will need to be removed with a file. This will not affect the strength or working properties of the table. If it is required to leave the extension permanently in place, yet still use the original fence for small work, a slight depression should be filed in the inner edge of the appropriate rail so that the fence securing screw can seat in its proper position.

The New Fence

The original fence being removed when wide work is being undertaken, a new fence and work support is made from a 6in. length of extrusion. Two clamps are cut from 1in. lengths of material by cutting down the centre arm to $\frac{7}{8}$in., removing one of the side arms completely, and reducing the other to $\frac{3}{8}$in. The $\frac{3}{8}$in. projections prevent the clamps rotating when they are loosened or tightened. One 2 B.A. tapped hole in the fence is made to correspond with a clearance hole in the clamp, in the case of that shown at the top of Fig. 4. In the other instance the hole in the fence is clearance for the screw while the thread is in the guide piece.

By making the two clamps together from a 2in. long portion of material, and separating them after cutting off the surplus, the waste may be used to make the two $\frac{1}{4}$in. x 2in. x 3/32in. guide pieces which keep the fence parallel to the saw blade. Countersunk screws in clearance holes in the fence and tapped holes in the guides accommodate the securing screws. The guides should be set so that the fence can move along the rails without any side play. For a really neat job, socket head screws should be used throughout.

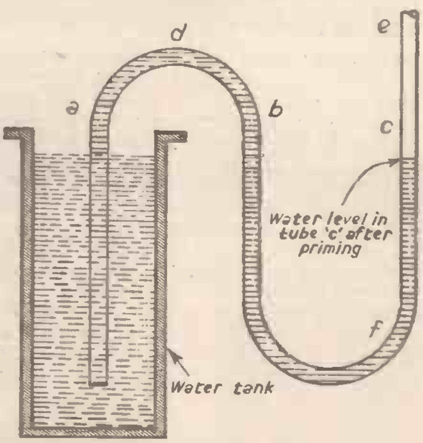
As the overhang of the extension may foul the power unit when the saw is used for cutting thick material, the table should be reversed so that the fence is situated away from the portable drill. No structural changes are required to accomplish this and the general arrangement may be seen from Fig. 5. Some very thin packing pieces may be required between the rails and the original table to bring the fence to the correct height.

In use the wingnuts are slackened off, the fence adjusted forward or backward and the nuts retightened. The edge of the panel being cut rests on the base of the Tee and against the fence formed by the upright central arm.

Ever-primed Pump

A METHOD of keeping a horizontal centrifugal pump constantly primed has been devised by Mr. H. Fenwick, who is an engineer. His idea is to deliver the water through a tube which forms an inverted siphon. The effect of this is to keep the pump constantly primed enabling it to be used intermittently without the need for continual attendance by an operator.

In the sketch is shown the inverted siphon on which Mr. Fenwick's idea is based. A



Mr. Fenwick's idea in diagram form.

flexible tube (abc) is filled with water, the end (a) being submerged while the end (e) is kept sealed until it is formed into the inverted siphon shown in the drawing. When the siphon is formed, the water level in leg (c) will fall to the level of the water in the tank.

If a centrifugal pump is inserted at any point in legs (a) and (b) say at (d), it can be used to expel the water from the tank. When the pump is stopped the water in leg (c) will fall to the level of the water in the tank; so long as the level does not fall below the point (f) the siphon and pump will remain primed. An essential feature of this method is the continuous water sealing of the pump glands.

Mr. Fenwick claims that by this method a pump can be operated automatically, by float control, by remote manual control, or by time clock.

New Telephone System

TWO people thousands of miles apart can now have a telephone conversation without even picking up a receiver. This has been made possible by Britain's latest loud-to-loud "no hands" telephone system.

The new instrument, which is designed principally for export, makes use of radar techniques to operate an electronic switching system. This, it is claimed, eliminates all the disadvantages suffered by similar installations in the past—from the clipping of speech to the monopoly of the channel by the instrument picking up the most background noise.

All that the person on the receiving end needs to do to switch the speech channel in his direction is momentarily to raise his voice. Any number of speakers can be connected up to participate in the conversation. The microphone will pick up speech when the speaker is up to 20ft. from it.

Tests so far carried out between places as far apart as Rome and Paris and London and Madrid have been completely successful.

The manufacturers are Winston Electronics Ltd., Shepperton, Middlesex.

Development of New British High Altitude Breathing Equipment

FLIGHT trials began last January of a prototype liquid oxygen system for aircraft made by Normalair Limited, of Yeovil. These trials sponsored by the Ministry of Supply are designed to speed up the development of high altitude breathing equipment, and of cabin pressurisation and air conditioning units.

A given volume of liquid oxygen will provide over 800 times its own volume of gaseous oxygen, and by storing the aircraft supply as a liquid in a liquid oxygen converter instead of as a gas in conventional storage cylinders, significant reductions can be made in installation weight and space occupied. The system being flight-tested by Normalair employs a liquid oxygen converter of 5 litres liquid capacity, giving a gaseous supply equivalent to that provided by six standard 750 litre storage cylinders. Converters of other sizes are being developed.

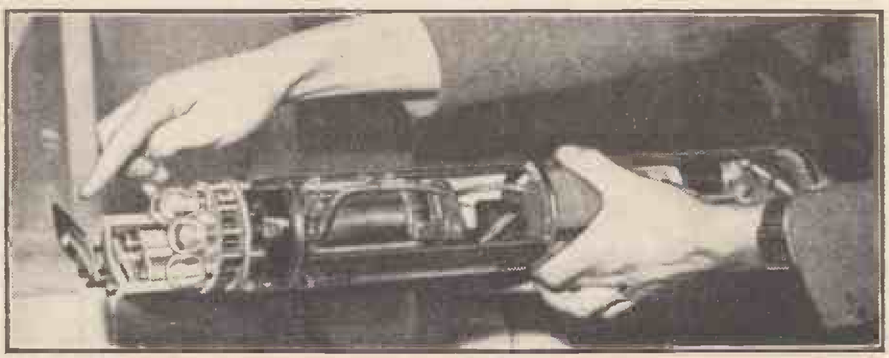
The components of the system, which fall into two distinct groups, are neatly tucked away below a radio equipment shelf in the Meteor aircraft being used for the trials and just behind the fuselage skin in a position allowing the hose of a ground charging truck to be easily coupled up. A standard Normalair demand oxygen regulator can be used with the system.

Mishandling of the equipment during recharging of the converter is prevented by use of simple safety precautions.

The current flight trials form part of a development programme for liquid oxygen equipment, which is being pressed forward alongside actual production on units for American aircraft in service with N.A.T.O. air forces. Performance data is being collected over a wide range of operating conditions. In addition, a detailed investigation is being made into related problems.

Mechanical Power Transmission Exhibition

PART of the collection illustrating mechanical power transmission is now on view in Gallery 3 of the Science Museum. The exhibits include original examples, models and illustrations, of gears, bearings, chain-drives and couplings which are arranged to show historical development from classical times to the present day.



Under contract to the Atomic Energy Authority, Pye, Ltd., have designed and completed a special camera, shown above, which is capable of being used inside an atomic reactor. The camera, though based on Pye's normal industrial equipment, has had to conform to certain rigid specifications, and as a result of experiments carried out at the Authority premises it was found that special materials had to be used. In addition many complex problems of design had to be solved. For ease of manipulation, the camera carries its own source of illumination consisting of a series of four small bulbs grouped around the camera's lens. In addition a system of mirrors enables sideways viewing to be obtained. As the equipment is to be used while the atomic pile is dangerous, the camera can be remotely controlled and is housed in a thin stainless steel casing $3\frac{1}{2}$in. in diameter and 30in. long. The whole apparatus, involving the camera and its 75ft. of cable, the control unit and the monitor, is mounted on a trolley so that it is ready for instant use.

RADIO CONTROLLED MODELS

By Members of I.R.C.M.S.

10.—A Single-valve Crystal-controlled Transmitter

THE transmitter to be described in this month's article is of very simple design and is the second to be described in this series. It is given because of its suitability for operation with the superhet receiver described last month which, due to its high selectivity could not be worked with the two valve transmitter described in the October, 1955, issue of PRACTICAL MECHANICS. Before proceeding further, however, it must be pointed out that this transmitter is not capable of such a high output as the two-valve unit, moreover, it is, in spite of its simple circuit, quite critical in its initial adjustments, although once set up it will work without attention almost indefinitely. It is particularly suitable for controlling model boats and land vehicles but for model aircraft (which will, on account of weight limitations, almost certainly use super-regenerative receivers), we recommend the use of the two-valve type of transmitter already described. A transmitter of this type may be seen in use in Fig. 1.

Legal Requirements

A G.P.O. licence is necessary before transmissions for model control can be made. The licence costs £1 for five years and is obtainable from the following address: Radio and Accommodation Department, Headquarters Building, G.P.O. St. Martins-le-Grand, London, E.C.1. No tests or examinations are carried out before this class of licence is issued.

Transmitter Details

The circuit makes use of a 27 Mc/s overtone crystal manufactured by the Quartz Crystal Co., Ltd., Kingston Road, New Malden, Surrey. This type of crystal is not suitable for use at parallel resonance and a series resonance type circuit must, therefore, be used.

Fig. 1.—Mr. E. C. Kennedy preparing his model of an Admiral's barge to compete in last year's I.R.C.M.S. annual contest (Saltwell Park). This model also employs a superhet circuit to enable simultaneous operation to be carried out with other models using this circuit. The group is seen on the specially prepared operating platform used by competitors.

Fig. 2 shows the actual circuit used which is a modified Hartley type and is usually termed the Squier's Circuit. It requires the use of a triode valve with a high gm. and the 6C4 type works very satisfactorily. This is an indirectly heated valve but the current requirement is only .15 amps. (at 6.3 volts), so this can easily be met. An early version of this transmitter used two twin cell cycle lamp batteries to provide heater current. These batteries were used for the transmitter only—not the control box, and lasted for many months with normal use.

It is the anode coil and the position of its tapping which makes the circuit rather difficult to set up initially. Although this is wound as a single coil with a tapping point it is best thought of as two separate coils. The top half (A-B) is tuned by the 3-30 pF. trimmer and the circuit is completed through the 500 pF. T.C.C. "Micadisc." This part of the coil should resonate in the 27 Mc/s. band and with the coil described this will take place with nearly minimum capacity in circuit. The lower half of the coil (B-C) is the feed-back portion necessary to maintain oscillation. If too many turns are used (i.e., too much feed-back) the circuit will self-oscillate and the crystal loses control, whilst if too few turns are used no oscillation takes place. If the tapping point is adjusted to alter feedback then the tuning of the top half is altered at the same time. For these reasons we recommend that the coil winding instructions we give are followed very carefully so as to ensure correct operation.

The remainder of the circuit is conventional, the 10 KΩ resistor being simply a current regulator and R.F. stopper. The makers of the crystal state that if the H.T. supply is 150 volts from a regulated source the value of this resistor can be reduced to 1,000Ω. If the transmitter is fed from a dry battery H.T. source of 150 volts this condition would apply.

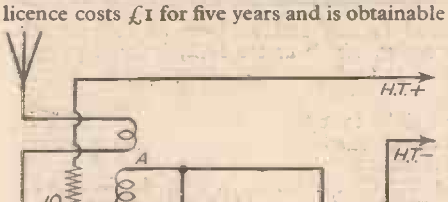


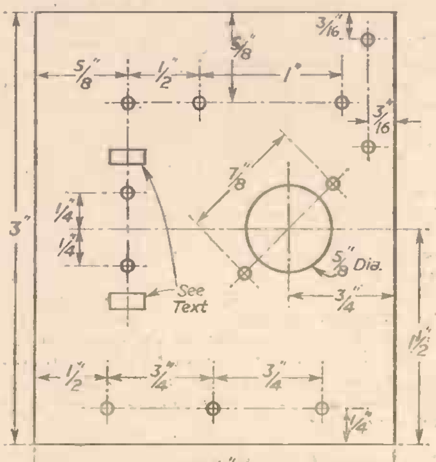
Fig. 2.—Single-valve transmitter circuit.

Construction

The transmitter unit is constructed on a base of 1/16in. thick Paxolin sheet and this is drilled as shown in Fig. 3. A word here about the method of mounting the crystal. These two-pin crystals have a pin spacing of ½in. and can be plugged into an International octal valveholder. Commercially-made holders for the crystals are available but rather difficult to obtain so the writer made use of two of the socket clips from an old 1.0 valveholder of the paxolin type. The baseboard for the transmitter was drilled and cut to accept them as shown in Fig. 3. If a commercial crystal holder is available so much the better.

As previously stated the coil in this transmitter is quite critical and this should be wound as follows:

Use 18 s.w.g. enamelled copper wire and



Material 1/16" Paxolin All fixing holes 3/32" dia.

Fig. 3.—Drilling plan for one-valve transmitter.

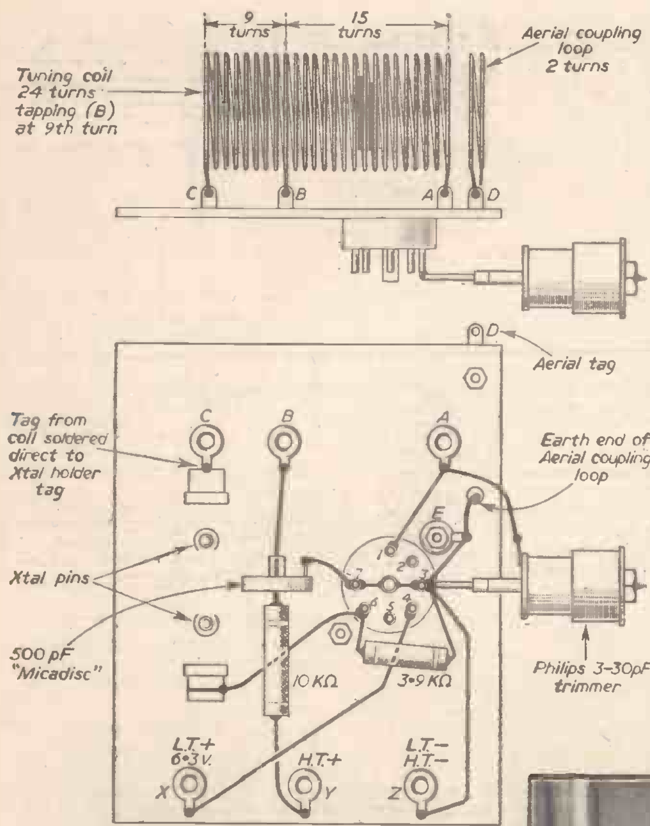


Fig. 4.—Wiring diagram and component layout for one-valve transmitter.

wind on an 11/16in. diameter former. A tubular condenser was used as a former for winding the original, but if you do not have one the right diameter, roll a strip of paper round a smaller diameter dowel or condenser until the correct size is obtained. A total of 24 turns is required with the tapping at the 15th turn. ¼in. stubs of wire are left for connecting up and the tapping is formed by baring approximately ½in. of wire and doubling back so as to form a ¼in. stub for soldering to the mounting tag. The winding should be close wound but being of a fairly heavy gauge it will inevitably spring apart slightly when taken off the former.

All components should now be mounted and solder tags bolted to points X, Y and Z (battery connections), E (below chassis) and D (above chassis) and on both sides of the chassis at points A, B and C. The tags above chassis at A, B and C are intended for mounting the coil which should be soldered in position. This three-point mounting will be found to make it reasonably firm and no difficulty has been found in this manner of construction. The remainder of the wiring is straightforward and is shown in Fig. 4.

Note that the tag of the crystal socket nearest to tag C (below chassis) should be soldered to tag C.

The only other point which needs to be mentioned is the aerial coupling loop. This is a two-turn winding one end of which is soldered to tag D. This tag also forms the point for attaching the aerial lead. The other end of the aerial loop is earthed to tag E through a hole in the paxolin. The aerial coupling will have to be adjusted and this is done by bending the loop away from the anode coil. Initially, the loop should be separated from the anode coil by about ¼in. as too much coupling will prevent oscillation.

Testing

For testing the unit, power supplies of 6 volts L.T. and 200-250 H.T. are necessary. As previously mentioned dry battery sources can be used but the writer uses 2-volt L.T. accumulators and a small rotary transformer for H.T. These will be discussed later. The valve and crystal should be plugged in and a 0-30 mA meter connected in the H.T. lead. A wavemeter, such as that described in the November issue of PRACTICAL MECHANICS is almost essential for tuning up as it enables the operator to confirm that the transmitter is operating in the band and radiating correctly. With power supplies turned on, a steady current of 10 mA will be drawn and the trimmer should now slowly be rotated preferably with an insulated trimming tool.

At one point a definite dip in anode current will occur and a reading obtained on the wavemeter. If the crystal is in control the reading will be on the crystal frequency in the 27 Mc/s band. If excessive feedback is being applied, however, self oscillation will occur at other points in the rotation of the trimmer and this will result in off frequency working. The effect should be counteracted by gently bending away turns from the feedback section of the coil (i.e., those connected to tag C). These should be bent away from the main portion until oscillation takes place only on the crystal frequency. The aerial coupling loop can only be set up with the full aerial extended and this is, therefore, best left until later.

The Complete Transmitter

The transmitter carrying case and the method of mounting the transmitter are matters of personal taste and are dictated to some extent by the power supplies to be used. Fig. 5 shows the way the writer mounted his equipment. The case is made from tinplate which solders very easily and access is gained by a sliding panel. This avoids the use of screws or bolts and is recommended as being highly convenient for making adjustments and for removing the batteries for recharging.

PARTS LIST

Transmitter unit

1 27 Mc/s Overtone crystal (Type FO) and holder.
1 B7G valveholder.
1 6C4 valve.
1 3.9 KΩ ½ w. resistor.
1 10 KΩ ½ w. resistor.
1 500 pF T.C.C. "Micadisc."
1 3-30 pF Philips trimmer.
18 s.w.g. enamelled copper wire, paxolin, nuts, bolts solder tags. Connecting-up wire, systoflex, etc.

Additional Components to Make Complete Transmitter

4 2-volt accumulators.
1 Hoover rotary transformer (11.5 volt input, 310-360 volt output).
2 Q.M.B. type single-pole switches.
1 8μF 350 volt working electrolytic condenser.
1 0-30 mA meter.
2 stand-off insulators for aerial mounting.
1 telescopic aerial.
1 indicator lamp (6/8 volt bulb).
2 .01μF mica condenser.
1 22Ω resistor.
1 5-way plug and socket (for control box).
1 transmitter case.

The case size of this original is 10in. × 8in. × 4½in. H.T. is obtained from a Hoover rotary transformer, supplies of which are very plentiful at present on the surplus market. They usually cost about 15s. and are the smallest and lightest of the type that the writer has seen. They weigh 20oz. and measure 2in. diameter × 4½in. long. It would be possible to operate this rotary transformer from 6 volts but this would tend to under-run the transmitter and 8 volts are, therefore, used in the circuit given in Fig. 6. With fully charged batteries an H.T. voltage of 240 volts is available which is adequate for the transmitter and provides enough spare current to power the control box in addition. Full details of the multivibrator control box used with this transmitter (Fig. 7) were given in the January issue of PRACTICAL MECHANICS, but it can, of course, be used with any type of control system. Four 2-volt 10-amp. hour accumulators are used and these are of the type at present available on the surplus market from Lasky's Radio, 370, Harrow Road, London, W.9. Two accumulators are mounted at each end of the case and this balances the weight which makes for ease of carrying.

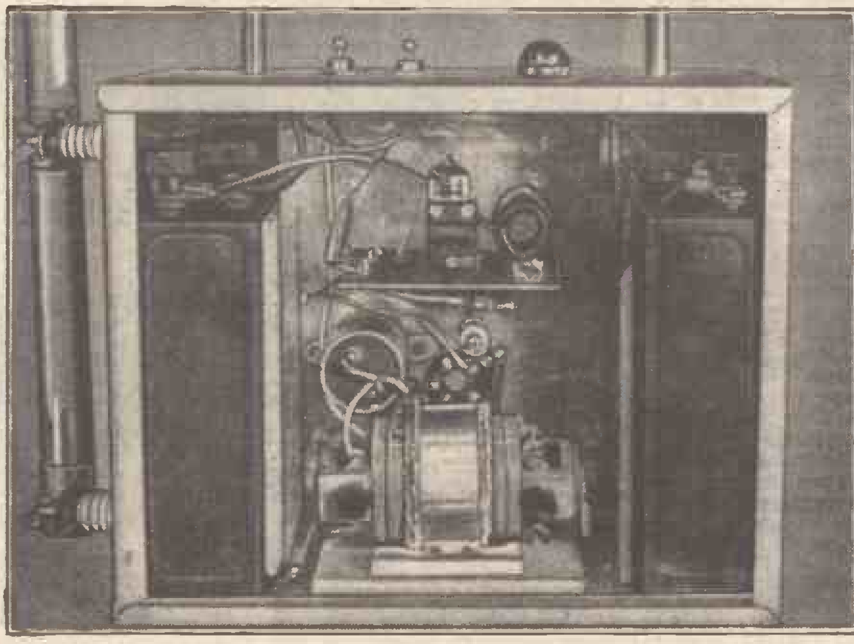


Fig. 5.—The single-valve transmitter described in this article shown in its case with rotary transformer H.T. power supply. The socket, visible at the back, is for plugging in the control box.

Smoothing of the H.T. is obtained by means of the 8μF electrolytic condenser shown and is adequate for pulse or mark/space operation. An additional choke capacity filter may be necessary if modulation of the transmitter for audio control is attempted. The .01μF condenser across the L.T. end of the generator is to suppress interference and this should be a mica type mounted as near to the motor brushes as possible. A similar suppressor condenser may also be necessary across the H.T. brushes if trouble is experienced in this respect. A suppressor circuit consisting of a .01μF mica condenser and a 22Ω resistor is connected across the leads to the control box. If the multivibrator circuit is used this will prevent the relay contacts from sticking and will reduce sparking. Separate switches are used for H.T. and L.T. supplies. This is very convenient when testing as the L.T. can be left on whilst making adjustments to the model and the transmitter instantly brought into action by operating the H.T. switch. This saves current as the rotary transformer is rather extravagant.

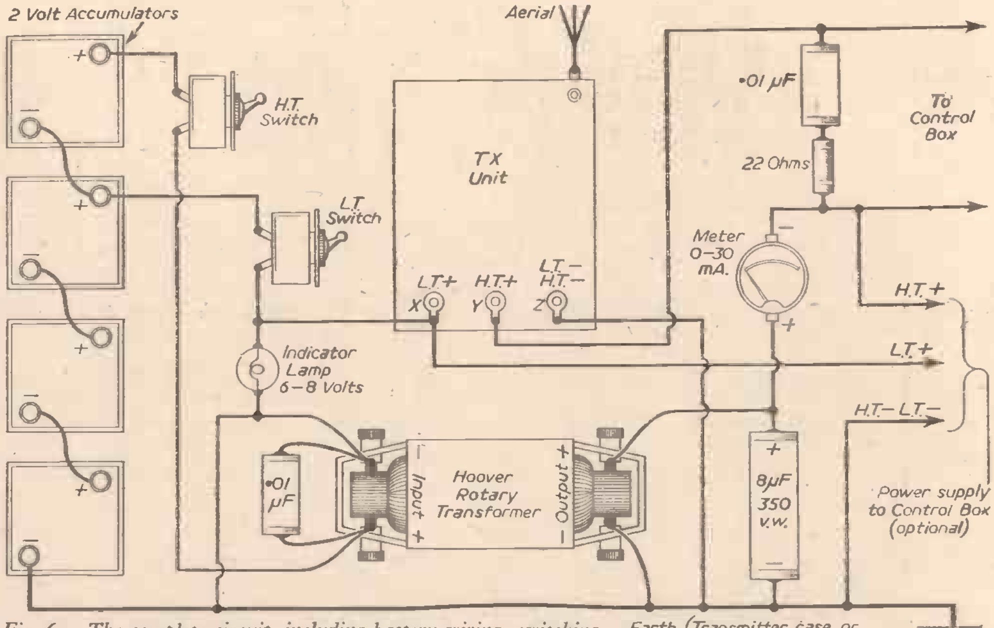


Fig. 6.—The complete circuit, including battery wiring, switching arrangements, etc.

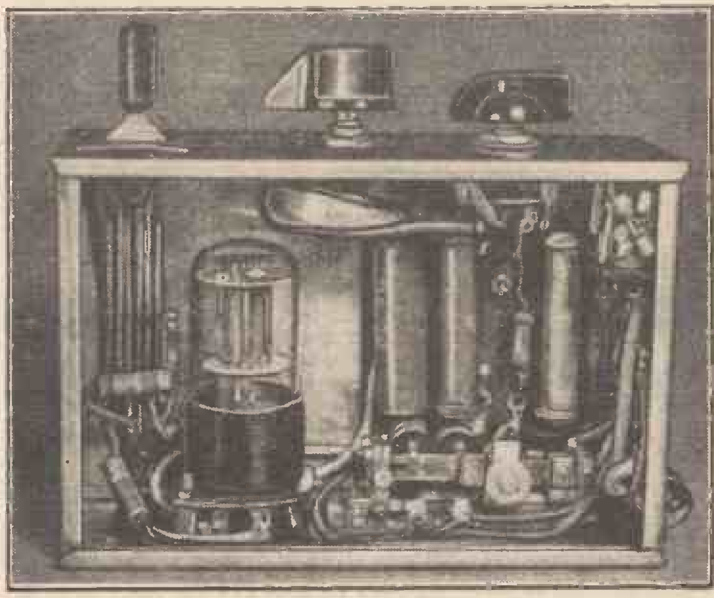


Fig. 7.—The writer's multivibrator (Mark/Space) control box. The key switch at the front is used to increase speed when pushed forward and to reduce speed (and reverse) when pushed back. It is normally in the position shown when the box generates Mark/Space pulses in the ratio determined by the centre (steering) knob. The switch knob (right) is an experimental control and gives 80/20, 50/50 and 20/80 in its three positions.

The transmitter should be checked for oscillation as before and tested to ensure that the frequency is in the band (i.e., that the crystal is in control). With the aerial fully extended, coupling should be increased by bending the aerial loop nearer to the anode coil. An alteration to the trimming capacity will probably be necessary and it may be necessary to increase the feed-back by bending in the turns at the grid end of the coil (i.e., at C in Fig. 4). Too much aerial coupling will prevent oscillation. Fig. 8 shows the correct position of the trimmer for tuning a crystal oscillator (i.e., just before the peak).

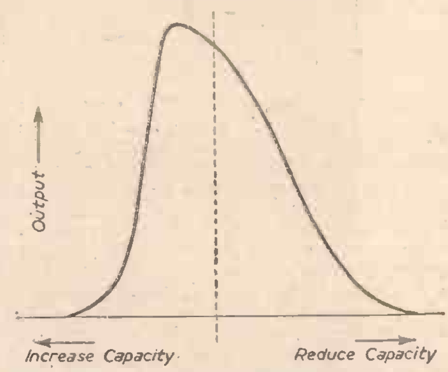


Fig. 8.—The correct position for tuning the transmitter which is just before the peak.

Once adjusted the transmitter will give excellent service and a frequency stability which will be very beneficial to the owner even if this transmitter is used to operate super-regenerative receivers.

Readers should note that any crystal frequency in the model control band (26.96 to 27.28 Mc/s) can be specified and used in this transmitter and, arranging arbitrary frequency separation between transmitters, it is possible for several models to work simultaneously.

Although not fitted to the original, the writer recommends that a milliameter to read H.T. current be fitted to the transmitter case in such a position that it can be seen whilst operating. It is a very useful check that everything is working correctly in the transmitter and it will also give the correct tuning point whilst trimming.

The Aerial

Most radio controllers make use of a quarter wave vertical whip aerial which should be of a total length of 8ft. 6in. for the 27 Mc/s band. This length includes the lead inside the case to the aerial coupling loop. Suitable telescopic masts are still available on the surplus market and should be mounted by means of metal clips to a pair of porcelain stand-off insulators as shown. The lead from the coupling loop should be taken to the bottom clip and when assembled in its case final tests should be carried out.

WATCH REPAIR

A New Series on the Repair and Adju

By F. J. C

THE good timekeeping of a watch, the consistency of its rate, and the length of its useful life, are dependent upon regular cleaning and inspection. A modern watch regularly serviced and given its annual toilet of cleaning and oiling should last at least 50 years or even longer. Indeed, there is no reason why it should ever wear out. Such parts as wear or break can be replaced if the watch is one of the modern interchangeable machine-made variety. But if the watch is regularly cleaned and oiled, the wear rate is extremely slow and it is doubtful whether any of the parts will need replacement, apart from glasses, mainsprings and hands.

When a watch is dropped, it is usually the balance staff which suffers, and interchangeable balance staffs are available for those who possess a watch lathe or a set of turns, and are able to undertake the skilled jobs connected with watchmaking. There are those who boast that they have had nothing done to their watches for 10 years or more. That is nothing to boast about, for it means that the oil has vanished from the pivots and other wearing surfaces, and that the jewels have scored the pivots.

Regular cleaning and oiling is therefore essential, and with care this is well within the ability of an amateur. Kits of tools with oil and luminising compound for hands, tweezers, screwdrivers, an eyeglass and an oiler are now available for a few shillings.

The first sign that a watch is in need of cleaning and oiling is provided by the hands, which fail to indicate the correct time. This is an indication that something is wrong and the regulator should not be touched. The average person endeavours to correct the rate by moving the regulator, when cleaning and oiling will bring it back to its original rate. No amount of adjustment by the regulator will compensate for lack of oil. In this short series I therefore propose to deal with those aspects of watch repair and adjustment which are within the scope of the amateur.

Escapements

Most watches to-day are of one of two types —the lever escapement and the cylinder, although the latter is rapidly becoming obsolete. In a few years' time only the lever escapement will remain, since it has been found superior to all other forms of escapement such as the Chronometer, the Virgule, the Duplex, the Verge, rack and pinion, and the Remontoire. I include in the lever class the very cheap unjewelled watches with pin pallets instead of jewelled pallets. The pallet is, of course, the lever. Pin pallets are known as the Roskopf system, after the man who introduced it. When these watches wear there is really very little that can be done, because the holes, being unjewelled, after a couple of years wear oval and destroy the correct pitching or meshing of the teeth. Such watches are very roughly finished and require a very strong mainspring to overcome the excessive friction, and wear is therefore rapid. The pinion leaves and pivots are unpolished; yet it is surprising how accurate such watches can be for the comparative short period of their useful life. It is possible, of course, to rebush the holes, and tiny brass bushes or bouchons are available for the purpose. The holes in the plate are broached out so that the bouchon is a press fit and then the central hole is broached out to suit the pivot. This is, however, a slow and laborious job. Such watches when they cease to be reliable are intended to be scrapped and a new one bought.

My advice to anyone about to buy a watch is to wait until you can buy one of the first-class makes, as it is cheaper in the long run. You will have a watch for life, and in the course of the years it will prove to be cheaper than buying a large number of cheap watches.

The troubles chiefly encountered with watches include broken mainspring, broken hands, broken balance staff, damaged hairspring, loose pallet stones, broken jewels, hairspring magnetised (causing watch to gain), stopping in various positions, bent or broken teeth. I shall deal with these defects in this series.

Tools and Materials

The first things to get together are the necessary tools and materials. You will require a pair of brass tweezers for handling steel parts, a pair of fine steel tweezers for hairspring work, an oil well, a bottle of good watch oil, a set of screwdrivers, an eyeglass (a 2½X is suitable for most people), a set of Swiss files, some pegwood, some small celluloid trays in which to keep the parts and also for holding the cleaning fluid, some benzine, a few sticks of 20-gauge hard-drawn brass wire, a watchmaker's vice, some acid-proof tissue paper for holding the parts whilst brushing and assembling, a

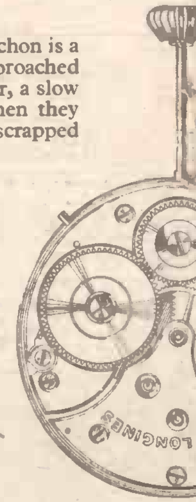


Fig. 1. — Enlar
Longines wrist wa
The layout is typ
mass-produced

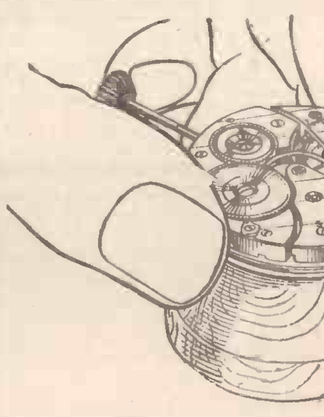


Fig. 2.—The movement is su
whilst the escapement is checked. T
with a piece of pegwood, or a

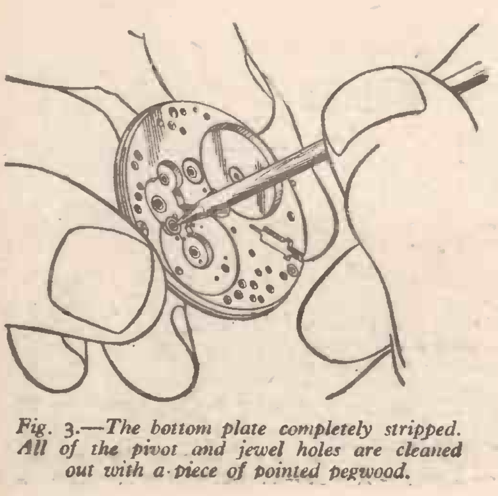


Fig. 3.—The bottom plate completely stripped. All of the pivot and jewel holes are cleaned out with a piece of pointed pegwood.

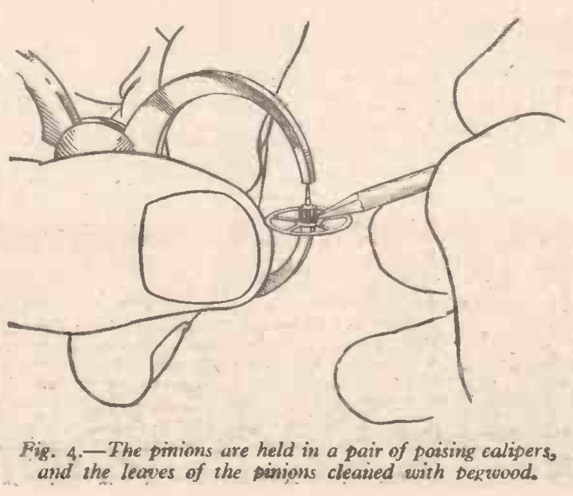


Fig. 4.—The pinions are held in a pair of poising calipers, and the leaves of the pinions cleaned with pegwood.

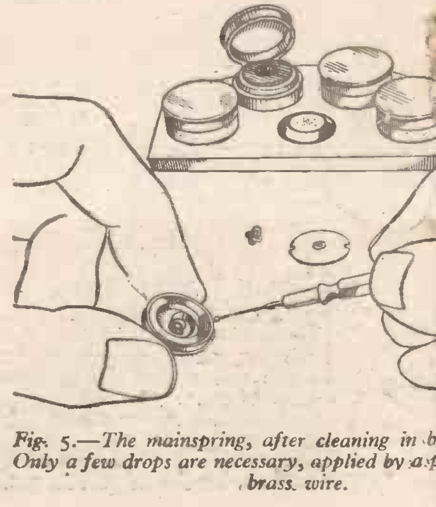
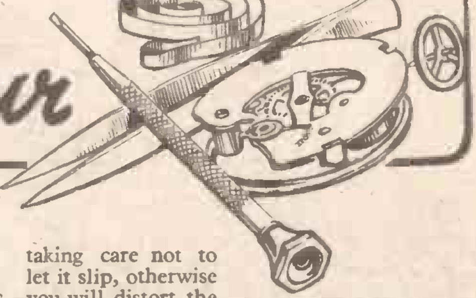


Fig. 5.—The mainspring, after cleaning in b
Only a few drops are necessary, applied by a f
brass wire.

RING for the Amateur



stment of Wrist and Pocket Watches

CAMM

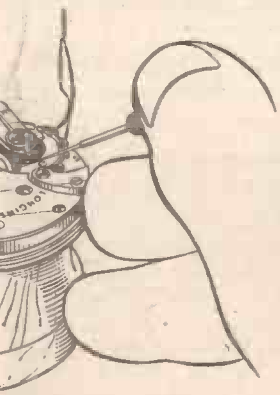
soft watchmaker's brush, cleaning chalk, and some luminous compound for luminous hands. With this equipment you will be able to carry out cleaning and oiling, and such other tools as are necessary will be dealt with as they are required.

rged view of
atch movement.
ical of modern
l watches.

If you propose to do watch-cleaning on a fairly large scale you should purchase one of the watch-cleaning machines and the cans of necessary cleaning and rinsing fluids. These are really efficient and enable the parts to be cleaned without being touched by hand. I have taken a particular example of a first-class modern watch, the Longines, the layout of which is typical of many modern watches.

Parts of a Watch

All watches of whatever make contain a mainspring barrel, a train of gears, the lever or pallets, and a balance wheel. It is upon the correct adjustment of the escapement, which includes the escape-wheel, the pallets and the balance-wheel, that the correct timekeeping of a watch depends. The watch must keep time whether it is fully wound, half-wound, or nearly unwound. That is to say, the time of the arc of vibration must be isochronous. In other words, the time of the arc must be the same, irrespective of the angle of the arc. When the oil of the balance staff becomes dry or congealed, greater resistance is offered and the arc of swing falls off, causing the watch to gain. In chronic cases the watch may even lose, and when a timepiece exhibits these symptoms damage can be caused by continuing to wind it.



pported on a wooden block
The balance is gently led round
piece of pointed brass wire.

Removing the Movement from the Case

Cleaning becomes desirable, and for this purpose it is necessary completely to dismantle the movement. In order to do this, it must be removed from the case. Needless to say, the work should be carried out in a good light, natural light in the day-time, and under a lamp of the anglepoise type at night. Have a piece of white paper on the table or bench to reflect light so that all parts can be clearly seen. Arrange the small triangular celluloid trays at the back of the sheet of paper, and as the parts are removed place each group of parts in a separate tray.

Before the movement can be removed, with most watches, especially those having three-piece cases (bezel holding the glass, the band and the back) the winding shaft must be removed. If you open the back of the watch you will see a small screw (not to be confused with the screws which hold the back plate to the pillars), and by turning this in an anti-clockwise direction for a couple of turns the stem and button may be removed. Next, remove the two case screws which clamp the movement to the band of the case. You have, of course, previously removed the bezel and carefully prised off the hands. The movement may now be gently pressed out from the back towards the front of the case.

In some watches fitted into two-piece cases, the movement may be removed, after removal of the bezel, without removing the winding shaft, the case being slotted to permit this.

Removing the Balance

The next step is to remove the balance cock with balance attached, to avoid all risk of breaking the pivots whilst the dismantling process is going on. Remove the screw which holds the cock, and by means of a screwdriver placed in the kittle nick at the back of the cock, gently prise it upwards, taking care not to let it slip, otherwise you will distort the hairspring. Hairsprings are of two types. In the cheaper watches they are flat and fairly easily trued up with two pairs of tweezers if they become distorted, and in the better class watches they are of Breguet formation, which means that the outer coil is lifted up and reformed to a smaller radius. The object of this is to give a more concentric action to the hairspring and therefore a more consistent rate in the various positions. In those watches where the hairspring stud is secured by means of a clamping screw or screws, remove the screw or screws and let the hairspring hang free of the balance cock. Place the cock, the balance and the screw in one of the trays.

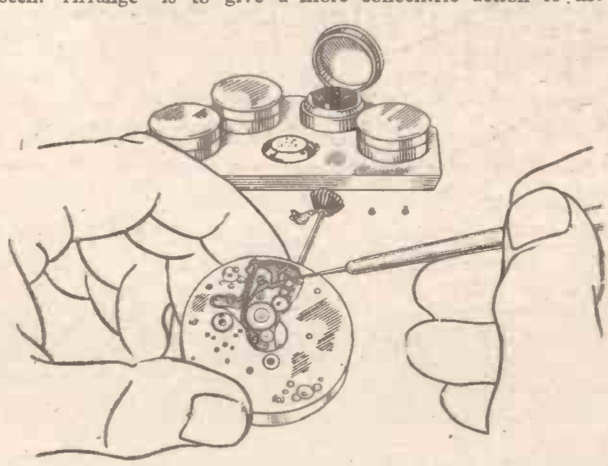


Fig. 8.—Apply oil to the hand-setting mechanism on the dial side of the back-plate.

It is important to ensure when removing screws that each screw goes back into its appropriate hole, because sometimes they are of varying lengths so as to clear other parts.

The Mainspring

It is now necessary to let the mainspring down, presuming that the watch is still wound up, and this should be done by placing

enzine, is oiled.
piece of flattened

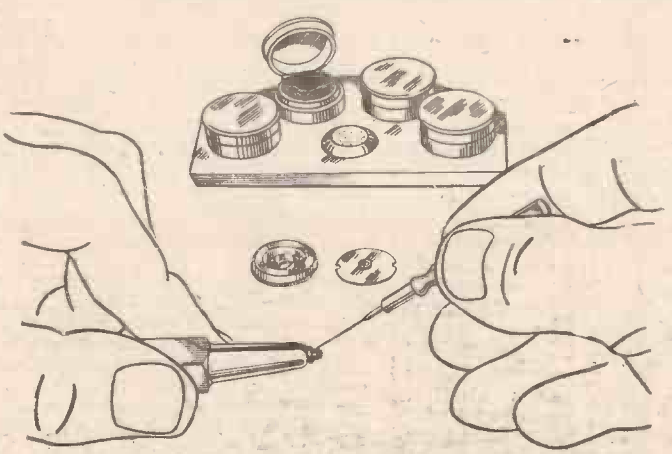


Fig. 6.—Similarly apply oil to the pivots of the arbor.

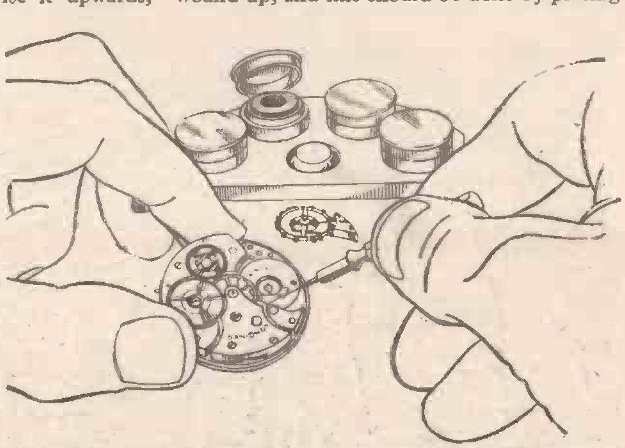


Fig. 7.—Before refitting the balance and balance cock, apply oil to the faces of the pallet stones.

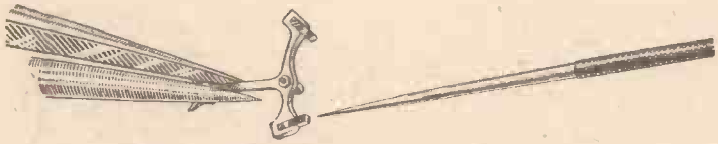


Fig. 9.—The pallet should be held in a pair of tweezers and the pallet stones examined to see if they are loose.

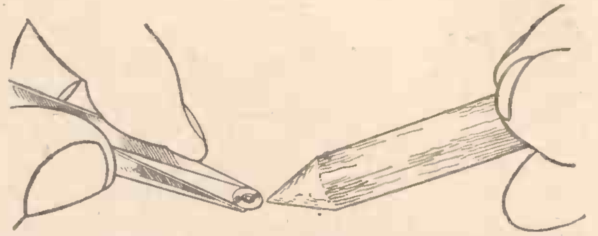


Fig. 10.—Apply oil to the end stones which should be held in a pair of hollow tweezers.

the stem back into the movement, and applying winding pressure to lift the little click which engages with the teeth of the steel wheel on the back plate which is attached to the mainspring arbor. Then, with a piece of brass wire, lift the click and gently allow the spring to unwind by permitting the button slowly to slip through the fingers. Do not allow the spring to unwind suddenly, as

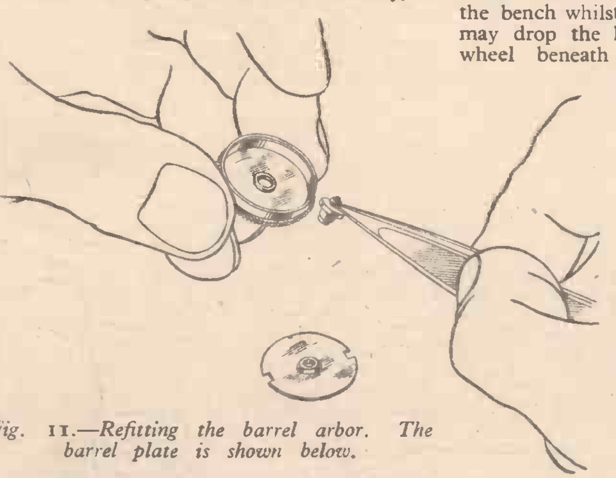


Fig. 11.—Refitting the barrel arbor. The barrel plate is shown below.

there is a risk of shearing one of the teeth off the mainspring barrel. Do not adopt the method of some amateurs of removing the balance and pallets and allowing the watch to run down, as the jewels will score the pivots, and may even cause some of them to break off, especially the smallest pivots of the whole train—the escape-wheel pivots.

Having let down the mainspring, undo the screw in the centre of the steel wheel which is directly over the mainspring barrel. It is important to note here that some of these screws are of left-hand thread, and some of right-hand thread. Only gentle pressure should be used, therefore, on the screwdriver till you have discovered which way the screw undoes. When this screw is removed the steel wheel can be gently prised off the squared end of the barrel arbor.

Removing the Dial

The next thing is to remove the dial. This is usually secured by two dog screws which have crescent-shaped slots cut in a knife-edged flange. This knife edge cuts into the two copper feet of the dial. When the screw is given half a turn the crescent-shaped slot will clear the dial feet and allow the dial to be gently prised off. If it is a china dial, be very careful not to use undue pressure or it will crack. Be careful also to hold the movement well over the bench whilst doing this, otherwise you may drop the hour wheel and the minute wheel beneath it on the floor. These wheels are not fixed in any way. Some dials of the three-feet type are locked to the plate by screws in the edge of the pillar plate.

Removing the Canon Pinion

Now remove the canon pinion. This is the centre pinion over which fits the hour wheel (the wheel to which the hour hand is attached) and to which the minute hand is attached. A steady direct pull with a pair of brass-nosed pliers will remove it, taking care not to bend it. If the minute hand is attached to the arbor and not to the canon pinion, a gentle tap with a hammer on the end of the arbor will release the canon pinion. The canon pinion is friction tight on the abor to allow for hand setting.

Completing Dismantling

Now reverse the watch and remove all screws holding the plates or bars, noting the order of the screws as recommended above.

This will leave you with the pillar plate to which is still attached the pallets. Now unlock the screw securing the pallet bar and carefully place the pallet, the bar and its screw in a separate tray. You may if you wish remove the hand setting mechanism but usually this is not necessary.

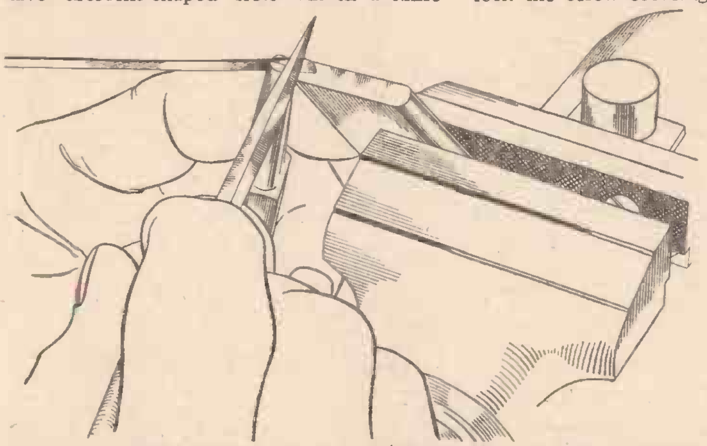


Fig. 12.—Filing the rivet of the hook flush with the surface of the mainspring. This is necessary when the driving end is broken off the outside coil.

Cleaning

The watch is now dismantled and ready for immersing in the benzine. It must be pointed out, however, that the pallets and the balance wheel must not be placed in benzine. The pallet stones are secured by a shellac, and the impulse pin on the roller of the balance is also secured by shellac, and shellac is solvent in benzine. I will explain how these are cleaned later on.

Place all of the parts in the benzine and leave them to soak for half an hour or so. Then remove the pillar plate from the benzine and allow it to dry off. Next rub the brush on the cleaning chalk and gently brush the plates to revive the polish inserting in the benzine again, to remove all traces of chalk, and dry off. Now hold the pillar plate in the left hand, and, with a piece of pointed pegwood, peg out each pivot hole to remove all traces of chalk, dried oil or dirt. Now lay the pillar plate aside and give attention to the mainspring barrel, which after removal from the benzine and drying off should be brushed clean.

The Mainspring

The mainspring must, of course, have been previously removed and must now be replaced, using preferably a mainspring winder, but if not gently recoiling it inside the barrel, making sure that the hooked outer end engages with the dog on the outer edge of the barrel. Care is necessary so that the main spring remains flat. Otherwise it will take on conical form and will bind up in the barrel giving an erratic power output.

The brass mainspring barrel cover is, of course, prised off by means of a screwdriver blade inserted under the slot in the cover

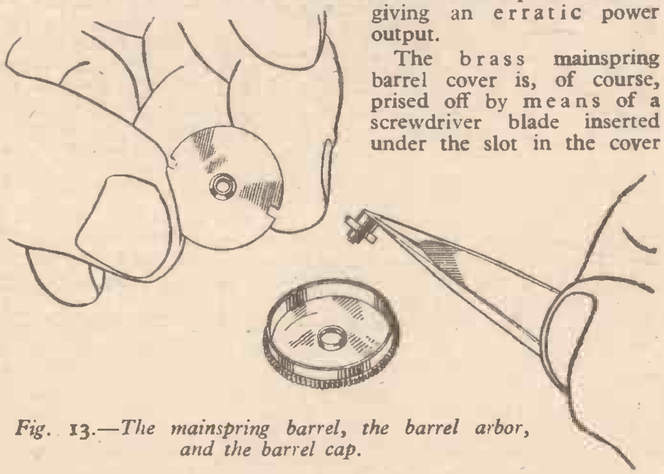


Fig. 13.—The mainspring barrel, the barrel arbor, and the barrel cap.

before the spring and the barrel arbor are removed. Having replaced the spring and reinserted the arbor, making sure that the driving dog engages with the hole in the inner coil of the spring, place three or four drops of good oil on the spring at various points and a couple of drops on the bottom of the barrel and snap on the barrel cover, closing it down with a pair of tweezers till a distinct snap is heard. The barrel can now be inserted in the pillar plate.

The Train

Now turn attention to the centre wheel (the one which carries the canon pinion) brushing and cleaning this and inspecting all teeth to see that none is bent. Place this in the pillar plate. Next examine the pallets to make certain that the stones are not loose. Just quickly dip these in the benzine, and dry off quickly, brushing off and placing it in its appropriate pivot hole.

(To be continued)

A COMBINED VIEWER & PRINTER FOR 35mm

A Versatile and Inexpensive Device for the Photographer

By J. C. LOWDEN

THIS instrument can easily be made using only the most elementary tools and workshop facilities. The measurements given are not critical, no special timber is called for and the total cost very low. The completed device may be seen in the heading photograph.

The Viewer

This is a stamp, filmstrip and slide viewer sold by a well-known multiple store and stationers generally, price 1s. 6d. A model similar in construction but costing £1 1s. is

Fig. 1.—The monoscope viewer bought from a multiple store.

also on sale in most photographic shops. This dearer model is usually in white plastic instead of black and the difference in price is probably accounted for by a much higher quality of viewing lens. The cheaper model (Fig. 1), however, gives satisfactory results.

It might be preferred to extend the longer side of the aperture on the viewer as it does not cover the full width of the standard 35 mm. negative, the actual cut-off being 3 mm. or so, and those who require all the negative the extension is a simple matter, as the plastic is easily cut with the point of a sharp knife.

If this extension of the aperture is to be undertaken, the light-diffusing screen, a sheet of translucent plastic, should be removed. After the cutting it should be carefully replaced.

A hole just large enough to take the finest woodscrew available should now be drilled in each corner of the rear leaf of the viewer.

The Ground Glass

The plastic diffusing screen supplied gives adequate diffusion when viewing in daylight, but for box use it is reinforced with ground glass. This is necessary as, first, the plastic would probably yield under pressure, and, secondly, the diffusion might not be sufficient when the light source is so small and in such close proximity.

The aperture should therefore be filled with a piece of the thinnest ground glass available. The type used in focusing screens is perfect for the job, and it can be bought in quite small sizes at a very moderate price from any photo dealer.

If there is any difficulty in obtaining a piece of ground glass, or if it is preferred to make one's own, proceed as follows. Wash away the emulsion from an old photographic plate and cut to size. Wet the glass, sprinkle it liberally with a household cleaner of the abrasive type and with the remaining glass make a sandwich of glass, abrasive paste and glass. Rub the two surfaces together and a perfect ground surface will be the result.

Whatever glass is used the cutting should be very accurate, and if necessary the edges should be "tailored" to fit the aperture by rubbing down on a hard oilstone. Once a firm press fit has been obtained, insert the glass into the aperture and the viewer may be carefully cleaned up and set aside.

The Box

The base of the box is a single piece of wood 6¾in. x 2¾in. x 1in. thick. A rebate ½in. deep is worked all around the edges. On the long sides the rebate is ½in. wide and ⅜in. wide at the ends. It might be preferred to "build-up" the base with two pieces of heavy plywood. Details are given in Fig. 2.

The ends and sides of the box should be

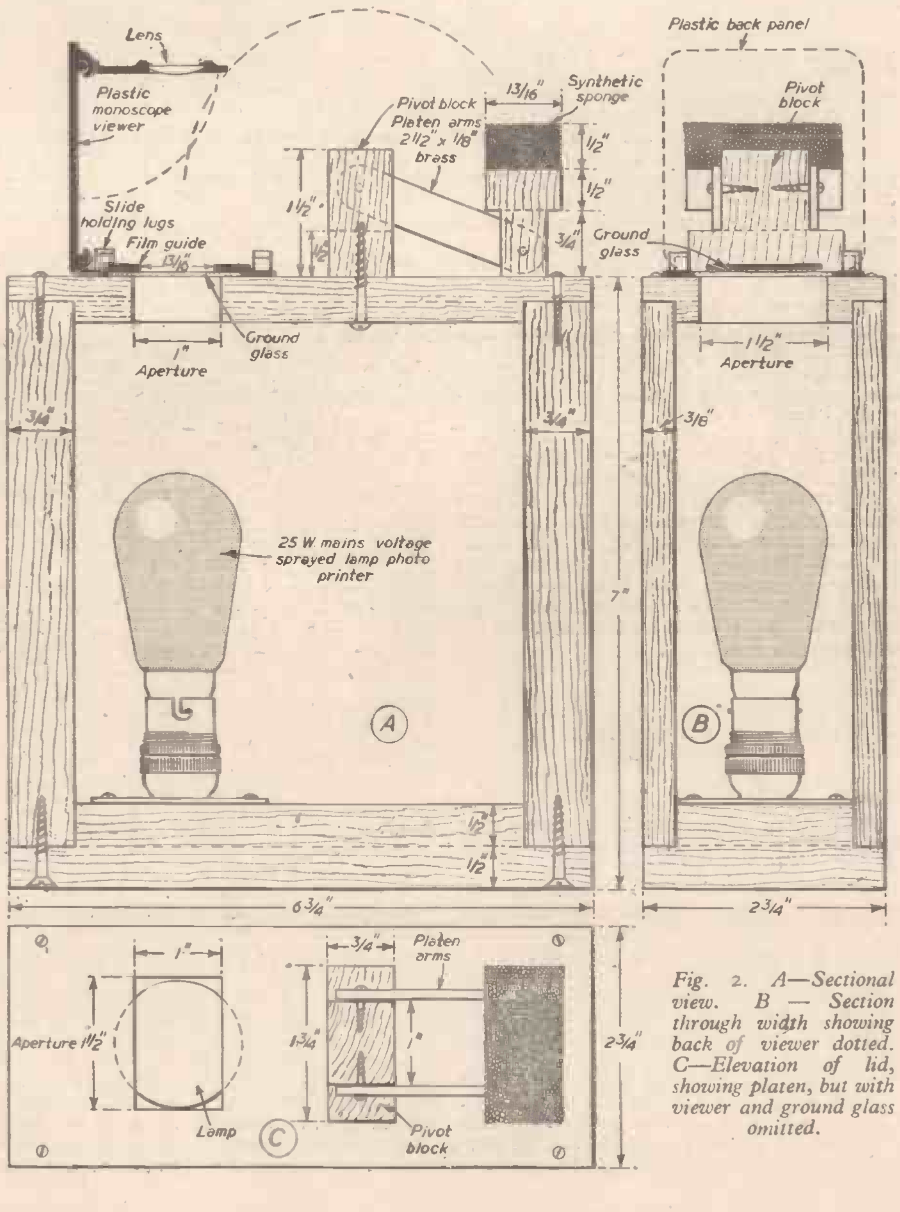


Fig. 2. A—Sectional view. B — Section through width showing back of viewer dotted. C—Elevation of lid, showing platen, but with viewer and ground glass omitted.

cut to the sizes given in the Parts List, and built up around the base so as to provide a firm, light-proof fit. The sides should be screwed to the end pieces. The base may then be secured by a stout woodscrew at each end, which should be countersunk.

The lid is exactly the same as the base in dimensions, save that it might be found more convenient to use a ½in. multi-ply laminated wood. The rebates can then be made very easily by scoring out with a sharp knife, the waste wood being pared away with a chisel until the first two or three laminations are removed.

The aperture, measuring 1in. by 1½in., should be cut through the lid of the box, and

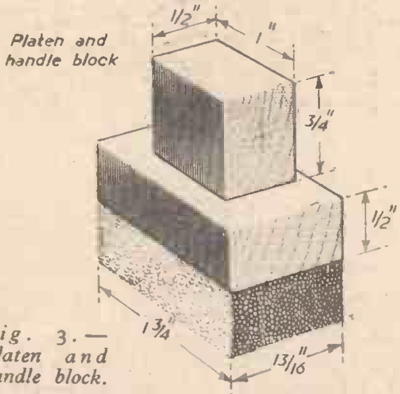


Fig. 3.—Platen and handle block.

the sides must be clean and sharp. Care should be taken when plotting out the aperture, the centre of which should be over the centre of the lamp. As batten holders vary in the size of their bases, each constructor should work out the exact location of the aperture to suit the batten holder which he proposes to use. The longer side of the aperture should be across the width (2¾in.) of the lid, and the aperture should be cut as close as possible to one end of the box. The lid is secured to the ends and sides of the box by light woodscrews.

Lighting

The batten holder should now be screwed into position and wired up for mains supply. A switch is essential, and this should be situated away from the box to avoid vibration. The lamp used is a standard 25-watt triple-sprayed Philips as used in commercial printers, price 2s. 6d.

If mains electricity is not available, a low-voltage battery-operated lamp can be used.

Once the light is fitted and the box assembled, the viewer should be fixed over the aperture as shown in Fig. 2. Check that the film frame in the viewer is evenly and cleanly illuminated, then screw the viewer into position on the lid. The box is now ready for use as a viewer, both for filmstrips and the standard 2in. slides.

At this stage another use suggests itself. The evenly illuminated film track, scanned by the magnifying lens, forms a perfect retouching desk for those who are skilful enough to attempt this difficult task.

The Platen Assembly

Some means is necessary by which negative and sensitive material can be held in contact during printing. The best solution is an articulated platen. This is permanently secured to the lid; it automatically locates itself on to the film track when in use, and swings clear when not in use.

The platen is a piece of multi-plywood about ¼in. thick, measuring 1¾in. in length and 13/16in. wide, as seen in Figs. 2 and 3. This width should be accurately checked to fit the film guide.

The plywood platen is then fixed to a wooden handle block measuring 1in. by ¾in. by ½in. The screws should pass through the plywood, and the screwheads must be countersunk (see Fig. 3).

PARTS LIST

Base 6¾in. × 2¾in. × 1in. timber (1 off)
Ends 6¼in. × 2in. × ¾in. Timber (2 off)
Sides 6¾in. × 6¼in. x ⅜in. or ¼in. plywood (2 off)
Lid 6¾in. × 2¾in. × ⅛in. plywood (1 off)
Pivot Block 1⅜in. × 1½in. × ¾in. timber (1 off)
{Platen and 1¾in. × 13/16in. × ¼in. plywood (1 off)
{Handle Block 1in. × ¾in. × ½in. timber (1 off)
Covered with manufactured sponge.
Platen Arms 2½in. × ½in. × ⅛in. metal (2 off)
1 Batten Holder B.C.
1 Lamp—25 watt mains voltage, sprayed, as used in printer boxes
Thin Ground Glass. Approx. 1½in. × 1⅝in.
Monoscope Viewer. As purchased.
Woodscrews.

The working face of the plywood must now be covered. Various materials such as felt, etc., can be used. I found that manufactured sponge, as sold for toilet use, is ideal for the job. This material cuts cleanly with a razor-blade. A generous strip ½in. thick and slightly larger all round than the platen surface is needed. Glue this to the platen face and allow to dry overnight. "Casco" casein glue does the job perfectly. After the adhesive has dried, the sponge must be trimmed to fit the platen surface.

Two platen arms, of light metal, about 2½in. by ½in. by ⅛in., are needed. At each end of these arms drill a fine hole, just large enough to clear the shank of a fine, round-headed woodscrew. Details may be seen in Fig. 2. Screw the platen arms to the handle block of the platen, allowing reasonable freedom of movement.

The pivot block is made from a piece of

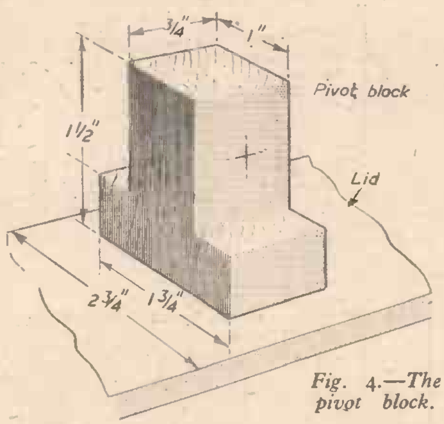


Fig. 4.—The pivot block.

hardwood 1⅞in. by 1½in. by ¾in., and is shaped as in Fig. 4. The upright measures 1½in. by 1in. by ¾in. The free ends of the platen arms are screwed to the sides of this upright.

Locate the pivot block by placing the platen surface in position on the film guide. The pivot block will rest on the lid in its proper position. Square it up, mark off the correct location, and screw the block to the lid either from the underside of the lid or through the projecting bases of the block itself.

The Box in Use

For paper test prints I used a piece of normal grade glossy contact paper, cut to the exact width of the negative and about 2in. long. The negative strip was inserted into the film guide, emulsion side up. The printing light was switched on, the required frame was brought into position and the printing light switched off. The strip of contact paper was then inserted into the film guide, emulsion side down. The platen surface was swung over and held firmly on the back of the contact paper. The light was then switched on for the required printing time and then switched off, the platen swung clear, and the paper removed for development and fixing.

Printing time is of course a "variable quantity," but I found that from five to eight seconds was a range of times giving good results. Fig. 5 shows this in progress.

After preliminary tests it might well be borne in mind that contact paper, cut to match 35 mm. in width, and perforated, can be bought, but the roll as sold—200ft.—is rather an expensive item.

Whatever type of paper is used, these contact prints provide a quick, accurate copy of the negative and are ideal for record filing.

Positive Transparencies

The most attractive feature of the machine is the ease with which transparencies can be

Fig. 5.—The box in use as a printer.

produced. For these 35mm. positive film on safety base is used. The film should be loaded into a spare cassette, and the cassette clearly labelled at once. Otherwise it will find its way into your camera!

Test a scrap of this film in your safelight first! I found that it could be worked with in a bright ruby safelight. Loading the film is exactly the same as for contact paper, but the printing time will be very much shorter. After rinsing, the transparencies were fixed in an acid fixing-hardening bath and thoroughly washed.

Drying must be carried out in a reasonably dust-free atmosphere, of course, and any attempts to accelerate the process should be undertaken with great care.

There are many different types of mount on sale and choice will depend on the particular projector used.

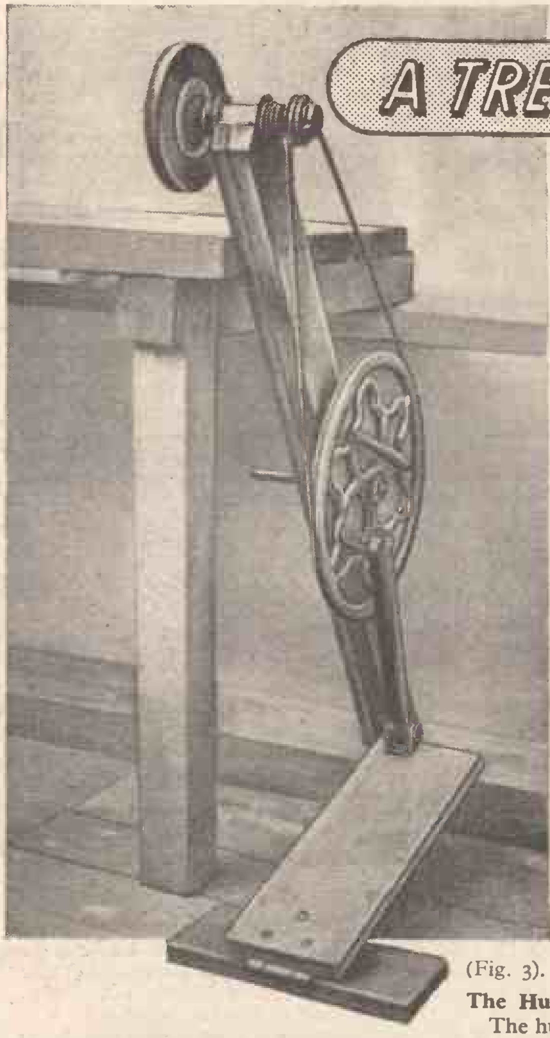
John Bull Golden Jubilee

THE John Bull Rubber Company was founded in 1906, and thus has just celebrated its Golden Jubilee. In a dinner to celebrate the event, tribute was paid to the progress the company has made in those fifty years. The full story of the company is printed in the 98th issue of "John Bulletin," which is the house journal of the company.

Mr. S. M. Portass

WE greatly regret to record the passing of Mr. S. M. Portass, principal of the firm of Charles Portass and Son, Sheffield, and manufacturer of the well-known Portass lathes, on March 11th, after a very long and painful illness. He was one of the oldest established makers of small lathes in this country, and he was a persistent advertiser in our pages.

The amateur and model engineering world has lost one of its pioneers.



A TREADLE GRINDING WHEEL

A Simple Piece of Equipment for the Workshop

By W. E. RICKARDS

A TREADLE grinder similar to the one described below has been in use constantly for a number of years. This, together with the fact that several abrasive wheels have been worn out on it, gives a good indication of its efficiency. It will be found extremely useful for quite a number of small grinding jobs of all descriptions which do not require great accuracy or do not justify the use of a power grinder. It has the added advantage of leaving both hands quite free. It is comparatively simple to construct and easy to operate.

Materials Required

The main feature of this grinder is the use of a cycle hub as a bearing for the stone and its driving pulley. This gives a free-running assembly which, with reasonable care, will last a lifetime.

The following parts (shown in Fig. 1) will be required :—

- Complete front cycle wheel hub (either new or used), H.
- Driving pulley, L.
- Treadle wheel, D.
- Belt to fit pulley and wheel.
- Abrasive wheel, K.
- Wood for support, treadle, connecting rod (pitman), etc.
- Nuts, bolts, woodscrews, strip iron, tubing, etc.

As will be seen from Fig. 1, the wooden support, A, is fixed at an angle to the end of the workbench, B, or in any other convenient position. It carries the hub assembly, C, at the top, the driving or treadle wheel, D, lower down, with the treadle, E, hinged to a block which is screwed down to the floor or baseboard.

The Support

This should be cut from stout timber, about 3ft. 3in. long by 3in. wide and 2in. thick, to the shape shown in Fig. 1. The angle at the base should be adjusted to the bench and user, a few trial positions will soon give the correct height; about 65 deg. at the base will be about correct. The top is cut at the same angle, which will bring it parallel with the floor when it is fixed into position.

A semi-circular groove is cut across the top at right angles to form a seat for the hub as shown in Fig. 2. The size of the hub available will, of course, determine the diameter of the groove. The spoke flanges of the hub should make a good fit across the top of the support (A, Fig. 3). This can be achieved by cutting or packing, according to the width of the hub. A piece of thin sheet iron should be cut and shaped as shown in Fig. 2 to form a clamp which, when screwed down, will firmly fix the hub on its seat. Wood screws should be driven into the support through enlarged spoke holes to prevent the hub itself from rotating (Fig. 3).

The Hub Assembly

The hub should, of course, be in good condition. Normally, the fitted spindle will be too short, so a new one long enough to accommodate the wheel, K, and the pulley, L, should be obtained. The new spindle should be fitted with cones and lock nuts. Two additional nuts and two clamping discs (M, Fig. 3), should also be provided to lock the grinding wheel firmly to the spindle. The pulley, L, can be fixed by grub screw or any other convenient method. Assemble the hub, adjust carefully for easy running without play, lock the cones, add the wheel and pulley, tighten up, and fix into place on the support.

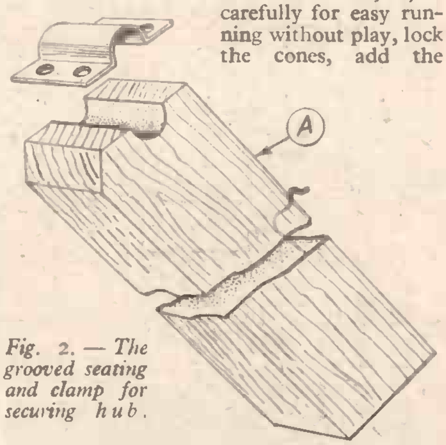


Fig. 2. — The grooved seating and clamp for securing hub.

The Treadle Wheel

Practically any type of treadle wheel will do, providing it will accommodate the belt. The treadle wheel from a sewing machine can readily be adapted. If the wheel carries the cranked bearing, this should be removed and a spindle of ample length substituted. A hole, to take a split pin, should be drilled

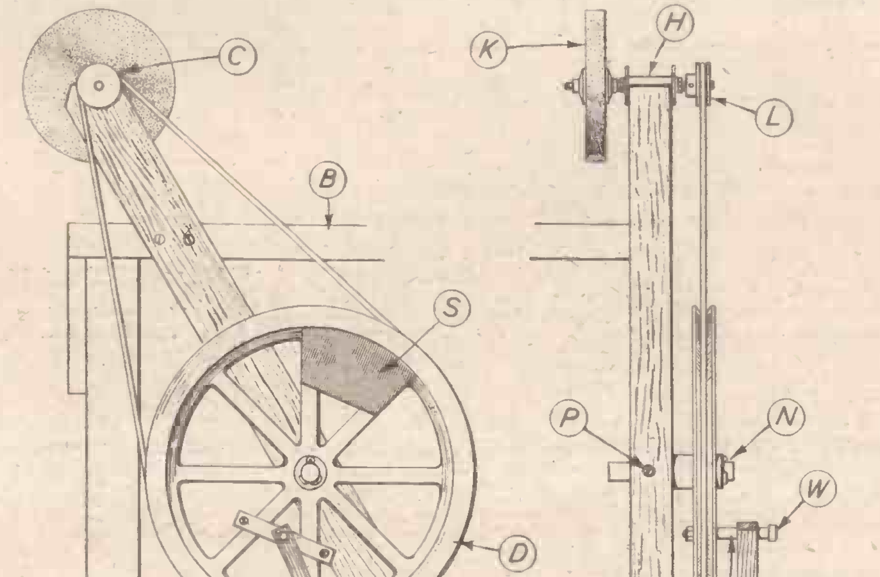


Fig. 1.—Side and end elevations of the assembled grinding wheel.

close to one end of the spindle (N, Fig. 1), and a flat filed for the retaining screw. It is fitted tightly into a hole in the support. Care should be taken to ensure that it is at right angles, otherwise the belt, when fitted, will be out of alignment. The spindle is retained by a wood screw, P, with the end cut off, driven through the support on to its flat. A distance piece should be provided to keep the wheel away from the support (Fig. 1).

The Pitman

Marked R in Fig. 1, this is the next consideration. It is made from solid wood about 12in. by 1¼in. by 1in. Its bearings (U,

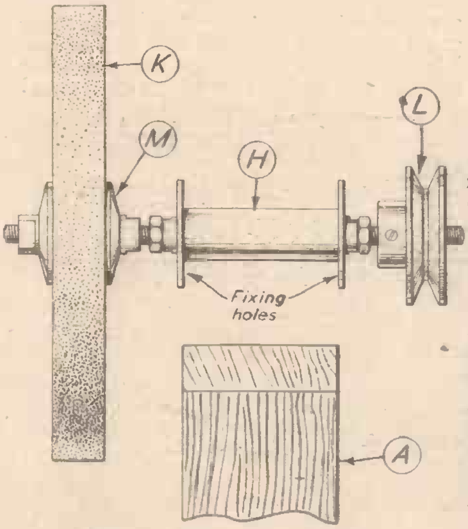


Fig. 3.—The hub assembly.

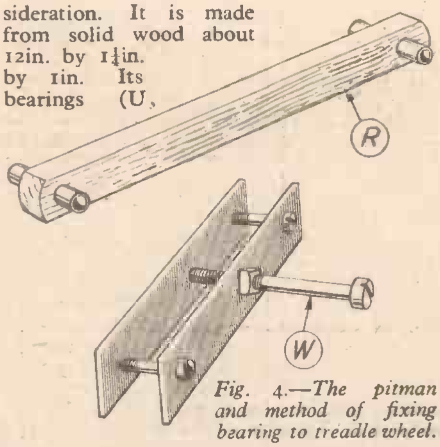


Fig. 4.—The pitman and method of fixing bearing to treadle wheel.

Fig. 4), are formed by two short pieces of iron tube about 1¾in. long and 5/16in. internal diameter, pressed into holes bored through the wood. The tubes can be pressed into place by the aid of the vice and they should be a very tight fit. This is clearly shown in Fig. 4. The upper bearing is completed by the addition of a 5/16in. bolt W, which is fixed to the treadle wheel. This is accomplished by means of two pieces of strip iron as in Fig. 4. By clamping the strips across the spokes (Fig. 1), the throw can be adjusted to individual requirements. The lower bearing is also finished by adding a 5/16in. bolt, which passes through the holes in the bracket as in Fig. 5. The bracket is screwed or bolted down to the treadle (Fig. 1).

The wooden treadle E is about 18in. long, 6in. wide and ½in. or ⅝in. thick. It is hinged as in Fig. 1 or, if preferred, as in Fig. 5.

A counterbalance weight will be needed to bring the treadle a little over half way up when the grinder is at rest. This can be of any convenient shape or material and is fixed on the same diameter as the upper pitman bearing, but on the opposite side of the wheel (S, Fig. 1). If, when in use, the driving wheel is found to be too light, a disc of lead fastened securely to the wheel will effect an improvement.

A tool rest can be fitted if required.

Before permanently fixing the grinder into place the following points should be noted:

1. The driving and pulley wheels must be in line.
2. The pitman must clear the driving wheel spindle.
3. The best position for the treadle, E, on the floor, should be found by trial.

The sketches are not to scale and the measurements are given as a guide and can, of course, be modified to suit individual requirements or materials.

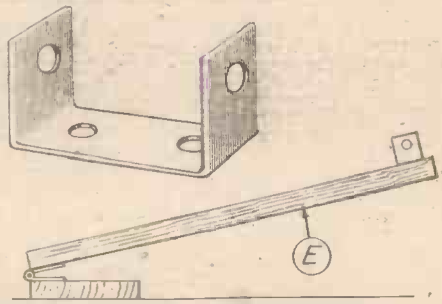
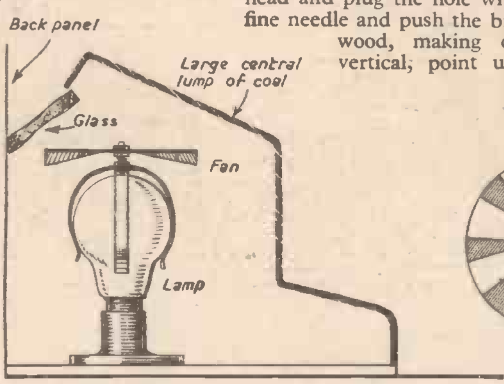


Fig. 5.—The lower bearing bracket and an alternative method of hinging the treadle board.

An Electric Imitation Coal Fire

This Article by J. W. Wood was Received in Answer to a Request Published in "Information Sought"

IMITATION coal is suggested rather than imitation logs, as this is simpler to make. The coals may be made from Perspex sheet bent to any irregular shape and size. The central lump of coal must be large enough to cover the flicker unit and lamp; it must be open at the back and the rear edge within 1-1½in. from the back panel. Cover the larger pieces of coal with white nylon, leaving it at least 1½in. longer on each side than the coal. Fix the nylon with any suitable fixative such as Bostik and cover the top to a depth of ¼in. with Alabastine. If it is desired to have cracks appearing in the coal, have uneven wooden strips in the desired position before covering with Alabastine. If these strips are covered with grease first they will be easy to remove when the Alabastine is set. Finally, paint the top and part of the sides with an enamel. Small pieces of coal may be imitated by dissolving Perspex in a jam jar and cutting it out with a knife, but it must be remembered these pieces will shrink during hardening, and it may be a week before the final size is reached. These small pieces may be laid about between the larger pieces and will cover the joints in the overhanging nylon.



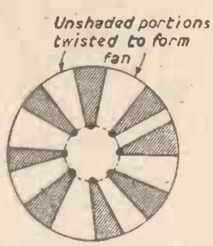


Fig. 1 (left).—Section through fire. Fig. 2 (right).—Method of forming the fan.

The Flicker Unit

Either a 40- or 60-watt lamp is used; it is flame-coloured and is mounted vertically as shown in Fig. 1. A clip is made to fit the lamp by bending two pieces of scrap 20 or 22 s.w.g. sheet metal about ¼in. wide. The two pieces should be drilled where they cross and secured with a cheese-headed screw with the head resting on top of the lamp, as shown in Fig. 1. Drill down the screw towards the head and plug the hole with wood. Break a fine needle and push the broken end into the wood, making certain that it is vertical, point uppermost. This will carry the fan which is to provide the flicker.

The Fan

Take a flat piece of thin aluminium sheet, describe two circles of ½in. and 1¾in. radii and drill seven or eight holes on the inner circle, then cut from the outer circle to the holes, but do not make the cuts of regular pattern: the more irregular, the better. The parts to be cut out are shown shaded in Fig. 2. The remaining sections should be twisted at the outer ends, each in the same direction, to form the fan blades. Drill a hole in the centre to take a cheese-headed screw, which should be fastened to the fan with a nut. After fixing, file off the screwdriver slot and drill from the head with a ⅛in. drill for a depth of 3/16in., then follow with a 1/16in. drill for a further 1/16in. Place this on the needle point and balance it by cutting or filing small pieces off where necessary. The important points are balance and a sharp needle point standing vertically. Switch on the lamp, and after a few seconds the fan should begin to turn.

The lamp should be fixed about 1-1½in. from the back panel, with a piece of ripple glass (used for bathroom window) about 5in. by 1¾in. mounted on the back panel above the fan and below the upper edge of the central lump of coal, as shown in Fig. 1. It is important that space is left above the glass for the hot air to escape. The fan will again turn shortly after switching on the lamp, but at a lower speed than it did before the coal was put over it. The speed may be altered by increasing or decreasing the twist on the fan blades.

Variation in the effects may be obtained by different lamp positions, different type of glass, different angle of glass, and variations in the relative positions of lamp, fan, glass and back panel.

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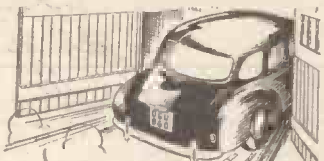

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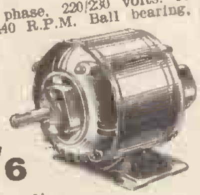

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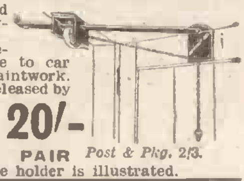

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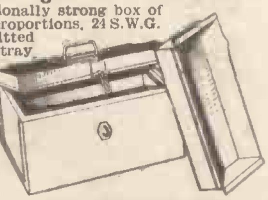

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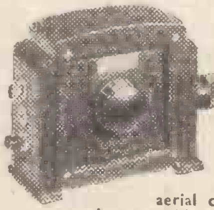

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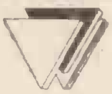

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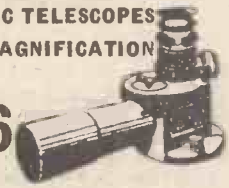

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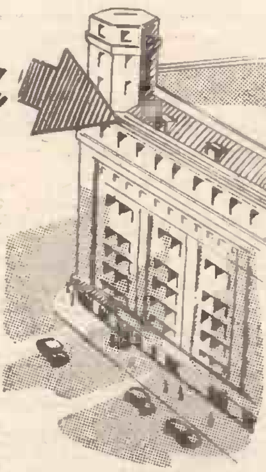
Letters to the Editor



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

An Electric Footwarmer

SIR,—It may interest your readers to know that when their aluminium footwarmers go out of action as a result of leakage they need not be discarded; they can easily be converted into electric footwarmers.

The one I have in mind is a Swan, provided with a metal stopper. The method of conversion is as follows :—

Bore a hole in the stopper sufficiently large to admit an ordinary bayonet lampholder. Screw the lampholder into the stopper with the bulb facing inwards. Attach to the other end of the lampholder about 6in. of stout double flex. To this should be attached a pronged connector. The cap complete should then be screwed into the footwarmer. Sufficient flex with proper connectors should be provided to enable the footwarmer to be connected up with the plug in the bedroom. As a result of this arrangement the footwarmer can be connected or disconnected while resting in bed. Any hole which may be in the warmer can be used to detect if the bulb is functioning and to allow the passage of air.

[*It might be wise to increase the size of this hole to ensure sufficient ventilation. A totally enclosed bulb has a very short life.*—ED.]

The bulb, which should be sufficiently narrow to allow its being passed into the footwarmer, should not exceed 15 watts. This when under the bedclothes develops a sufficiently high temperature. A higher wattage might result in the bedclothes being singed.— E. GILFILLAN (Belfast).

Enlarger Focus Finder

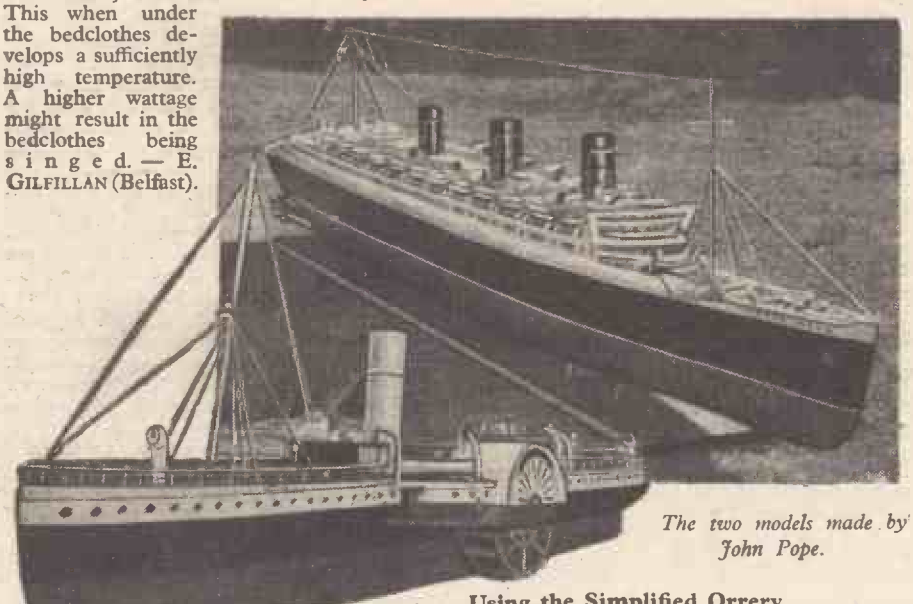
SIR,—In response to the "Information Sought" query by R. West (N.11), seeking information on an enlarging focus finder, I am using on my home constructed enlarger the same basic principle, which I believe is used in commercially constructed enlargers. It is in a very simple form and was adapted to my requirements after the enlarger was made. It consists of (a) any very dense or overexposed negative with a fine but *clear* line scratched from end to end across the centre of the longest side of the negative (on the emulsion side); (b) a strip of thin metal, two-thirds the width of the lens diameter, which swings (from the masking screen arm in the case) across and immediately below the centre of the lens in the same direction as the line on the focus-finding negative. With the latter in the negative carrier and the metal strip in position, the projected image on the baseboard or frame will be a *double* line, *until* the lens to negative distance is adjusted to bring the negative into correct focus. The metal strip can, of course, be incorporated on the inside of the lens housing, if this is more convenient and provided that it can be moved into the central position and next to the lens.

I have found this to be quite accurate and simple.—R. S. HARRINGTON (Cardiff).

Young Modelmaker's Work

SIR,—The photograph below is of a model I have made from plans in PRACTICAL MECHANICS. My *Westward Ho !* is powered by a clockwork motor taken out of a Triang tractor.

You may also be interested to know that I have just completed a 1/16in. to 1ft. scale model of the *Queen Mary*, which is 5ft. 4in. in length. This model took nearly six months to build, and below is a photograph of her.—JOHN POPE (aged 15) (Milford).



The two models made by John Pope.

Using the Simplified Orrery

SIR,—With reference to PRACTICAL MECHANICS, February, 1956, on page 249, "Using the Simplified Orrery," there appears in Fig. 14 the heliocentric positions of the planets for 1955. I see that the positions of Mercury are not complete.

Mercury is shown as: Inner circle, positions, 1, 2, 3; second circle, positions 4, 5, 6; third circle, blank; fourth circle, positions, 11, 12, 13.

What has happened to positions 7, 8, 9 and 10? Were these unknown, or is it a misprint? —M. S. LEACH (Swanage).

Author's Reply

SIR, — I regret that the inner positions for Mercury are not on the diagram. I found it most difficult owing to the small size. The best way to fix Mercury is as stated at line 6, paragraph 2, column 1, page 249, i.e., from the right ascension shown in Whitaker.

Positional astronomy is a most exact mathematical science, and any good set of planetary tables for 1955 will provide reassurance that Mercury has not gone without attention.—F. W. COUSINS.

Ciné-projector Mechanisms

SIR,—I read with interest Mr. F. G. Rayer's notes appearing in the January, 1956, issue of PRACTICAL MECHANICS, on cinematograph projection mechanisms, and I agree that the potential constructor can obtain many of his mechanical requirements ready-made in the form of gears, pulleys and plates.

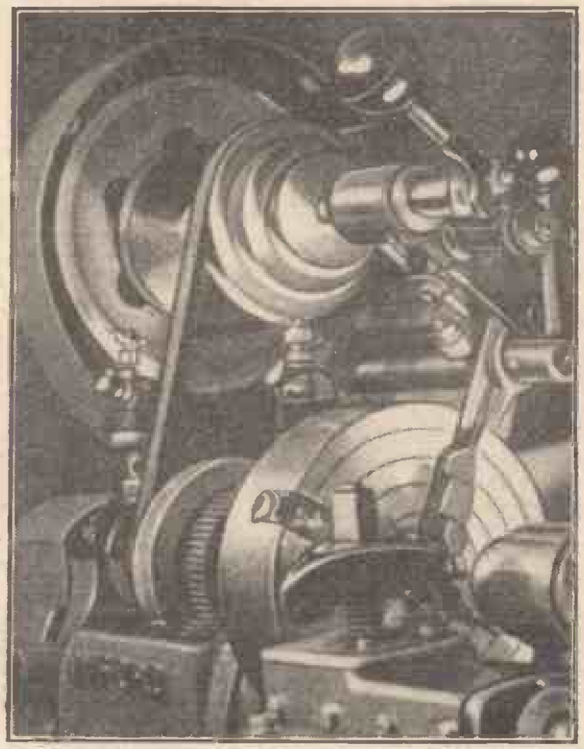
I would, however, like to express the view that Mr. Rayer's comment, "that a machine can be constructed without very great difficulty," is apt to be a little misleading to the would-be constructor, in that whilst such vital parts as the Geneva stop, sprockets, guide and gate can be readily produced by readers who possess, or who have access to, machine tools, it is a matter of quite some difficulty in getting these key components made by hand or engineered at some workshop.

Admittedly, the beater-roller, or Demeney dog—presumably one of the movements "which lends itself to home construction" —could be home-made, but what of the associated take-up sprocket; supply and take-up relationship between dog and sprocket is very critical. The apparently simple beater-roller mechanism is very much underestimated as an easy movement to make, in that any eccentricity or inaccuracy of pitch in the associated sprocket will result in "hunting."

The Geneva Cross, or Maltese Cross would, of course, be a very difficult movement to produce accurately by hand methods. The claw movement, however, could be made by hand, providing that considerable care is taken. Mr. Rayer makes no mention of the barrel shutter, which is perhaps the simplest and most efficient of cinematograph shutters. This device can be arranged as an integral part of the claw and cam movement and could conveniently be interposed between gate and objective lenses. Gearing of any description is eliminated with this type of shutter and the light is chopped horizontally to the path of film travel and not obliquely, as with a fan shutter.

The take-up spool can be quite a problem. In operation it can be appreciated that the take-up spool should gradually and evenly rotate to a progressively lower speed to accommodate the ever-increasing amount of film on the spool. Sensitive tension springs (and slip drives) sometimes are unreliable. With a load of 400ft. of film on the take-up spool I have known them lose their operating efficiency, resulting in a pile-up of unwound film. A gentle continuous tension should be maintained between lower sprocket and take-up spool and this can be achieved by a positive drive to take up, incorporating a compensation device, or clutch arrangement, on the spool carrier.

Although it was not Mr. Rayer's purpose in his discussion to appraise the various optical and illuminating systems of the cinematograph projector, I feel that mention of these functions as prime considerations in achieving satisfactory end results would not be out of place. From the outset, the optical alignment and focal relationship of lamp, reflector, condenser and objective



Mr. G. J. Owen's lathe modification.

lenses (not discounting prisms if these are used) must be correlated with the mechanical configuration.

Heat dissipation of the lamp has also to be considered. This can, of course, be effected by either convection or fan.

A cinematograph cannot be built by "horse and buggy" methods but, in conclusion, I would like to say to those who appreciate the difficulties that may arise and acquaint themselves with the optical fundamentals, merits and demerits of the various movements, much satisfaction and pleasure can be derived from building one's own projector.—L. D. COGSWELL (Gloucester).

Checking Rifle Sights

SIR,—In the February issue of PRACTICAL MECHANICS, under "Letters to the Editor," you published a letter from W. J. Stannage *re* checking rifle sights. This is incorrect.

It should read: "After firing five shots at the centre of target, observe where the group is and correct the sights as follows: Group to left of bull, move foresight to left; group to right of bull, move foresight to right; group above bull, move foresight up; group below bull, move foresight down; i.e., the foresight is always moved into the same direction as the error of the group on the target.

A useful formula for finding the distance to move foresight, providing the backsight is set at the same range as the rifle is being checked, is as follows:

Error of foresight in inches = distance of foresight from backsight on rifle in inches × error of group on target in inches ÷ range in inches.

If the rifle is firing high, i.e., requiring a higher foresight, this may not always be convenient, but by lowering the backsight by the same amount the same effect can be obtained.—P. SMITH (Kingston).

Clutch-operated Drive for Myford M.L.7 Lathe

SIR,—The photograph below is of a countershaft belt drive for my Myford lathe. This alteration was carried out at a very little cost and was all done on the existing lathe.

I have used this clutch very successfully for a long time, and it has resulted in marked improvement in the performance of the lathe in general, thus avoiding undue wear on belts, pulleys and switchgear in motor.—G. J. OWEN (Dagenham).

The Rocket and the Jet Engine

SIR,—In the December issue of PRACTICAL MECHANICS it is stated in "Fair Comment" that both the rocket and the jet engine are identical in the mechanisms of their thrust development.

Whilst this may be near enough correct, speaking generally, it overlooks the sharp basic difference between the two types of power unit. The atmospheric medium is only a hindrance to the rocket, since it obeys laws which, from the aeronautical point of view, are space laws.

The jet engine, on the other hand, must have air, which it uses in huge quantities. Because of this, it sets up, in the atmospheric medium, a local pressure-velocity field of force, and this, in turn, sets up a translation dynamic or "tractive" on the jet. Because a jet engine burns fuel, however, a large proportion of its thrust is derived from positive or rocket drive.

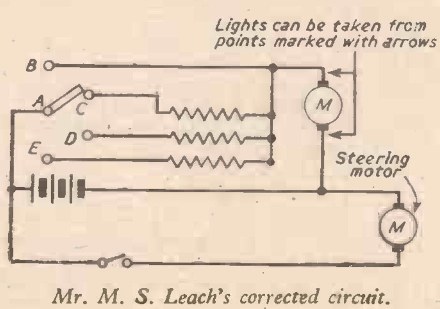
Rocket drive is the most expensive of all and for this, and other reasons, the jet engine, in its commercial applications at any rate, will be modified to make more use of "harmonic drive," as does the by-pass engine.—MARTIN MAHER (Ireland).

Gears for Remote-controlled Model Car—Correction

SIR,—In Letters to the Editor on page 269 (February issue), J. Woodhouse (E.5) gives an electrical circuit for model car gears. From this I observe:

(1) With arm A on the contact B, current passes from the battery, through the motor, and back to the battery.

(2) When A is in contact with either points C, D or E, current returns to the battery without passing through the motor. The motor is therefore off, and the resistances are of no use.



Mr. M. S. Leach's corrected circuit.

Surely, the common lead from the resistances should be taken "up" (as per sketch) to side B of the motor and not "down," as in Mr. Woodhouse's circuit!—M. S. LEACH (Swanage).

[*We regret that the circuit should have been as Mr. M. S. Leach suggests.*—ED.]

Author's Comment

SIR,—The circuit diagram does not specify the values of the three resistances, but I found that the motor needed all the power it could get. I actually tried a variable resistance in the drive motor circuit, to act as accelerator, but the loss along the fine flex was such as to make this impracticable.—A. B. ORR (Belfast).

Conduit Wiring for the Home Workshop

SIR,—I have been reading the article in the February issue of PRACTICAL MECHANICS by W. J. Stannage entitled "Conduit Wiring for the Home Workshop," and although I consider this a most excellent article I must point out an omission.

In the paragraph on socket outlets reference is made to the Ring Main system. I must point out that in order to comply with the Electricity Board's requirements, plugs and sockets for this system must be of the 13 amp. 3 pin type and (I quote from the 13th edition of the I.E.E. regulations): "Where the use of fused plugs is essential for compliance with Regulation 114(b) the plugs and associated socket-outlets shall be of a pattern in which non-fused plugs are unobtainable."

I would further point out that on D.C. supplies the socket outlets must be of the 3-pin type.—J. E. DIXON (Portishead).

Author's Comments

SIR,—The opening sentence concerning the plugs should have read: "In most cases four plugs or socket outlets will be enough, and the cheapest way to install these is to use the 13 amp. variety on the ring main system."

The further comments concerning the earthing are in order, but are not necessary as any socket outlet of a reputable make, suitable for fitting to conduit fittings, will be automatically earthed to the conduit. The conduit is in turn earthed, and this was covered in the article. All sockets and plug tops of the 13 amp. variety are fitted with three pins, and are also fused. I think I am safe in saying that it is impossible to obtain either a two-pin socket or an unfused top.

Mr. Dixon states that on D.C. supplies socket outlets must be of the three-pin type. I will go further and say that all sockets, whether on A.C. or D.C., should be fitted with three pins.—W. J. STANNAGE.

Radio Controlled Models—Correction

WE regret that a printer's error appeared in line seventeen, column two, page 526 of our September, 1955, instalment of Radio Controlled Models. The figure mentioned of 32 mA should have been 3½ mA.

The Advance of Plastics

AN item appeared in "Science Notes" in the February, 1956 issue, entitled "The Advance of Plastics" in which mention was made of a synthetic resin which could stand a temperature of 1,000 deg. C. We have since learnt that the author of this statement claims to have been misreported by the French press. What he intended to convey was that the synthetic resin, when introduced into the flame of a bunsen burner resisted for a few seconds, then took flame, but that the flame ceased to burn as soon as the resin was withdrawn.

READERS' SALES AND WANTS

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

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(Continued on next page)

Trade Notes

Mecca Spray Guns Products

THE new "Mecco" spray gun shown in the photograph will spray both cellulose and synthetic paints. It is supplied with fine,

The "Mecco" spray gun.

medium and standard jets, an extra heavy paint and distemper container and strainer and a ceiling nozzle. The price is 75s. net.

Also announced is a portable universal saw which can be attached to any electric drill from ¼in. upwards. It can be used for rip, cross-cut, coping, jig and hacksawing operations and will saw 1½in. timber or 3/16in. steel. Retail price is 49s. 6d. net with three blades.

A new electric sander-polisher and a hedge cutter are also available and leaflets of all these products are available from Mecca Spray Guns, 13, Lower Richmond Road, Putney, London, S.W.15.

X-Acto Hobby Knives and Tools

THE makers of these well-known tools, Trix Ltd., London, W.1, claim, "There's an X-Acto blade for every cutting job," and produce an impressive variety of cutting tools to support this statement. Three handles are produced and the whole range of blades, gouges, punches, routers, etc., are interchangeable fits in these. Tools are supplied in various packets and in complete sets. Prices are from about 6d. to 1s. each for the tools and from 6s. to 87s. 6d. for the sets.

Guide to Screw Thread Forms

MESSRS. W. H. A. Robertson and Co., Ltd., of Lynton Works, Bedford, have just produced a valuable guide to the screw threads of the world, showing at a glance the forms of over 60 standard screw threads in use throughout the world, and no less than 146 series from 21 countries are indexed, together with the reference numbers of relative national standards.

The guide is suitable for wall mounting, as well as for desk or library, and colour has been used to aid the eye.

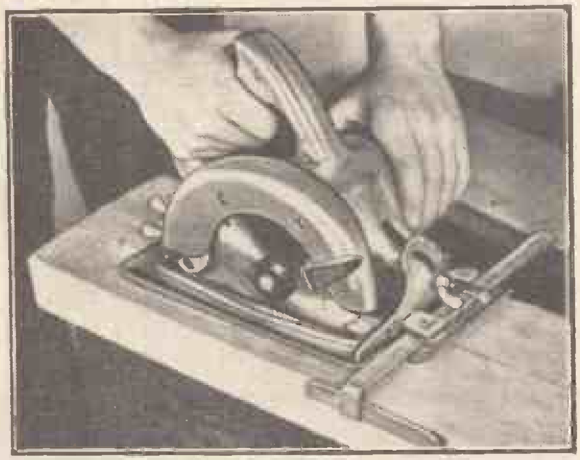
Suppliers of Conduit and Fittings

OF special interest to readers who have read our recent article, "Conduit Wiring for the Home Workshop" will be the products of Messrs. London Wholesale Warehouse, 165, Queens Road, Peckham, London, S.E.15. They supply all the fittings mentioned in the article and a large range of other electrical fittings of every kind. A comprehensive list appears in the London Wholesale Warehouse advertisement in PRACTICAL MECHANICS each month.

New Black and Decker Tools

NEW 6in. and 7in. heavy-duty lightweight saws have been announced which have been designed for a variety of purposes in addition to carpentry; one of these is shown in the photograph.

The telescopic lower blade guard closes automatically as the saw is lifted off the work, safeguarding the operator, and other features include built-in bevelling and depth cutting adjustments, a two-pole trigger switch and a rib fence.



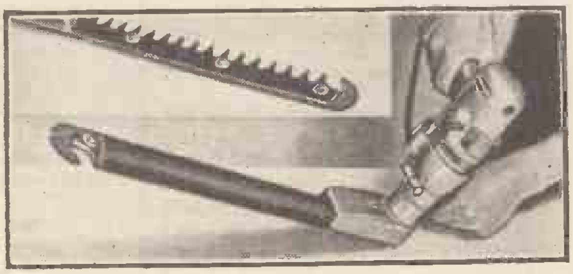
The Black and Decker 6in. heavy duty saw.

Various blades are available for cutting many materials. Prices of the 6in. and 7in. models are £21 and £25 respectively.

Also shown photographically on this page is a new pruning and hedge trimming attachment which will fit the ¼in. "Utility" drill, the sander-polisher drill and most other drills by means of adapters. The hedge trimmer blade can be swivelled to any position and is locked by a single screw.

A specially wide-spaced hooked tooth is provided at the end of the 13½in. blade for pruning. A sheet steel guard slips over the blade to provide complete protection and a firm hand grip, leaving only the pruning hook exposed.

The price is £5 19s. 6d. and drums of cable are supplied as accessories at 24s. for 25ft. and 46s. 3d. for 50ft.



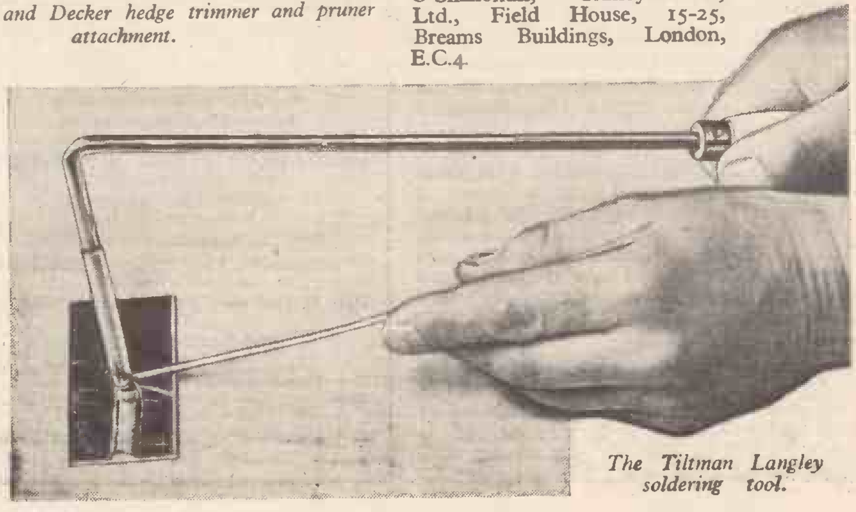
The new Black and Decker hedge trimmer and pruner attachment.

New Soldering Tools and Solder for Aluminium Alloys

MESSRS. Tiltman Langley have developed a soldering tool which is easily manipulated, light and cheap and capable of being used for the fluxless soldering of aluminium with any normal solder used for this purpose.

The equipment used is a hand tool and an electric hot plate for raising the work to the soldering temperature. The technique is to apply the solder and lightly brush the surface being tinned with a guarded refractory brush on the tool, any of the usual cleaning techniques having been previously applied to the aluminium; no flux is used. The surfaces to be joined after tinning are placed together and a neat fillet of solder produced by sweeping through the molten solder with the refractory brush.

Enquiries should be addresed to: Frank O'Shanohun, Sidney-Barton, Ltd., Field House, 15-25, Breams Buildings, London, E.C.4.



The Tiltman Langley soldering tool.

Your Queries Answered

RULES

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

Preserving Seaweed

I WISH to preserve some of the more fern-like types of seaweed, but it must, if possible, appear opened out like a living plant, not flat like pressed ferns.

Could you, therefore, tell me of a good preserving solution that the seaweed could float in or some way of setting the weed in a clear jelly ?

Better still, could I treat it and stiffen it like the "natural sea fern" that is sold in ornamental pots ?—M. M. Dawes (Margate).

YOU can try floating the seaweed in a jar of glycerine, to which a few drops of phenol have been added. Alternatively, you could try setting them in agar-agar. We do not think you would be able to stiffen the specimens in the way you suggest.

Cleaning Smoker's Pipes

HOW can I clean and sweeten a meerchaum and a briar pipe that have become strong through smoking, but otherwise in good condition ?—V. N. Howells (Birmingham, 20).

RUN pure alcohol or acetone through the stems of your pipes from the bowls and follow by a stream of air from a tyre pump for several minutes.

Hand Warmer Element

I HAVE recently bought second-hand a Japanese hand warmer, which in appearance looks like a thin cigarette case.

Unfortunately, the element part is missing. I believe this consists of a short spring packed with asbestos fibre ; I have fixed a spring to mine and packed it with asbestos fibre, but it does not work. Do you know of what substance the spring and fibre are made, and if they are obtainable ?—A. C. Sanderson (Liverpool).

THE principle on which your hand warmer works is based on the physico-chemical principle that certain substances give an exothermic reaction by oxidation induced by a catalytic reaction set up by a mixture of the substance and air coming into contact with *platinised* asbestos. In this instance the catalyst is the platinum chloride which has to be deposited on the asbestos pad. Methyl alcohol is such a substance which gives out heat on oxidation.

We would suggest that you purchase another asbestos pad from chemical suppliers such as Griffin & Tatlock, Ltd., Kemble St., London, W.C.2, and instruct them to have it activated with platinic chloride.

Electric Fire Coal Effect

I AM building an electric fire, but have been unable to obtain anything suitable for the "coal" effect. Could you please inform me where I could obtain sodium silicate or any other suitable material to cover the area of the "coal" fire, which is 13½in. × 7in. and approximately 3½in. deep ?—E. Tarr (Weston-super-Mare).

SODIUM silicate can be obtained from Messrs. Townson & Mercer Ltd., 101, Beddington Lane, Croydon, Surrey.

Why not build up your "coal" by cementing together irregular geometrical rhomboids of perspex ? I.C.I. (Plastics Divn.) Welwyn Garden City, will recommend and supply the requisite solvent or adhesive.

12 Exposures in a 616 Camera

HOW can I obtain 12 exposures on a 616 film ? My camera is a Kodak 616 folding, taking 8 exposures of 2½in. by 4¼in. I would rather drill another hole in the back than rewind the film.—G. Moye (Yorks).

BY using an internal mask of thin metal, suitably shaped and placed between the camera frame and film, the size of the exposure may be reduced to any desired dimension. Masks of this type, giving 12 or 16 exposures on 120 or 620 film, for use in the usual 8 exposure type camera, may be obtained. Fitments enabling such film to be used in 616 cameras are occasionally seen advertised in photographic journals. A mask could be cut from thin metal, subsequently darkened by soaking in mild acid, or in some similar way. The surface upon which the film travels should be carefully smoothed.

If the type of 616 film you use has alternative rows of numbers (*e.g.*, up to 12), these may be used by drilling a window at the appropriate point, covered with red for ortho, or green for panchromatic film. If no further numbers are present, 16 exposures about 2½in. by 2½in. could be obtained by drilling a further window at a suitable distance from the present window. Winding would be as follows : 1, (1) in first window ; 2, (1) in second window ; 3, (2) in first window, etc. In all cases the mask should be of a dimension to suit the extent to which the film is wound on, with the aperture centrally placed where definition is best.

De-scaling a Boiler

CAN you give me any information regarding the de-scaling of a domestic back boiler by means of chemical action ?—H. Smaller (Grimsby).

TO clear the scale deposit empty the system of water and run into it a solution of hydrochloric acid in water. We advise buying the strong commercial muriatic acid and diluting it one-third acid to two-thirds water by volume.

The danger lies in keeping this solution too long in the boiler so that chemical action also takes place on the metal surfaces ; but there is a fair margin of safety here, for the acid solution will have greater affinity for the lime deposits and will dissolve these by forming calcium chloride in preference to ferric chlorides. We think you could keep the acid solution in the boiler for not longer than half an hour. You must then flush out the system very thoroughly with running water until there is discoloration of blue litmus paper to red.

To prevent this scale forming to such an extent you must install a domestic water supply water softener. Any water engineer's merchants or your local electricity undertaking will advise the type for your district.

Copperplating on Tin

I AM about to copper electroplate a number of 2in. x 3in. x 1in. articles I have cast in tin, and would be obliged if you could enlighten me on a number of points.

(1) Is caustic soda unsuitable for degreasing tin ? If so could you give alternatives ?

(2) As I am only plating one side, do I need only one anode ?

(3) What is the easiest method to prevent the concave side from being plated ?

(4) Is there a critical distance between the anode (or anodes) and the article being plated ?—E. C. Symons (Leicester).

(1) CAUSTIC soda solution in the strength recommended will prove to be quite suitable for degreasing tin provided that the solution is used cold.

(*Continued on page* 383)

(2) Only one anode will be required if one side only of the article is to be plated. A point to remember here is that only the area of the surface actually being plated is taken into account in calculating the required current.

(3) A simple method of preventing deposition of copper on part of the article is to warm the article and rub it with a candle so that a protective coating of paraffin wax is formed. Another method is to use a lacquer consisting of scrap celluloid dissolved in a mixture of equal parts of acetone and amyl acetate. (This lacquer dries very rapidly.)

(4) The distance between the anode and the article being plated is not critical. To obtain uniform plating, however, the nearest distance divided by the greatest distance should be as near unity as you can arrange. In practical terms this means that the anodes should not be too near the article.

Depending on your requirements, you might find an alkaline plating bath of the type given below will give more satisfactory results:

Copper sulphate	2 oz.
Sodium potassium tartrate	5 oz.
Sodium hydroxide	2 oz.
Distilled water	2 pints.

Special Ozone Generators

WE have recently developed some machines in connection with the blanket trade, and we are now asked to provide a small supply of ozone to each of these.

Can you possibly help us, as our knowledge of the manufacture of this gas is elementary?

Each machine would have its own generator and the amount required would be about 1 to 2 cfm. per machine; there is a slight suction in the machines, which would draw the gas in, but the supply of gas would have to be stopped when the machine is switched off for refilling.

Can you please outline the method of generating the gas, which we seem to remember as the passing of oxygen (or air?) through a brush discharge, and please state the approx. H.T. voltage and power needed to give this discharge, and also give some details of a suitable vessel or tube through which the discharge takes place?—H. H. Parsons (Witney).

WE suspect that the ordinary commercial ozone generator would not be entirely suitable for your purpose, and would suggest a single unit generator so designed that the ozone-air mixture could be induced into your machines by the suction which you state is available.

In principle a satisfactory ozone unit could be made by using a silica or micanite cylinder of about 2 to 2½in. diameter as your dielectric, and the inside of the cylinder is fitted with aluminium gauze, and a similar aluminium gauze cylinder is bound round the outside of the silica tube. The inner and the outer gauzes are then connected by wires to a transformer yielding 7,000 volts D.C. and the transformer is put in circuit with your A.C. supply of, say, 240 volts.

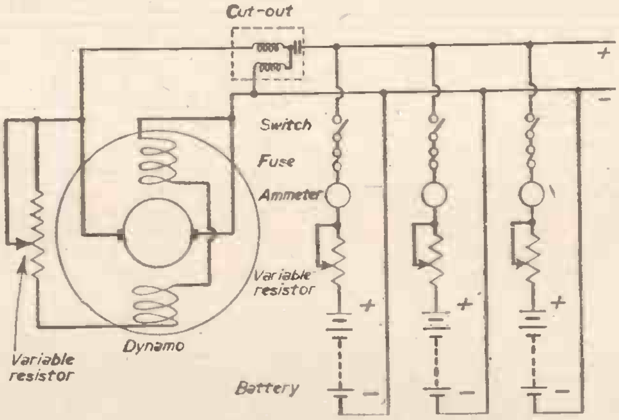
We suggest, however, that you should get in touch with a consulting engineer, as we feel this apparatus should be designed by a chemical engineer to give satisfactory service.

Charging Batteries

I HAVE a 110-volt motor-driven generator, A.C. and D.C., which I wish to convert to charge batteries at 24 volts. Could this be achieved by using resistances or is a transformer necessary?

Could you please also advise me as to the circuit? I have access to an ammeter and a sliding resistance and possibly a cut out.—R. Gilson (Somerset).

IF required you could charge three 24-volt batteries in series; alternatively you could charge the batteries in parallel. We advise using about 30 volts for charging each 24-volt battery. The output voltage of the dynamo could be reduced by driving the dynamo at reduced speed or by connecting a variable resistance in the shunt field circuit. If one battery or more than one battery in series are to be charged the shunt regulating resistance can be used to control the charging current. However, if you wish to charge the batteries in parallel it would be an advantage to reduce the dynamo voltage to 30 to 40 volts and use separate charging circuits each with a switch, fuse, variable resistance, and preferably an ammeter in each circuit as indicated in the diagram.



Circuit for charging batteries in parallel

Making a Cold Box

I WISH to construct a large size milk and butter cooler. I intend making a wooden box about 1½in. larger than a biscuit tin, filling the space between them with some cement compound, finally removing the box, but using the tin as the interior. The door would be cast of similar material.

Could you please suggest a suitable porous material and a method of preventing cement from sticking to a wooden or cement mould?—S. Corbett (Croydon).

YOU will not get sufficient porosity from a cement-sand mixture for an efficient cooling surface by evaporation, and we suggest that you build your cooling jacket of a cellular type brick, such as can be obtained from British Uralite and Cellalite Ltd., Gravesend, Kent.

These bricks are made of small cross-section and can be cemented together in the usual way. Your biscuit tin can be poised in the middle of this chamber and you will have an excellent cooler.

Possibly Sankey's, the builders' merchants, would let you have a small quantity from stock; though the makers might oblige you if you explain the purpose for which they are required.

Information Sought

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

A Paraffin Dispenser

I WISH to make a paraffin dispenser. Can you tell me the working principle and how to make one? I wish to measure out one gallon at a time fairly rapidly. The main tank would feed the dispenser by gravity. Are there any books or publications dealing with this subject?—R. J. PERRY (Ramsgate).

"Live" Water Action Washing Machine

I WISH to construct a washing machine, using the "live" water action.

What type and size of water pump would be required, and where could it be purchased; also what size of electric motor is required to drive it?

How could the water be heated by gas without it clashing with the pipe leading to the water pump, and with the motor, electrical circuits, etc.?—A. DAVISON (Wallsend).

Mirror Ball Making

I WOULD like to make a mirror ball for a dance hall, as the price of a commercial one is prohibitive. Could you advise on how to form one about 16in. in diameter?—BRIAN MCAULEY (Co. Derry).

Making Marble Beads

CAN you let me have a process for making and drilling marble beads, and a convenient way to sand and polish? The beads must be uniform from, say, 5 to 8 mm. and hole not greater than .080in.

Is there any book you could recommend on the working of marble?—WM. A. PALMER (Dublin).

Ex-Govt. Camera Operation

I RECENTLY bought a G.C.S. 16 mm. Recorder Mk. 2 (ex-Govt.) camera. I understand that this type of camera can be operated at single shot and also 15 frames per second. Unfortunately I am unable to find the method of control, so I would be pleased if you could tell me how this camera operates, and also if it is possible to make it into a hand-operated camera.—C. J. THOMAS (Rugby).

Electric Garden Cultivator

CAN you please give me details for building a petrol- or electric-driven garden cultivator of the rotating blade type?—H. B. THOMPSON (N. Ireland).

China Glacé

I AM trying to find a process to china glacé a leather box without affecting the shape and colour. Would you tell me how it is done?—W. I. JONES (Port Talbot).

Dressing for Canvas

COULD you tell me the method and formula for a flexible dressing for canvas as used by British Railways on their canvas tarpaulins, also a flexible dressing for the canvas skin of a folding canoe?—DONALD WELCH (S. Lowestoft).

Electrical Vibraphone

I WISH to build an electrical vibraphone and wonder if you can give constructional details of such an instrument. I understand that one type of vibraphone incorporates a clockwork motor, but the type I intend building uses an electric motor.—R. W. FEAR (Cheltenham).

A Simple Steam Turbine

A Powerful Miniature Unit for Driving Small Models

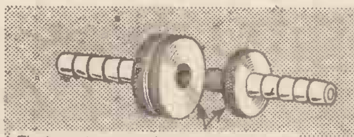
THIS model steam turbine is capable of driving small models or miniature dynamos designed to light one or two flash-lamp bulbs. For the turbine casing, obtain a circular shallow tin box; a furniture polish tin measuring 4in. or 5in. in diameter will answer admirably. Find the exact centre with the aid of a pair of compasses and then with the lid on carefully drill a ⅛in. hole right through and exactly perpendicular to the tin (see Fig. 1). Also make two holes in the middle of one side to the dimensions shown in the same sketch.

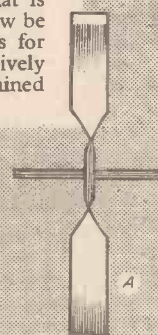
The rotor or fan should be made out of thick tinplate and of such a diameter to fit comfortably into the tin box, which is now the turbine case. The vanes are marked out on the disc and cut, as shown in Fig. 2. A ⅛in. hole is drilled in the centre and the vanes afterwards bent at right angles to the axis, as at A, Fig. 2. A smooth piece of wire, such as a motor-cycle spoke, is next required for the spindle; it should work without shake in the ⅛in. bearing holes in the turbine case. About 2½in. of wire is needed and the fan is securely soldered to the middle. A foot of what is known as ⅛in. "comp. pipe" should now be obtained from the plumber's. This is for the steam pipe, and each end is respectively soldered to a screw-on fitting, obtained from two old cycle-pump connecters. This is clearly shown in Fig. 3.

A screw-in fitting from the opposite end of one of the connectors is next required. This forms the steam nozzle, and should be soldered into the 3/16in. hole in the side of the turbine case (Fig. 4). The boiler is the next thing to make and consists of a 1lb. "Golden Syrup" or similar strong tin, with the lid securely soldered down. Two holes have to be made in the lid, one to receive the screw-in fitting out of the remaining cycle pump connecter, and the other a screw-top from a tooth paste tube, forming the water filler (Fig. 5).

Assembling the Turbine

The spindle with the fan soldered to it should be put through one hole in the case and the lid fixed on and lightly soldered round.





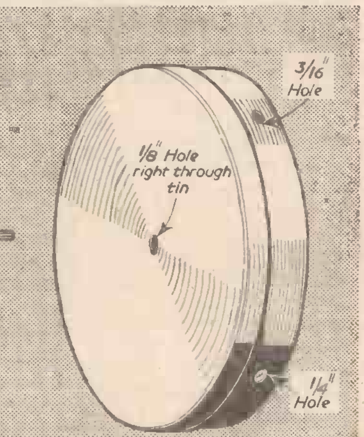


Fig. 1.—Drilling centre hole.

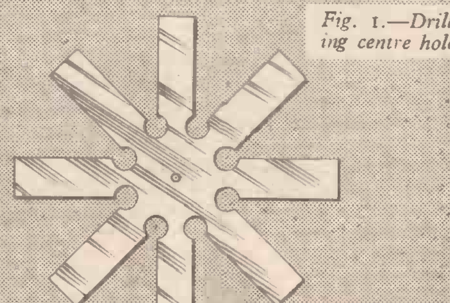


Fig. 2.—Cutting and bending the rotor blades.

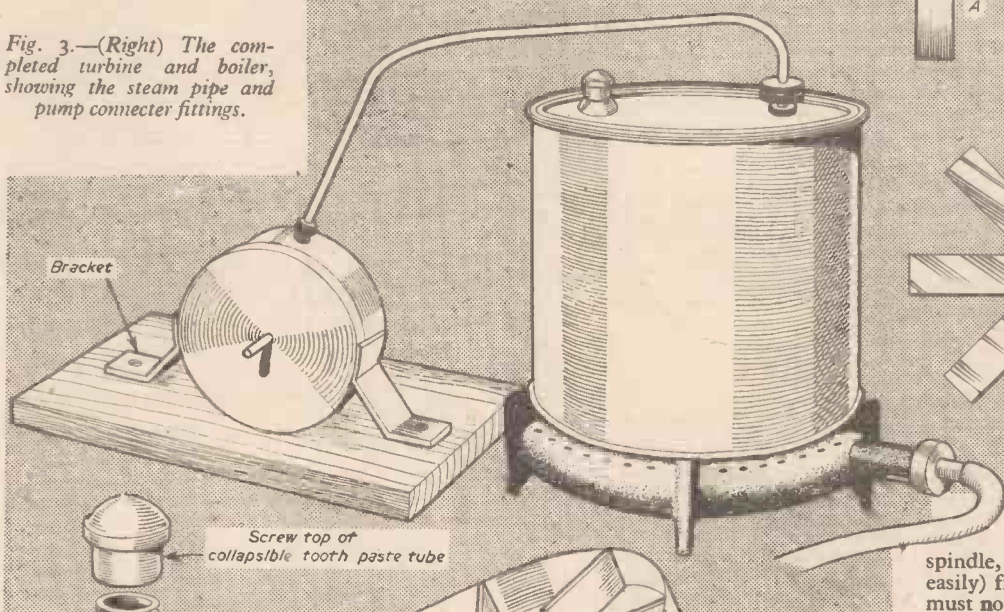


Fig. 3.—(Right) The completed turbine and boiler, showing the steam pipe and pump connecter fittings.

Fig. 4.—(Left) The turbine casing with steam nozzle fitted.

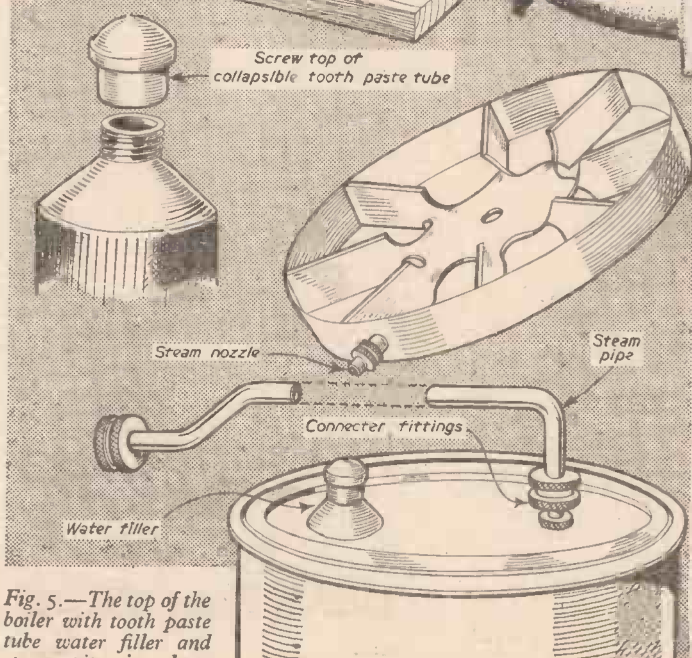


Fig. 5.—The top of the boiler with tooth paste tube water filler and steam pipe in place.

Two tinplate collars will have to be soldered on to each side of the spindle, to prevent the fan (which should spin easily) from touching the sides. The turbine must now be mounted on a wooden baseboard, and to do this two strong tin brackets must be soldered to each side (Fig. 3). Everything is now ready for working, so oil the bearings and fill the boiler three parts full of water. Having done this, connect it with the turbine by means of the steam pipe and place on a gas ring or other source of heat. As soon as it boils the turbine will begin to revolve, the waste steam escaping by the ¼in. hole in the side (Fig. 1).

Driving Pulley

A driving pulley can be attached direct to one end of the spindle, but a far better method, and one giving a great increase in power, is to drive through gearing. This is easily accomplished by soldering a cog to one end of the spindle and making it drive a large cogwheel carrying the pulley. The cog and cogwheel can be obtained from a disused clock.

Simple ELECTRICAL EXPERIMENTS FOR THE JUNIOR MECHANIC

A TESLA COIL

FOR those who have an induction coil capable of giving a ½in. to 1in. spark is recommended the "Tesla" coil shown in Figs. 1 and 2.

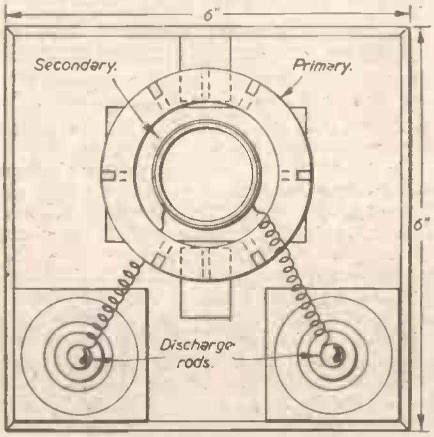


Fig. 2.—A plan view of the coil.

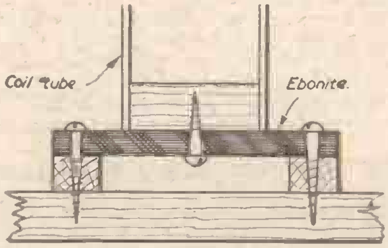


Fig. 3.—Method of fixing coil to the base.

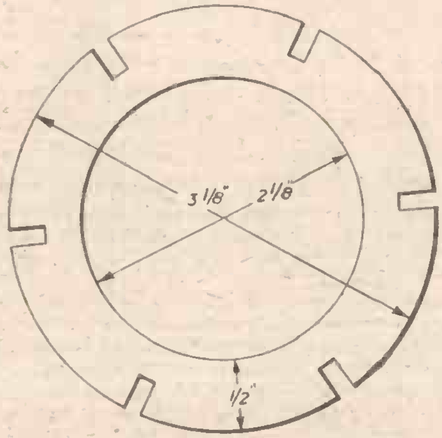


Fig. 4.—The former for the primary.

The Secondary

Select a postal or cardboard tube 1¼in. diameter and 6in. long, varnish it with shellac and wind it from one end to the other with No. 32 s.w.g. double cotton-covered wire, pressing each turn close to the preceding one. When this has been done varnish the wire with shellac and cut a disc of wood ½in. thick to fit tightly into the end of the tube. This should be held in position with glue, *not* nails. Cut a strip of ebonite 2in. wide and 3in. long, and fix the coil to it by means of a screw driven into the centre of the disc. Cut a base for the coil 6in. by 6in. by ½in., and chamfer the edges and stain a dark brown. When dry, the coil should be fixed in the centre as shown in Figs. 1 and 3.

The Primary

Cut two rims from 3/16in. plywood to the size shown in Fig. 4 and also six spacers 1¼in. by ½in. The notched spacers are fixed symmetrically into the rims with glue, and when firm five niches are made in each to accommodate the wire for the primary (see Fig. 5). The primary is five turns of No. 20 s.w.g. bell wire, the ends of which are connected to terminals on the rims. This coil is unlike the ordinary spark coil, as the primary is outside the secondary. Make two supports for the primary as shown in Fig. 6, and fix one at either side of the secondary. Slip the primary over the secondary, and when symmetrically placed glue it to the supports.

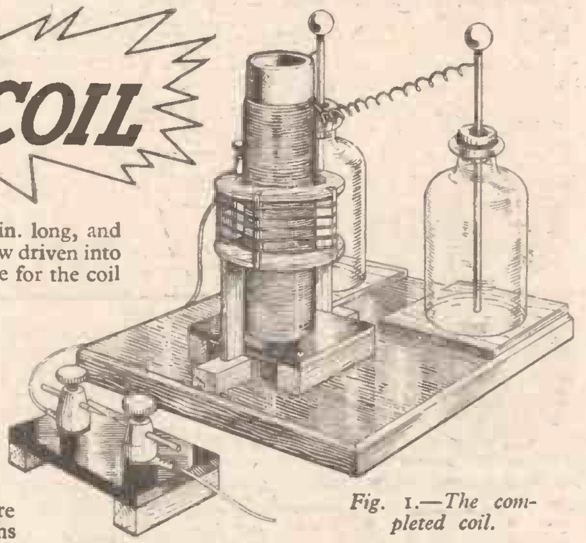
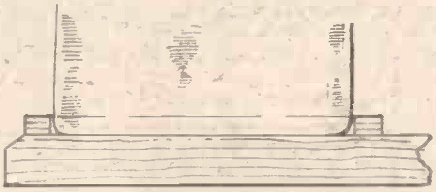


Fig. 1.—The completed coil.



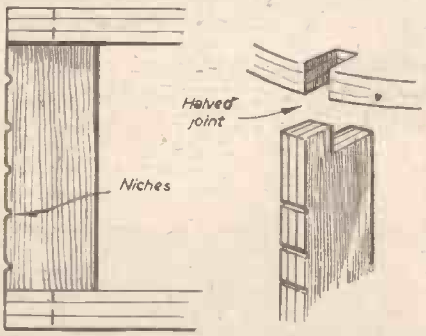


Fig. 5.—Fixing the rims and spacers and position of the niches.

Fig. 7.—Details of the support for the bottle.

The Discharge Rods

Two discharge rods must now be made. Obtain two small bottles as much alike as possible, dry them and cut wooden stoppers to fit tightly into their necks. The discharge rods consist of stout wires with metal balls at the ends, and are fixed in the stoppers by means of sealing-wax. Fix a bottle at each of the two front corners of the base by means of the support in Fig. 7, and connect the wires from the secondary to the discharge rods. The coil is now complete and should be connected to an induction coil. In Fig. 8 it will be seen that the Leyden jars are connected directly across the secondary of the induction coil. The spark gap consists of two terminals mounted on a piece of ebonite (see Fig. 9) and is connected in series with the primary of the "Tesla" coil. On starting the induction coil a fat white spark should jump across the gap. At the same time a discharge will take place from the rods of the secondary.

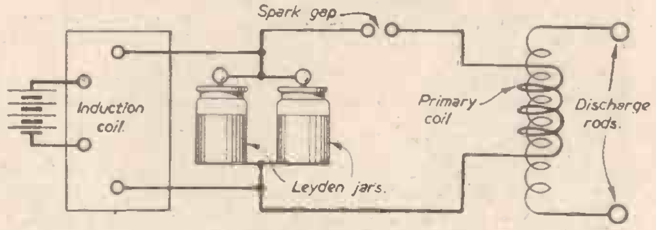


Fig. 8.—The circuit.

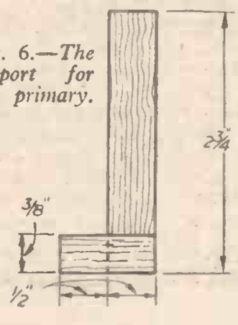


Fig. 6.—The support for the primary.

The Spark

The strange beauty of the discharge is only really apparent in the dark. Start the induction

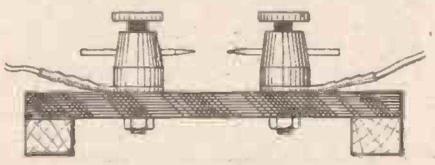
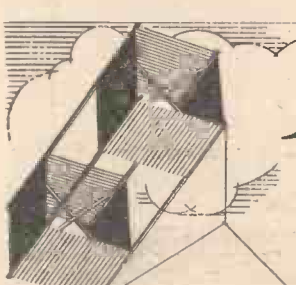


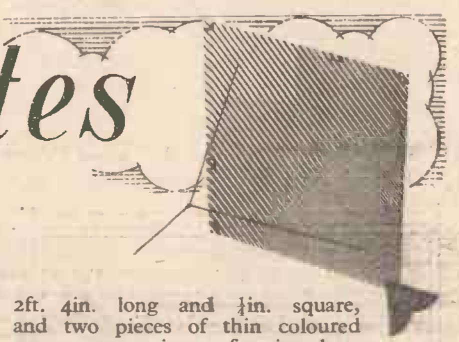
Fig. 9.—The spark gap.

coil and adjust the gap until a continuous discharge takes place from the rods. This discharge, which is of a peculiar greenish-yellow nature, does not give a shock, but merely causes a slight pricking sensation on the skin. Bring the hand towards one rod, when the discharge will immediately jump out towards it. If a rod is earthed and a piece of metal brought up towards the other one, the discharge may be led about without the operator feeling any uncomfortable sensation.

Take a piece of bare copper wire and bend it to form some words such as "good night." Connect it to one rod and it will at once glow, revealing the nature of the message. There is no limit to the shapes that may be made and illuminated in this way, but as a fitting end to a demonstration grasp one rod and bring the face up to the other. The effect is most startling as the head and face are surrounded with a halo of small sparks.



Making Kites



Two Easily Made Types

THE Indian kite is dealt with first as it is the simpler to construct. In spite of its being extremely light and fragile, it can fly so high that it nearly disappears from sight and may be used in only a breath of wind. Ordinary sewing cotton will serve as a line, provided that the kite is not required to rise more than 500 yards.

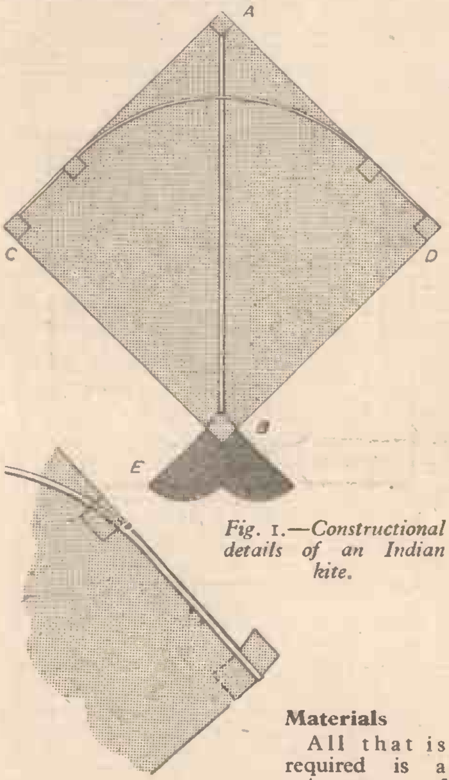


Fig. 1.—Constructional details of an Indian kite.

Materials

All that is required is a 12in. square of tissue paper, a piece of bamboo cane about ½in. thick and 18in. long, a 4in. square of stiff brown or packing paper, some adhesive, some Sellotape, a pair of scissors and a couple of yards of thread.

The tissue paper should be cut exactly square. It can be made from one piece, several pieces of contrasting colours pasted together, or one piece with a smaller pattern pasted on, i.e., a skull and crossbones or a fleur-de-lis.

Split the bamboo cane down its entire length, and from one of the halves shape the backbone by whittling it down to ¼in. wide by ⅛in. thick. Care should be taken to preserve as much as possible of the glazed casing of the bamboo, otherwise its elasticity will be impaired. The arch must be made in the same fashion, but should be a trifle thicker in the middle, tapering slightly towards each end; here again, the glazed surface should be preserved as much as possible to stiffen the back of the arch. The length required will be found by trial later on when it is bent round.

For the tail, cut the piece of stiff paper to a heart shape as indicated at E in Fig. 1.

Assembly

Lay the square of tissue paper flat on a table or on the floor, smear the glazed side of the backbone with paste and lay it on the paper diagonally from corner to corner. Ensure that it sticks well all along the backbone's length. On the two free corners stick flaps made of Sellotape, about 2in. long, as shown in Fig. 1, and then two further flaps about 4in. nearer the apex along the top two edges, as shown.

Place one end of the thin bamboo arch under one of the corner flaps and secure. Bend the bamboo approximately to the curvature shown and fix the other end. Stick down the two additional flaps and snip off the surplus end of the bamboo crosspiece. Turn the kite over and stick on the stabiliser or tail, then turn it back again and stick a small piece of Sellotape at the top and bottom of the backbone, i.e., at A and B, to prevent the paper from tearing away.

The Bridle

Take a yard of thread and pass it through a hole pierced in the kite with a thick pin. The position of this hole is behind the point where the bamboo supports cross. Pass the thread through, round the supports at the point of cross and back again through another hole, and tie a tight knot. Make two similar holes, one either side of the backbone, about 2in. from the bottom, and knot the other end of the thread in the same way.

Suspend the kite by this loop of thread and note if it balances exactly. If it does not, this may be remedied by sticking pieces of paper to the lighter wing. Slide your finger along the bridle until the tail-end is slightly depressed. This will be the point at which the flying line will be attached. On this point of attachment will depend the angle at which the kite flies and it should be tied so that it cannot slip. If the kite is sluggish in mounting or tries to get too much overhead, it may have to be hauled down to have the point of attachment readjusted.

Flying the Kite

To fly the kite, let out a dozen yards of the reel of cotton (or more if there is room) and get a friend to hold the kite upright lightly by the wings, at arm's length above his head, of course, *facing* the wind. Stand with your back to the wind, holding the line taut. At the next gust the kite should be released and will, if it is properly balanced, launch itself into the air and rise rapidly. Pay out the cotton steadily, checking it at intervals to make the kite lift.

A Box Kite

To make a box kite, you will require first of all four straight strips of light wood, each 2ft. 4in. long and ¼in. square, and two pieces of thin coloured paper measuring 4ft. 2in. long and 10in. wide. Take the strips of coloured paper, turn over the edges 1in., and glue down the folds after inserting a length of fine, strong string in each fold. When completed, glue the ends of each paper strip with a 2in. overlap so as to form continuous bands 8in. wide. Now fold each band to divide it into four equal parts, and at each crease glue one of the long sticks. The outer edge of each band should be 1in. from the ends of the sticks, and there should be a space of 10in. between the bands as indicated in Fig. 2. Before glueing the sticks in place, slightly notch each one at a distance of 5in. from each end to receive the notched ends of the crosspieces A. For the crosspieces, take two pieces of 5/16in. x 3/16in. stripwood, each 16½in. long, place them together and drive a fine wire nail through the centre, turning the end of the nail up underneath. Treat two more pieces of the same length in the same way. Notch the ends as at B, open out the crosspieces and fit them inside the kite. They must not fit too tightly or they will split the paper. If they are too long, shorten them slightly and deepen the notches.

The flying line is tied as shown in Fig. 2. To fly the kite, let out about 20 yards of line, and get someone to throw up the kite a short distance. The technique of flying is similar to that used for the Indian kite.

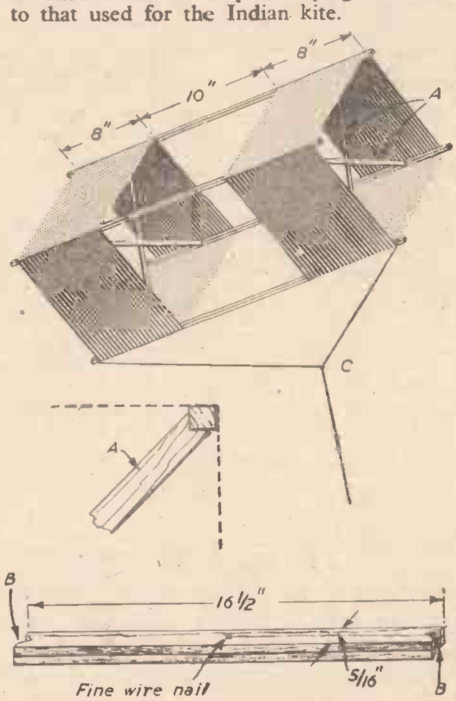


Fig. 2.—Constructional details of a box kite.

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WHAT I THINK

By F. J. C.

Cycling for Health

MUCH publicity has been given to the statement by Paul White, President Eisenhower's medical adviser, drawing attention to the benefits of cycling upon health. He advised Americans to cycle more. Of course it is sound advice, but we must not attribute too much to cycling. If a man is still able to cycle at the age of 70, and has passed a half century of active wheeling, that does not mean to say that his longevity is due to it, any more than a man can attribute longevity to walking. If cycling happens to fit in with your mental outlook and your physical development, taken in moderation it can do nothing but good. So can rump steak. That does not mean to say that without it you are likely to fall into a state of miserable decrepitude. Some old cyclists I wot of do not look particularly good advertisements for the pastime. Most of them look weary and worn out and should have given up cycling a long time ago, but prefer for reasons of personal vanity to go on twiddling the pedals at an ever decreasing rate.

Personally, I am always suspicious of general medical advice like this, bearing in mind some of the stupid statements which have been made by the medical profession in the past. Only just over half a century ago, a well-known doctor gave it as a considered opinion that no man could ever travel in a motor car at 60 miles an hour, as his heart would not stand the stress and he would drop dead. Yet many cyclists have exceeded this speed and, indeed, Albert Marouet has covered a mile at a speed of 86.95 m.p.h. Letournor pedalled a mile at the rate of 108.92 m.p.h. and Leon Vanderstuyft actually covered 76 miles 504 yards in one hour, on a bicycle behind motor pace in 1928. It is fallacious to argue that because a cyclist achieves reasonable longevity it is *de facto* due to cycling. It could reasonably be argued that it was due to any other habit or pastime in which he indulges regularly. It is impossible to say how long these life-long mile-eaters would live if they had not cycled.

New Title for the Cycle Union

THE British Cycle and Motor Cycle Manufacturers' and Traders' Union Ltd., (what a mouthful !) has decided to amend its name. Bearing in mind its lengthy appellation, which must cause everyone who has to address an envelope to curse, and which has been abbreviated anyway by business people to "The Union", I am surprised that the opportunity was not taken to devise a much shorter title than the new one, which is "The British Cycle and Motor Cycle Industries' Association." A press notice says that the new title is shorter than the old—an amusing statement when you realise that there are 59 letters in the old title and 52 in the new, a saving of only seven letters !

The new title expresses the true nature and function of this association of manufacturers which was incorporated in 1910. What's wrong with The British Cycle and Motor Cycle Association ? Or The Federation of Cycle and Motor Cycle Manufacturers ? The former could, through its initials, be abbreviated to Candma.

Production

NOTWITHSTANDING its cumbersome title, however, the industry managed to produce during 1955 3,564,000 machines, as compared with 3,198,000 in 1954, an increase of 366,000. The 1955 figures are the highest since 1951, and the second highest ever achieved. No less than 65.8 per cent., or in figures 2,352,000, of this production went overseas.

Russians Out of the "Oats"

BECAUSE of a prior engagement which clashes, Russian cyclists are unable to compete in this year's Oats, the 1,000-mile amateur cycle race which is to be held from August 11th to the 18th and which is provisionally routed from Skegness to Manchester, Morecambe, Rhyl, Aberystwyth, Barry, Weston-super-Mare, Southsea and Brighton. There will be 16 national regional teams in this year's race.

Stupid Nomenclature

ISN'T it high time that we adopted an international language for cycle sport and touring ? Why introduce the silly word tourisme for touring ? Why such ridiculous terms as primes, omniums, criteriums, kermesses, and the other jargon which the B.L.R.C. has imported from the Continent ? The British have always slavishly copied Continental terms, not only in cycling, but in connection with motor cars. Chauffeur, garage, chassis are typical examples. Are we too lazy to think up some words of our own ? I notice that the editor of the B.L.R.C. official journal comments on this.

The Menace of Dogs on the Road

I AM glad that the Minister of Transport had decided to introduce a clause in the Road Transport Bill, making it illegal for those perambulating pests, dogs, to be allowed to roam on the highway without being on a lead. They cause innumerable accidents in the course of a year. Unfortunately, it is not possible to make a similar regulation regarding cats which are mowed down in their thousands by motor cars every year. As far as the driver of a car is concerned, it is not a bit of good pleading in the case of an accident that he swerved to avoid a dog. In fact, it has been held in the High Court that a motorist must not swerve to avoid a dog. Of course, the motorist comes out unscathed from such collisions, but yapping dogs are a real menace to cyclists, especially when they do not react to the impact of the useful end of a bicycle pump !

New History of the Bicycle

PRE-WAR readers of "The Cyclist" will remember that we purchased from the publishers the copyright in the late H. H. Griffin's book on the history of bicycles and serialised it in this journal. Griffin, however, has been dead many years and his book, of course, only deals with the bicycle up to the time of his death. Now Mr. C. F. Caunter, of the Science Museum, has written "The History and Development of Cycles." It is not so exhaustive, of course, as Griffin's very detailed work, which is still much sought after by collectors of cycling literature, especially those "historians" of the Bartleet type who depend for their "facts" upon press cuttings and book indexes, as well as the files of old periodicals. Griffin, I think, can be quite relied upon in the last edition of his book, although there were some minor errors in earlier editions. He had no reason to dispute the claim of Gavin Dalzell to have invented the first rear-driven bicycle in 1846, and it is inane to criticise him on that score by referring to the fact that Macmillan was prosecuted in 1842 for riding his machine dangerously, a report of which appeared in a local Scottish newspaper. One could hardly expect Griffin to consult the unindexed files of all local newspapers. Bartleet claimed to be the cycling historian, yet his own book, which speciously claimed to be a history of the bicycle, was full of inaccuracies and it was only correct in those places where he had filched material from Griffin's book which was undoubtedly Bartleet's source book, as indeed it is the source book of other writers. Bartleet's book is packed with historical inaccuracy and in one or two instances with deliberate falsehoods, particularly his reference to the machine on which Hume won the first races on the first pneumatic tyres.

Mr. Caunter's work, however, is reasonably accurate and at the price of 4s. (H.M. Stationery Office) it will be of great interest to all those interested in the history of bicycles, even though it does not contribute much to what we already know. Its narrative, however, is written in a more entertaining style than the prosaic fact-stringing style of Griffin. Incidentally, I was browsing over some secondhand books in a shop some years ago and came across Griffin's family album, which contained a large number of photographs, annotations and comments in Griffin's hand. It was beautifully bound and I still possess it. How, I wonder, did such an obvious family treasure come to find its way into a secondhand bookshop, and be offered for sale for the few pence which I paid for it ?

A much larger work dealing with the history of the bicycle and the motor car is H. O. Duncan's monumental heterogeny of unrelated matter which he produced in the early 'twenties in collaboration with Jean Vavin. Duncan had a very high opinion of Duncan, and interlarded between scrappy information about bicycles and motor cars you will find a photograph of Duncan and a lengthy description of how he once won a cycle race at some obscure local village, riding against unknown riders. Duncan was anxious to impress the world with his great importance. His book, however, is practically useless because its hundreds of pages are not indexed and any attempt at chronological arrangement of the matter does not exist. It would seem that he had collected a number of odd press cuttings and some photographs and slung them together in no particular order. At the front of the book there is an article by Jean Vavin who was the redactor of the book lauding Duncan to the skies and, of course, an article by Duncan on Jean Vavin. There is no evidence throughout that Vavin edited this work as it needed to be edited. —F. J. C.

THE CYCLE CHAIN

Alignment : Adjustment : Maintenance : Repair

Fig. 1.—Using the chain rivet extractor.

THE cycle chain is often one of the most neglected components of the bicycle, and by being wrongly tensioned and aligned, seldom cleaned and seldom oiled, its life can be drastically shortened and its efficiency decreased, adding to the effort required for propulsion. Correct fitting and frequent cleaning and oiling will help to combat the effects of rain and dirt, which are the chief enemies of the exposed chain.

Chainwheel and Sprocket Alignment

Before fitting a new chain it is important to check that neither chainwheel nor sprocket teeth are worn or damaged and that they are both in line and running true.

An inspection of the teeth will soon reveal whether or not they are worn. Worn teeth take on a hooked shape as shown at B in Fig. 2. The correct shape of the teeth is shown at A. Bent or damaged teeth will also cause noisy running and a tendency for the chain to jump off, so these points should also be checked.

To test whether or not the chainwheel is running true, place the end of a straight edge on the chain stay just clear of the chainwheel teeth, and spin the cranks. If a tendency to ovality in a chainset of the three-pin type is revealed it can often be corrected by undoing the three pins, removing the ring, turning it round and replacing so that it is in a different position on the "spider," as the three-armed chainwheel centre is sometimes called.

If the chainwheel is buckled, i.e., it wavers from side to side when rotated, it must be levered back into alignment by means of a short crowbar or a long cold chisel, as shown in Fig. 3. Cranks which have become bent may be straightened by removing the pedals, sliding on a piece of steel tubing and using this as a lever to force them back into the correct alignment.

A long straight edge is useful to check that the rear sprocket and chainwheel teeth are in line with each other, but this may also be checked by laying the chain along the top teeth, holding it taut and sighting with the eye along the chain from the rear of the cycle.

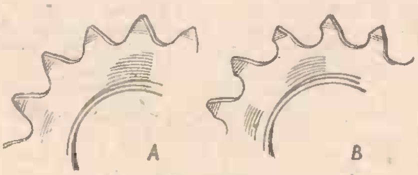


Fig. 2.—Worn sprocket teeth.

Provided that the cycle frame is not out of track, alignment should not be far out and the small adjustment necessary can usually be accomplished by means of shims or spacers slipped on the hub behind the sprocket on the rear wheel.

Shortening the Chain

If a new chain is purchased it will need shortening before it can be fitted. The correct length can be found by positioning the rear wheel half-way along the rear fork drop-out, and placing the chain round the sprocket and chain ring, when the number of links to be removed will become apparent. Always remove links so that the end link is an inside one, as shown in Fig. 4. The two end inside links of the chain must be finally joined with a spring link, as is also shown in Fig. 4. Remember when shortening a chain that it is much easier to take off some additional links later than it is to replace some when too many have been removed. If too few links are removed and the chain is too slack when the wheel is pushed as far back in the rear fork-end as it will go two links must be removed, so that the end link is again an inside one.

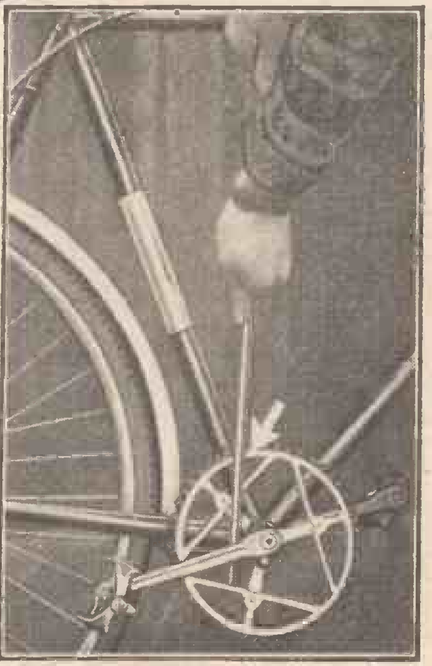
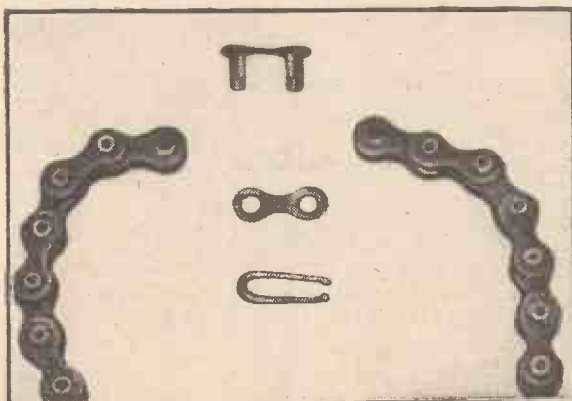


Fig. 3.—Aligning the chainwheel.



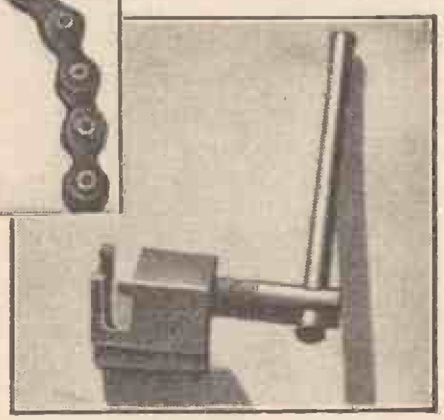


Fig. 4.—The spring link.
Fig. 5 (Right).—A chain rivet extractor.

There is always sufficient space for adjustment in the rear drop-out slot to allow for the removal of two links.

The easiest method of removing links is by means of a rivet extractor of the type shown in Fig. 5. The chain is located on two lugs so that the screwed rod by means of the spigot on its end will push the rivet out when the tommy bar is turned. The rivet extractor in use is shown in Fig. 1.

An alternative method is to use a pair of pliers as a makeshift anvil and punch out the rivet with a thin punch or a nail and a hammer.

Joining the Chain

The usual method of accomplishing this is by means of a spring link as shown in Fig. 4, and the only thing to remember about this simple job is to make sure that the closed end of the spring fastener is facing forward when fitted in the chain on top of the chainwheel, i.e., the closed end must face the direction of travel of the chain.

Tension

It is important that chain tension should be right, as if it is too tight the chain will become stretched and worn out before its time; if it is too loose it is likely to jump off. If it jumps into the wheel an accident could result, the chain breaking spokes, buckling the wheel and throwing off the rider. Correct chain tension is obtained when the chain can be moved approximately $\frac{3}{4}$in. up and down in its tightest position.

Chain Wear

The easiest method of detecting wear is to pull the two strands of the chain towards each other and then lift it away from the front of the chainwheel. If it can be moved an appreciable amount then a new chain is indicated. Another form of wear which may be noticed is best described as "twisting," a term which is self-explanatory.

Cleaning and Oiling

To clean a chain thoroughly, first soak it in a dish of paraffin and scrub it with an old toothbrush until all the dirt and old grease are removed. Then, after drying it, soak it in a tin of melted grease, allow to set, and finally wipe off the surplus. In the interval between major cleaning operations the chain may be kept lubricated by applying light oil to the inside face of the chain, which is in contact with the chainring and sprocket.

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