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NEWNES

PRACTICAL MECHANICS

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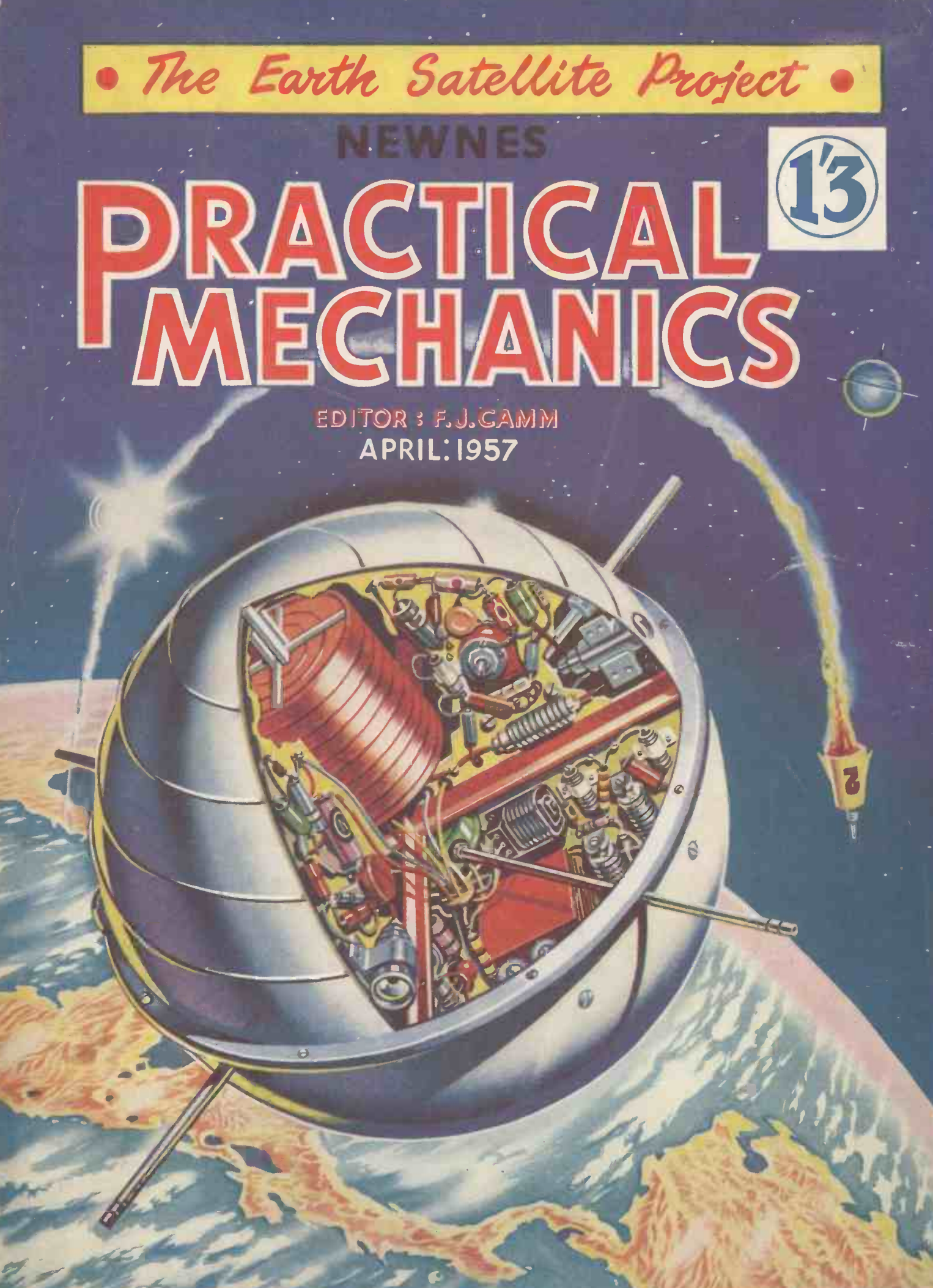
EDITOR : F. J. CAMM

APRIL: 1957



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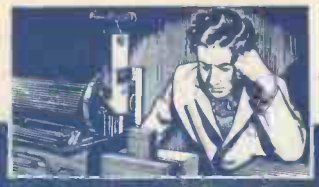

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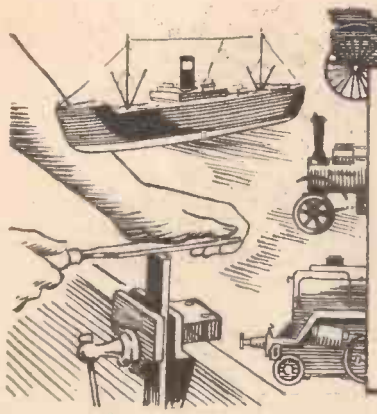

Practical Mechanics

Vol. XXIV No. 278 APRIL, 1957

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

FAIR COMMENT *by the Editor*

Electricity and Prosperity

IS it true, as a lecturer recently stated, that the amount of electricity consumed per head of the population is a measure of the prosperity of the country? I doubt it. A country is only prosperous if its annual budget is considered in relation to taxation per head of the population. Taxation to-day is higher overall than it has ever been, and we are frequently told by politicians of all parties of our economic and financial difficulties. Our export trade is vital to us, and whereas before the war this flourished on the principle that our exported goods were an excess of production after the home market had been supplied, to-day it is bolstered up by restricting home supplies and forcing manufacturers to export a high percentage of their total production. Quite often it has to be done by selling at cost, at a small margin of profit and sometimes at a loss. That is not prosperity.

Moreover, if, as is undoubtedly the fact, more electricity is being consumed per head of the population than ever before, we need also to take into consideration the number of other industries which have suffered as a result. If people are using electricity a number of other industries and therefore sources of employment are adversely affected, and before we can relate electricity consumption to prosperity we need to draw up a balance sheet. I do not suggest that an increase in the consumption of electricity is not a good thing. Old-fashioned methods must give place to new.

The relative cost of a horse-power hour of human energy compared with animal energy and electrical energy is as 480 : 30 : 1. Undoubtedly this is the key to higher productivity and it should result in higher prosperity, but I challenge the lecturer to produce evidence in substantiation of his statements.

The average man can exert between 1/10th and 1/20th of a horse-power over a comparatively short period of time, and therefore to place a 1 horse-power motor at his disposal provides him with from 10 to 20 electrical slaves.

The increased consumption of electricity is undoubtedly due to the fact that it has been made more readily available all over the country as a result of the grid scheme rather than to the introduction of new uses for electricity.

The P.M. Second "How-To-Make-It" Book

PROMPTED by the great success of our first "How-To-Make-It" Book, we shall publish next month at 15s., or 16s. by post, the second "How-To-Make-It" Book, which contains all those articles which during the past five years have proved extremely popular and for which back issues are no longer available. Here is a summary of the contents: A Reflecting Enlarger; One-stringed Fiddles; Folding Steps and an Extending Ladder; An Electric Guitarette; A Miniature Billiard Table; A Synchronous Electric Clock; A Glove Puppet Theatre; An Automatic Garden Sprinkler; A Midget Camera; A Potter's Wheel; A Catamaran; A Rowing Machine; An Aqualung; Home-made Fishing Tackle; Installing a Tropical Aquarium; A Snow Scooter; Underwater Photography; A Pair of Skis; Projecting Time on the Ceiling; A Harpoon Gun; Small Wind-power Plants; An Electric Hedge Trimmer; Bathroom Scales; A Folding Outboard Motor-boat; Flash Photography; Gas Fired Pottery Kilns; A Back-projection Episcope; Motorising Your Lawn Mower; A Skeleton Synchro-electric Clock; A Combined Viewer and Printer for 35 mm. film; A Cycle Trailer; An Electric Imitation Coal Fire; A Mechanical Potato Peeler; A Home-made Duplicator; Making Rubber Stamps.

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"More Miles Per Gallon"

IF you run a motor-car, motor-cycle, moped or scooter, you will undoubtedly be interested in extracting the maximum number of miles from every gallon of petrol you use. Accordingly, we have just published at 2s. 6d., by post 2s. 10d., a book entitled "More Miles Per Gallon." The contents explain the causes of excessive petrol consumption, methods of restoring lost performance, carburetter adjustments, simple economy adjustments; it deals with petrol economisers and alternative fuels and petrol dopes, how to make a test tank, and concludes with some interesting facts and figures. Additionally, manufacturers' recommendations are given, applying to cars, motor-cycles, mopeds and scooters.

Apart from petrol rationing, with the present price of petrol and, indeed, remembering that petrol is likely to be very highly priced for a long time to come, methods of extracting the maximum mileage from each gallon of petrol should be of importance to every motorist, motor-cyclist, moped and scooter owner, even when petrol comes off the ration.

Boats for Amateurs

AT the recent Boat Show at Olympia it was apparent that the do-it-yourself movement had penetrated that industry. A number of exhibitors were selling kits of crafts for various types of boats. There was, for example, a 7ft. 9in. sailing-rowing dinghy, large enough for three adults, which can be made in its rowing version for less than £10. Interest in boat building is on the increase, as is shown by the great demand for back issues of this journal in which we have described the construction of various types of boats.—F. J. C.

Making a Circular Saw Machine

Diagrams and Notes on Constructing an Efficient Saw Bench

By D. S. MALCOLM

Fig. 1.—The completed saw bench.

THIS saw bench is designed to rip, cross-cut, rebate, tongue and groove and mitre. It also takes a grinding wheel and flexible drive, and drives a lathe.

The article describes a 6in. saw with ½in. arbor which will cut to a depth of 1¾in. The measurements, which can be taken from the scale drawings, need only be used as a guide. Since equipment varies, it is advisable to prepare individual specifications *after* acquiring such equipment as cannot be made. A blacksmith will supply, fashion and drill fittings if necessary. Fig. 1 shows the completed saw bench.

The rise and fall works as follows. The spindle is in a fixed position, and the table top is supported by four brackets two of which (A, Fig. 3) are bolted to the superstructure. These act as hinges about which the top is raised and lowered. The other two brackets (B) each carry locking straps (C), which lock the table top at any desired level by means of a winged nut on a bolt which passes through the superstructure and the slot.

The Trestle

This is 2ft. high and made of 1½in. by 1in. wood, mortised and tenoned and half-lapped as shown in Fig. 2. Note the resting block X for the top when at rest; also the stretcher Y which spans the superstructure and on which the bearings are bedded. To facilitate the positioning of the bearings the stretcher should be accurately made to a length equal to the distance between the outer faces of the superstructure, its width being that of the length of the bearings. It is cut away to admit the pulley and should not be positioned until the bearings are ready for assembly. Wedge-shaped chocks have been fitted to resist the pull of the driving belt.

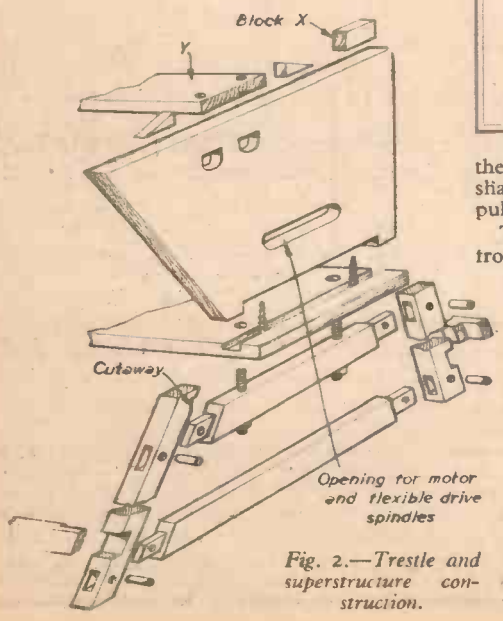


Fig. 2.—Trestle and superstructure construction.

The superstructure (11in. high) is made from 1in.-thick well-seasoned wood to the dimensions shown in Fig. 3. This is essential to avoid warping, which would destroy the accuracy of the saw. If this is not available, thick plywood is suggested. The distance between the bearing centres is 6½in.

A ⅓ or ½ horsepower motor should be used. Note the wooden guide rails (Fig. 4) pinned to the trestle top. These permit the motor to be moved if the belt needs tightening; hence the elongated slot shown in Figs. 2 and 3.

The drive is by means of a V belt. A 2in. diameter pulley can be used on the saw spindle. When purchasing the saws, ascertain the rim speeds and the pulley ratios can be calculated as follows:

$$\frac{\text{Rim speed (in feet)} \times 12 \text{ (to convert to inches)}}{\text{Dia. of saw} \times 3\ 1/7} = \text{R.P.M. of saw.}$$

$$\frac{\text{Dia. of saw spindle pulley} \times \text{R.P.M. of saw}}{\text{Speed of motor}} = \text{Dia. of motor pulley.}$$

Ball or bronze, oil retaining, bush type bearings can be used. These are available from most tool merchants. "Picador," as advertised in P.M., were used for this bench. Saw washers are obtainable from the same source.

The saw spindle can be purchased with bearings, or it can be made from bright bar, of a size to suit the bearings, turned down at ends to ½in. dia. and threaded to take the saw at one end and a grinding wheel at the other. Fig. 7 is a photograph of the saw spindle assembly.

Table Top

Mild steel, ¼in. by 19in. by 16in., is used for this. Note that the top does *not* protrude beyond the shoulder of the spindle at the grinding wheel end.

Four brackets are made from 1in. by ¼in. flat bar and drilled to take ¼in. bolts. Note carefully their position from the diagrams and photographs.

The two stretchers are made from 1in. by ¼in. flat bar, and have two ¼in. holes drilled 12in. apart.

The two 9in. long locking straps are made from 1in. by ¼in. flat bar. Each is drilled ¼in. from one end, ¼in. diameter and a slot cut 6in. by ¼in.

Two brass nuts, drilled to spindle diameter, make excellent collars. Grub screws hold them in position against the inner faces of the bearings as shown at E in Fig. 5.

All the bolts required are ¼in. diameter with countersunk heads, except the four used for bearings and the fo r to secure the trestle top to the superstructure.

The Fence

The method of using this is shown in Fig. 6. Care should be taken to position the fence so that it will not foul the grinding wheel. As shown, it will clear a 6in. wheel. A clamp, screwed to the fence backing, gives added rigidity.

Rod G (Fig. 6) is bored at one end and a heavy wire nail driven through it and the fence backing. The fence is secured to the backing with No. 8 brass screws. The fence rises with the table and can be swung clear for cross cutting. An alternative and useful fence can be made from a straight-edge clamped temporarily to the table top.

The Guard

This is not shown, but consists of a zinc hood held to the fence by an adjustable sleeve on a rod. It should be noted that the law requires a guard and this should be made and fitted, especially if there is any likelihood of a third party using the saw.

Assembly

Position the motor with the spindle parallel to long edge of trestle top. Level up if necessary and fix the pulley.

Place bearings at either end of stretcher (Y in Fig. 2), mark off the bolt holes and drill. Insert one bolt through each bearing, pass spindle through bearings, at same time slip on V belt and pulley. Position with slack taken off belt and using a set-square against the face of the superstructure. Test that the spindle is on the same vertical plane as motor spindle, mark off bolt holes on superstructure and drill.

Bolt bearings loosely, use packing if necessary to level the saw spindle, and tighten down. Tighten V belt by moving motor.

Bolt brackets A and stretcher D (Fig. 3) to superstructure. The bolt hole should be at least 2in. down, otherwise the stretcher will foul the spindle when top is raised.

Bolt brackets (B) to stretchers. All the brackets are best drilled in pairs, one of the first pair drilled being used as a guide for the others. Clamp them back to back. The stretchers may be similarly dealt with.

If the wooden packing (1½in. thick) is made up of two sections ¾in. each, the brackets will be better held in position for the next operation if the lower half of the packing is now bolted to the brackets.

Cut saw opening in table top, approx. 6½in. long. Drill and file till a hacksaw blade can be inserted.

Position the saw. Add the upper half of the packing and lower the table top and clamp in place.

Mark bolt hole centres on underside of top by drilling from underneath through the unoccupied bracket holes and the wooden packing.

Remove the top, drill countersunk holes and bolt it to the brackets. Use a spirit level and set-square to ensure that the top is at right angles to the saw. Position the locking straps and the bolt for the winged nut.

To remove the saw it is necessary that the top can be raised clear. Ensure that the slots in the locking straps permit this.

Flexible Drive

Fig. 8 shows details of this. A brass rod on a face plate is bolted to the motor pulley. To take the squared end of the drive a hole is bored in the brass and squared with a file.

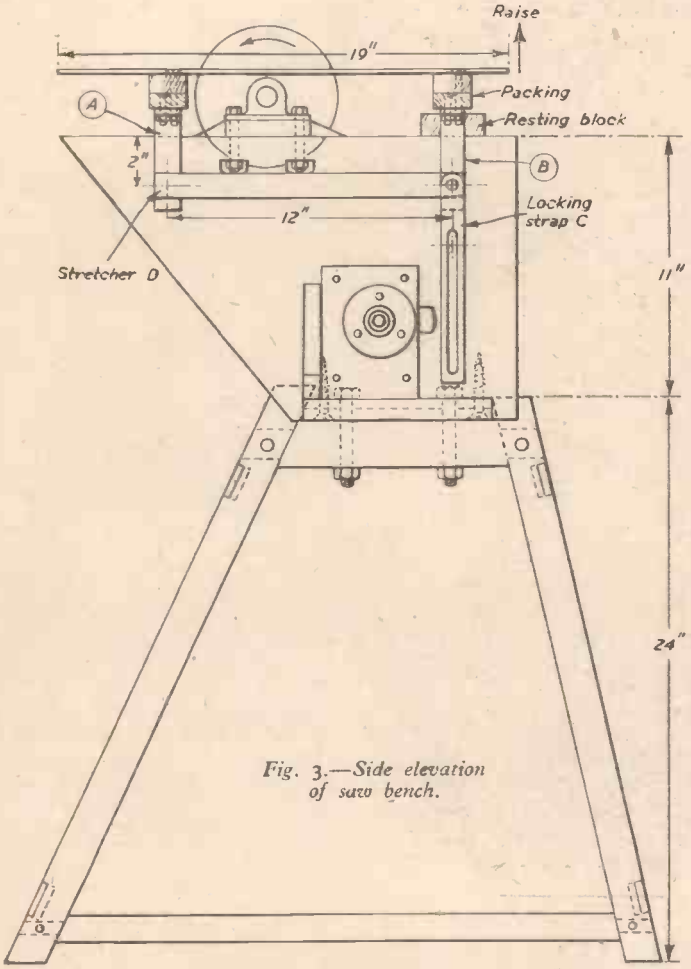


Fig. 3.—Side elevation of saw bench.

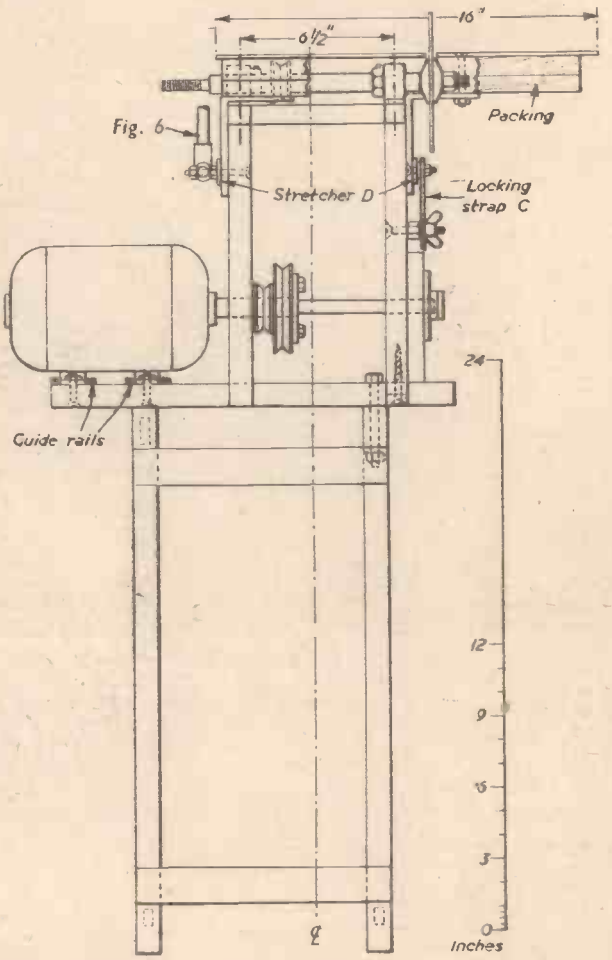


Fig. 4.—End elevation.

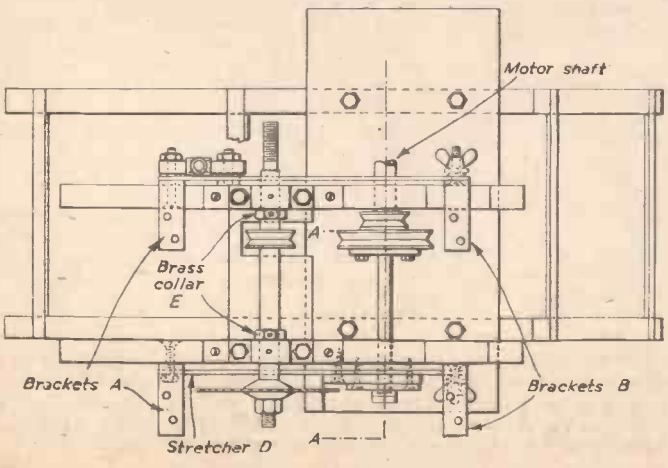


Fig. 5 (Left).—Plan view with table top omitted.

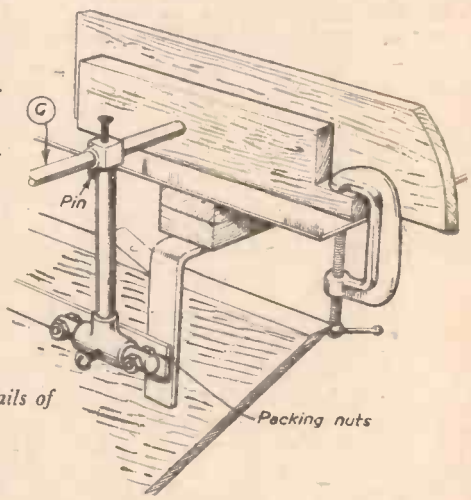


Fig. 6 (Right).—Details of the fence.

The threaded boss to take the retaining nut of the drive is screwed to the outer face of the trestle superstructure. A 6ft. drive with ¼in. chuck will be found ideal for sanding and drilling.

Dust Chute

This can be seen in Fig. 9. It is made from

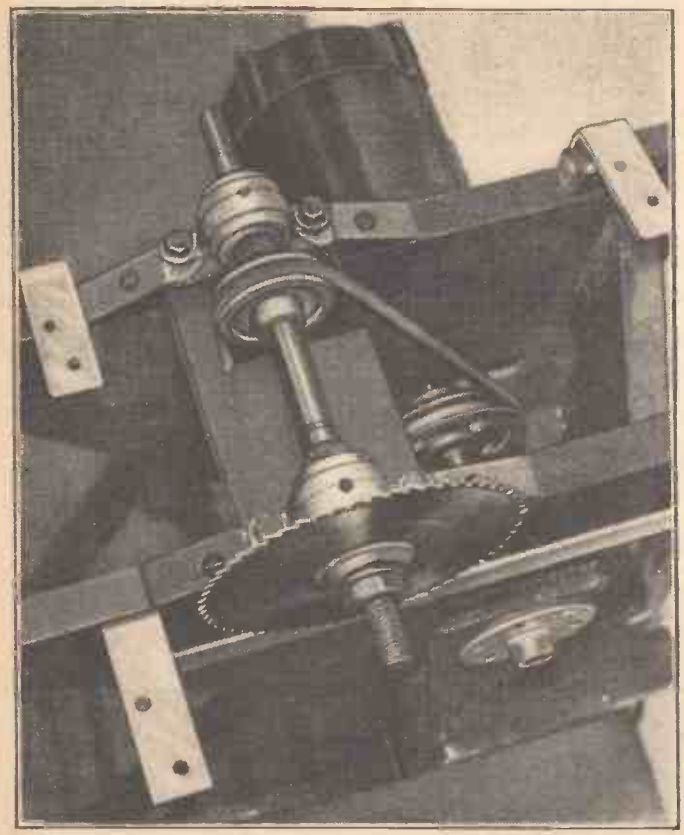


Fig. 7.—A view of the saw spindle assembly.

hardboard, bolted to brass tongues, which in turn are bolted to the brackets. A box (not shown) hangs from the buttress under the chute mouth. The front of the chute (not shown) hangs from fillets (visible in Fig. 9) nailed to the packing. A brass door bolt which passes into the packing holds the front in position. It is removable to give access to the saw.

Mitre Board

This can be made from ½in. wood. It is laid flat on the table top with one edge against

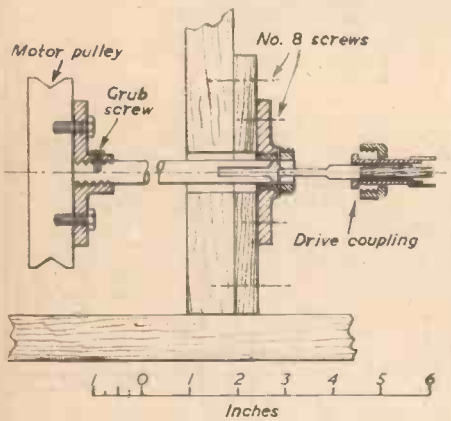


Fig. 8.—The flexible drive.

the fence and the job against the forward edge which is cut at 45 deg. Both mitre board and job are moved into the saw. A rounded block screwed to the board gives a thumb grip, but be sure this is far enough back to avoid the possibility of the saw touching the hand as it emerges from the job. A further view of the completed saw bench is shown in Fig. 9.

Lathe Drive

By fitting a double pulley to the motor, this has been utilised to drive a lathe. The lathe, when required, is positioned behind the saw bench and a V belt transmits the drive to the headstock via intermediary pulleys connected by the belt to the smaller of the pulleys on the motor.

Hints for the User

To those who have never used a saw the following advice may be of help.

Never use a cross-cut to rip; dust will not escape and the heat generated will ruin the saw.

If the saw cut is veering from the intended line of cut remove the job. Never try to correct the run of the saw by forcing the wood over. Small saws buckle easily.

Be sure that the saw is kept sharp and the set is open. Stalling or a smell of burning or smoke denotes that re-sharpening and setting is required. To strike a nail instantly blunts a saw.

If possible stand to one side or pull the wood towards you. The writer has seen a splinter of wood shot through a glass pane by his saw.

Keep the bearings oiled. Holes drilled in the table top will give easier access.

There is on the market a cross-cut with very fine teeth suitable for cutting plastics; this gives a finished appearance to end grain.

Fig. 9.—A view of the completed saw bench.

A Six-arm Puzzle

IF you hand this puzzle to a friend he will probably find it very easy to pull to pieces, but it is much more difficult to discover how it is put together again.

To construct the puzzle six pieces of wood, say, 3in. long and ½in. square are required. Half-inch square wood is available from almost any woodworker's store. One of the six 3in. pieces is put aside and requires no further work; this is piece A. Cut a groove across two other pieces as shown at B in Fig. 1. If wood larger than ½in. square is used the dimensions must be altered to suit. The C pieces are made exactly as B to start with and an extra groove cut afterwards.

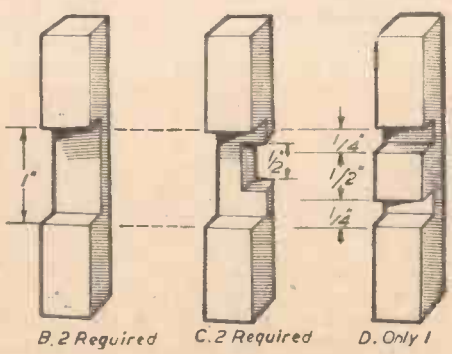


Fig 1—Dimensions of the parts required.

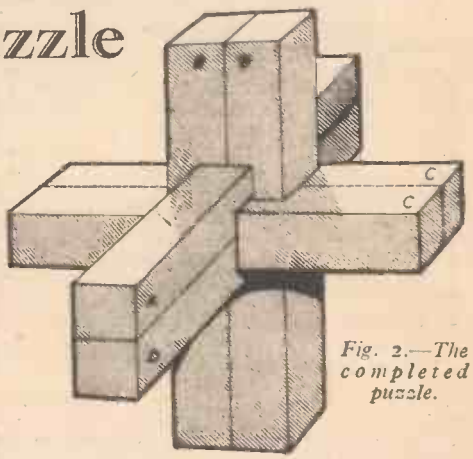


Fig. 2.—The completed puzzle.

D has two grooves, as shown; in every case the grooves are to be ¼in. deep.

Assembling the Puzzle

Take the first two B pieces and place them together with the slots facing each other so as to form a hole. Lay D centrally in this hole with the two grooves upwards. Then fit a C on each side of the two Bs, as shown in Fig. 2; the exact position of the two Cs will be quite obvious when their turn comes. A square hole will then be left between the two Bs; the plain piece A is pushed through this square hole, locking the whole six pieces together and completing the assembly of the puzzle.

Mains Power Pack for Models

A Unit Giving a Range of Voltages in Either A.C. or D.C.

By F. G. RAYER

WHEN one or more electrical models are operated it is of very great advantage to draw current from the mains, when this source of supply is available. This is especially so when the model requires an accumulator, which is expensive, requires recharging and eventually deteriorates. Even with small models run from dry batteries it is an advantage to dispense with these, thus avoiding running costs and the poor working associated with run-down batteries. The power pack shown in Fig. 1 was made for this purpose, a range of A.C. and D.C. outputs being provided.

Before going further it may be helpful to point out the particular uses to which alternating current (A.C.) and direct current (D.C.) may be put. A.C. can be used to run model motors having a wound field magnet, though they can also be run from D.C. On the other hand, the permanent magnet type of motor requires D.C., and can be reversed by reversing the polarity of supply.

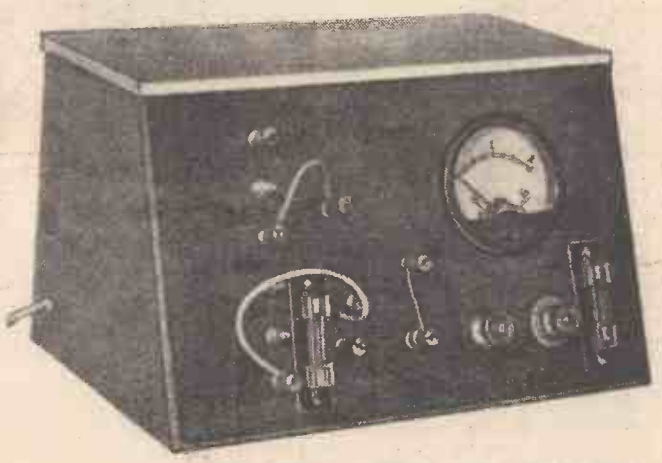


Fig. 1.—The completed mains power pack.

The small bulbs used to illuminate models may receive A.C. or D.C., whichever is most convenient.

In the power pack described here, A.C. is obtained from the transformer secondary. A metal rectifier allows D.C. to be provided, a maximum of 2 amps at 15 volts being allowed. To permit easy charging of accumulators used with a boat, a meter is added in the D.C. circuit. It will thus be seen that the pack has a wide utility.

Circuit Details

Fig. 2 shows the circuit, the various terminals being arranged in the same positions as they occupy on the panel, when viewed from the front. A.C. mains are necessary and two ½ amp (500 mA) fuses give ample protection in the event of any breakdown or short-circuit. When a three-pin plug is used, core and secondary are earthed and it is then totally impossible for any mains voltages to reach the secondary, so that leads, etc., can be handled exactly as with batteries. If an adaptor or two-pin plug is used instead, the earth lead is omitted. This will normally be safe, especially in earth-free situations. Nevertheless, if earthing is possible, it is recommended, as one or both ½-amp fuses would then blow if a fault chanced to arise in the transformer insulation.

The transformer has a 2-amp secondary, the 2-amp fuse here guarding against overload. A range of voltages can be chosen by modifying the positions of the selector leads. For example, counting the terminals from the top, 1 and 2 would give 7 volts, 1 and 3 would give 10½ volts, and so on. Or 2 and 3 would give 3½ volts, with 8 volts from 2 and 4, etc. A very considerable range of voltages is thus available. Transformers of this kind can readily be purchased, one popular type giving 6 volts, 4 volts, 5 volts, 3 volts and 12 volts or any appropriate combination. The voltage requirements of most models is not very critical.

When D.C. is required a link connection is added between two panel terminals. An on-off switch would do equally well. A second 2-amp fuse is present to protect rectifier, meter and accumulator, if the latter is connected in the wrong polarity. The D.C. output is equally suitable for trains,

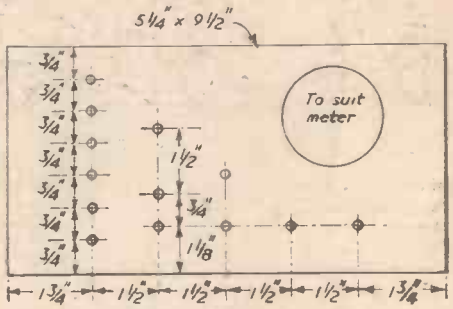


Fig. 3.—Drilling details.

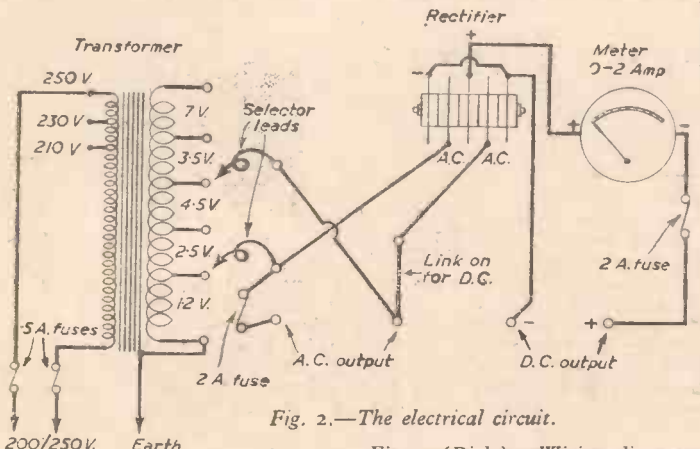


Fig. 2.—The electrical circuit.

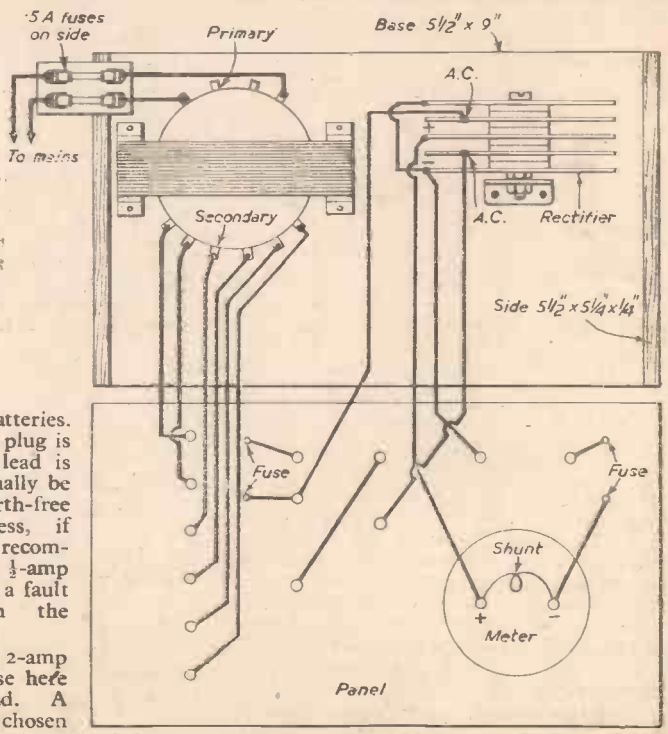


Fig. 4 (Right).—Wiring diagram.

magnets and other models requiring direct current.

Construction

This is very straightforward, and if sound joints are made and all leads adequately insulated trouble is unlikely. The panel is of three-ply, drilled as shown in Fig. 3. After drilling, the voltages and other terminal identification markings can be drawn on in indian ink, the wood being absolutely dry. A coating of clear varnish will then preserve these markings, avoiding any confusion in connecting up external equipment or models.

The sides are cut so that the panel slopes back about 1in. at the top, this being easier to see than a vertical panel. Terminals or screws of 4 or 6 B.A. are satisfactory, and a soldering tag is tightly held under each. It would be possible to fit six sockets for voltage selection, though the terminal connections can be changed in a few seconds.

Base, panel and sides were securely fitted together with 1in. panel pins before any parts were mounted. Short lengths of flex were then soldered to the tags mentioned, and connected to transformer secondary and rectifier. When this wiring has been completed the transformer and rectifier can be screwed in place, the latter having a bracket so that the fins are vertical. An alternative would be to fix panel and base together, with transformer and rectifier in position, and wire up, afterwards screwing the sides in place. No nailing should be done once the meter is fitted.

Fig. 4 shows a complete wiring plan, the panel being lain flat. The twin fuse-holder wired to the primary is screwed to the inside, at the left. The 2-amp fuses are on the panel, fitted in single holders, with leads passing back through small holes.

When wiring is completed a top and back of three-ply are screwed on. The back has two rows of ⅜in. diameter holes, as reasonable ventilation is essential when running near maximum rating.

Any small moving-coil meter can be used, with a dial or scale drawn up for 0-2 amps. A short length of resistance wire of about 20 s.w.g. is wired in parallel with the meter. A 12 volt 12-watt bulb may be used for calibration if another meter is not available. To do this it is wired to the D.C. output terminals and the selector leads placed to give 12 volts. The meter should now show 1 amp. If the pointer moves too far across the scale the length of resistance wire in parallel with the meter is reduced. If, on the other hand, the pointer does not move far enough, the length of wire is slightly increased. When the correct length has been found to bring the pointer to the 1-amp mark, it is wound in a spiral and permanently wired in position, being the shunt in Fig. 4. The power pack must be switched off each time the wire is disconnected to modify its length, or the meter will be damaged.

Two further views of the completed power pack are shown in Figs. 5 and 6.

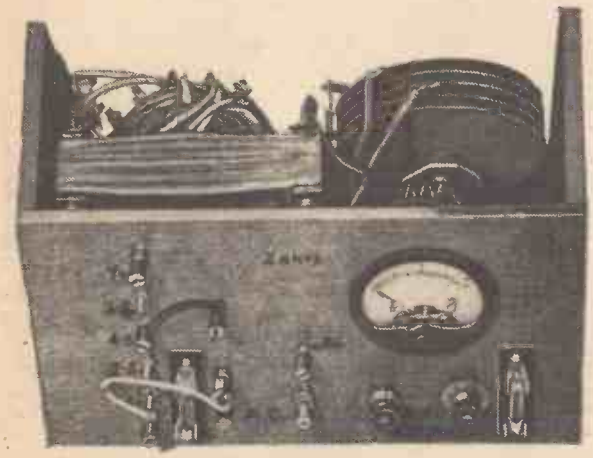


Fig. 5.—The completed power pack with top and back removed.

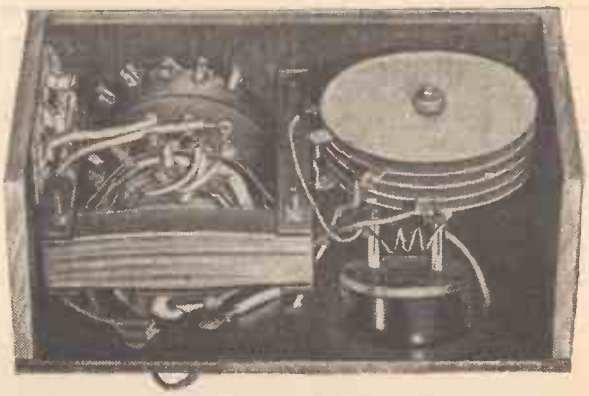


Fig. 6.—A further view, showing interior layout.

Notes on Using

Any model which can be run from A.C. is connected to the two A.C. terminals, and the selector leads are fitted to such pair of terminals as will give a suitable voltage. The link connection is left off, only being added when a D.C. output is required.

Operation with a D.C. model is exactly the same, except that the appropriate output terminals are used instead. If there is any doubt about the voltage required by a model a low voltage can be used at first, this being increased if necessary.

For accumulator charging, the D.C. output is used, polarity being observed. The voltage chosen by the selector leads will have to be a little higher than the accumulator voltage, and when the accumulator is fully charged each cell will reach 2.8 volts. With "dry" accumulators the data on the battery itself can be followed. This is usually given as the number of hours charging necessary at a specified rate. For example, 25 hours at 1 amp. An equivalent or longer charge, at lower rate, will be beneficial for old, sulphated accumulators—e.g., 50 hours at ½ amp.

With free-acid accumulators charging should continue, at the specified or a lower rate, until the specific gravity, as shown by a hydrometer, reaches about 1.280. The S.G. of a fully discharged cell is around 1.110, depending on temperature. As charging continues the S.G. slowly rises, the ammeter reading tending to fall back slightly.

Transformers of the type mentioned have a number of primary tags, for various mains voltages. The appropriate tags are used and connections here need not be altered unless a different mains voltage is subsequently employed to operate the unit.

Low-speed Plane in U.S.

A SMALL British transport plane, the Twin Pioneer, which can take off in 100 yards and land in 150 yards was demonstrated in Washington recently. Made by Scottish Aviation the aircraft has two Alvis Leonides engines, carries 16 passengers or a payload of 4,000lb., and has a maximum range of about 6 hours' flying. The plane is designed to fly with a cruising speed of only 130 m.p.h. and sells at £53,000.

Fast Jet Plane in France

A SPEED of 1,056 m.p.h. has been achieved by a French delta-wing jet fighter, the Mirage 3. The Dassault Company, who are the makers of the aircraft, say that this flight was carried out with full military equipment, and that if the plane were stripped down it could probably break the world's record, 1,132 m.p.h., set up by the British Fairey Delta.

The International Geophysical Year

BY arrangement with the Department of Scientific and Industrial Research, the Post Office is co-ordinating the distribution of special messages which will be sent to leading scientists, research stations, observatories and others in the United Kingdom, and in Malaya and the Falkland Islands, who are participating in the world-wide research to be conducted by 45 nations into the various phenomena associated with the earth and its planetary system.

When a period of unusual solar, magnetic, ionespheric or auroral activity is expected, the National Bureau of Standards at Fort Belvoir in Virginia, U.S.A., will issue "alerts" over the international meteorological teleprinter network. In the United Kingdom the messages will be received at the Meteorological Office, Dunstable, and sent direct to the Central Telegraph Office in London. From here they will be sent out to all scientists and research establishments who will be responsible for this country's contribution to the great scientific venture of 1957-58.

Britannia Engine Problem Solved

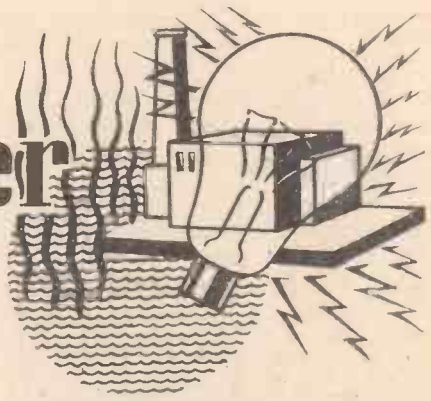
K.L.G., working closely with Bristol Aero-Engines Limited, has helped to solve the novel "dry ice" problem encountered in certain unusual weather conditions by the Proteus engines of the Bristol Britannia. The main aim has been to eliminate ice accumulations sufficient to affect combustion, but it was important also to introduce a method of restoring combustion instantly and automatically in the event of an interruption occurring.

K.L.G. developed a glow plug for installation in the combustion chambers of the engine.

The general principle behind this plug is that it provides a reservoir of heat forming a "pilot light" should the flame in a combustion chamber be extinguished. It consists of a simple platinum-rhodium tube thermally insulated from the body of the plug.

While the engine is operating the platinum tube is submerged in the engine flame and does nothing but absorb heat. If, however, the flame is extinguished the glowing tube provides immediate re-ignition for the fuel/air mixture. Four glow plugs are fitted to each Proteus engine.

Electricity from Hot Water



By R. N. HADDEN

The Main Details of a Unique Power Generating System

IT is an everyday occurrence to make hot water using electric current, as is done in electric kettles and immersion heaters, but it is quite another thing to try to-use hot water to make electricity. Yet this can actually be done, and there is at least one generating station running to-day on water that would not be hot enough to boil an egg.

This power plant belongs to a mining firm operating in the Belgian Congo. The plant itself was built and designed by an English firm, Messrs. Belliss and Morcom, and is shown in Fig. 2.

The problem that faced the mining company was how to get power to operate their plant, which was situated in a district that had no natural source of fuel, and where the cost of transport of oil or coal was exceptionally high. In fact, the only natural asset that might possibly be used to produce power were two fresh water springs, one hot the other cold. The Belgian mining engineers calculated that there was sufficient difference of potential energy between the hot water in one spring and the cold water in the other, to supply their power needs. The only question was how could it be done ? How could the process be reversed, instead of heating water by electricity, to make electricity by cooling water ?

After approaching many firms in many different countries to try to find a solution to the problem, it was eventually Belliss and Morcom who agreed to tackle the problem. Their solution was not only very ingenious but was also very successful in practice. They relied on the fact that the boiling point of water is not constant, but depends on the surrounding pressure.

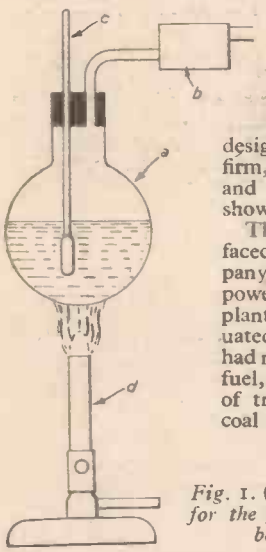


Fig. 1. (Left).—Apparatus for the first experiment in boiling water.

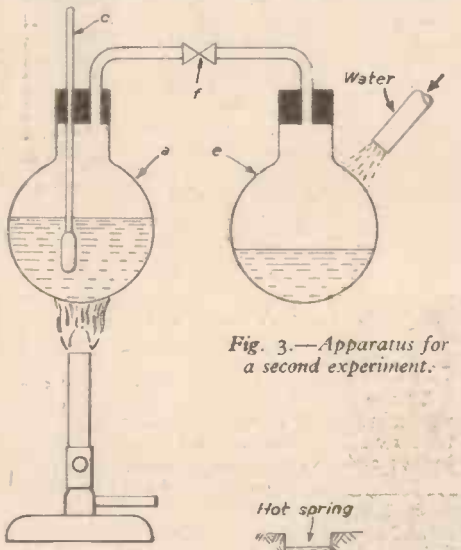
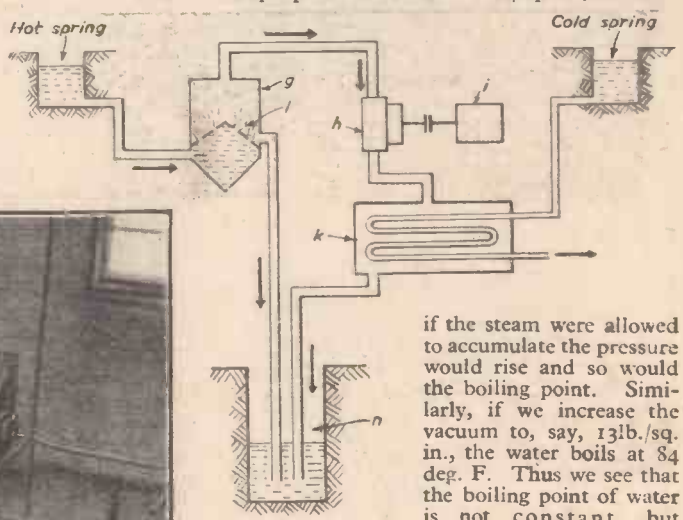


Fig. 3.—Apparatus for a second experiment.

Fig. 4 (Right).—The unit for extracting power from the hot-water spring shown diagrammatically.



To fully understand the operation of this interesting plant it is necessary to revise some of the facts about the boiling point of water. Suppose we connect up an apparatus such as is shown in Fig. 1, consisting of a flask (a), a vacuum pump (b), a thermometer (c) and a bunsen burner (d). Now, if we light the bunsen burner and heat the water we find that at normal atmospheric pressure the water boils at 212 deg. F. If now, however, we start the vacuum pump, and reduce the pressure in the flask to a vacuum of, say, 10lb./sq. in. we find that the water no longer boils at 212 deg. F., but at 158 deg. F. In other words, the water now boils 54 deg. F. lower. Of course, the vacuum pump has to work fairly hard to draw off the steam and keep up the suction of 10lb./sq. in., because if the steam were allowed to accumulate the pressure would rise and so would the boiling point. Similarly, if we increase the vacuum to, say, 13lb./sq. in., the water boils at 84 deg. F. Thus we see that the boiling point of water is not constant, but depends on the degree of vacuum in the vessel in which it is being boiled.

If now we change our apparatus to that shown in Fig. 3, where we have replaced the vacuum pump by another flask (e) and have put a valve (f) in the pipe joining the two. The flask (e) is kept cold by spraying water on to the outside. Assuming that the valve is shut and that the vacuum in (a) is 10lb./sq. in. and in (e) is 13lb./sq. in. We bring the water in (a) to the boil, and at the same time open the valve (f). The steam generated in (a) flows to the flask (e) due to the greater vacuum there. However, on entering the cold flask (e) the steam is immediately condensed back to water, thus maintaining the vacuum. As a result the process is continuous until all the water from (a) has boiled away and been condensed in (e).

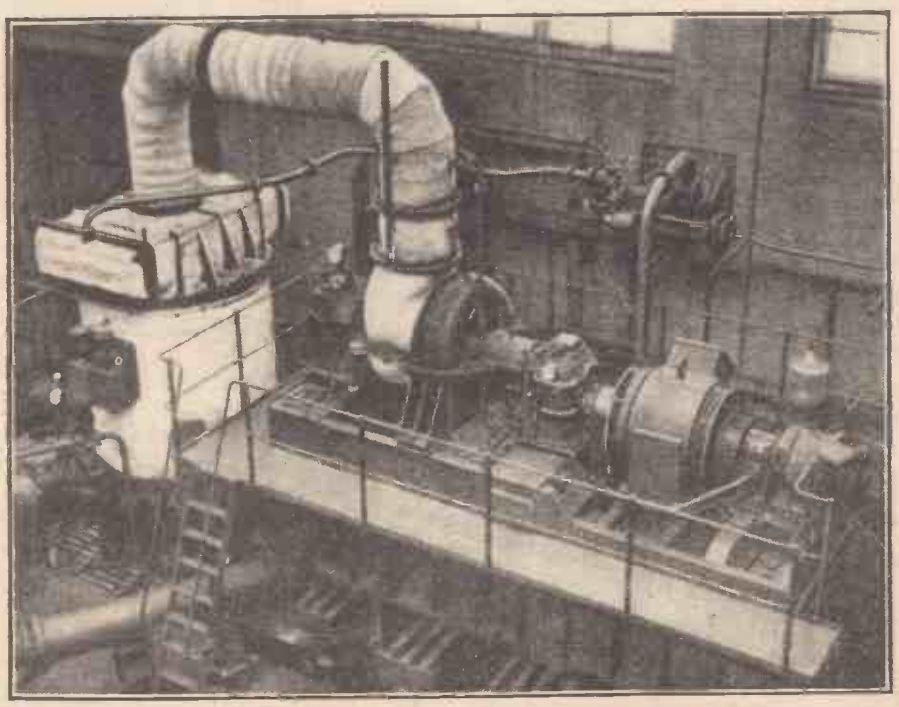


Fig. 2.—The plant designed by Belliss and Morcom for a Belgian Congo mining firm.

This then, is the principal which is adopted to get the power from the hot water spring. Flask (a) is replaced by the special boiler or evaporator (g) as shown in Fig. 4. The valve (f) is replaced by a low pressure steam turbine (h), which drives the generator (i), and the flask (e) by the water tube condenser (k).

The evaporator is maintained at a constant vacuum of 10lb./sq. in. by the condenser. Water from the hot spring flows into the bottom of the evaporator and is sucked into the main chamber through the nozzles (1) in a fine spray. Due to the vacuum in the main chamber the water immediately boils and turns into steam. Any water that is not turned into steam drains away down a long barometric pipe to the sump (n).

When the steam leaves the evaporator it passes down the steam main and drives the turbine and then goes on to the high vacuum in the condenser, where it again becomes water. The high vacuum in the condenser is maintained by the condensation of the steam, which is caused by the water from the cold spring cooling it by flowing through the tubes. The condensed water is drawn away down a barometric pipe to the sump.

Thus by this simple and ingenious method the engineers at Belliss and Morcom were able to solve the problem which at first sight seemed impossible. The plant has now run for many thousands of hours and is still in excellent condition. When working at full output it can develop 370 h.p.

While this installation is an isolated one, working under conditions that are relatively favourable, it must not be thought that this principle can only be applied to situations where there are hot springs. For instance, in some parts of the world the temperature of the sea on the surface is quite high, while deep down on the bed it is cold. This difference of temperature may in some cases amount to 30 deg. F. Using the system just described power could be generated on an almost unlimited scale, the physical size of the plant, the initial cost and the heavy maintenance costs being the chief drawbacks. However, if ever the power needs of the world become sufficiently acute there is no doubt that this form of energy will be used.

A PHOTOFLOOD DIMMING UNIT

A Series/Parallel Arrangement Giving Flexible Lighting and Bulb Economy

By A. WILSON

PHOTOFLOODS with "overrun" filaments have a very short life and emit tremendous heat, and it has long been the practice of photographers to use some type of series/parallel arrangement to overcome these limitations.

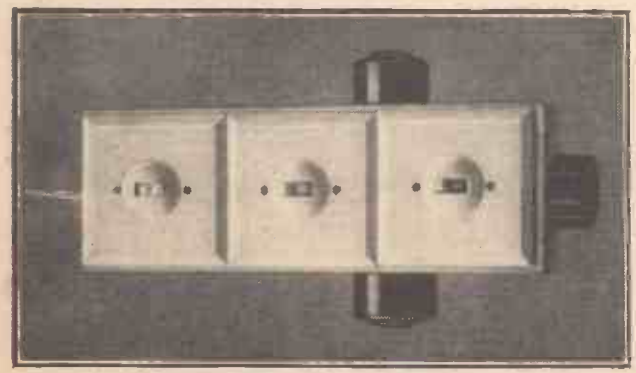


Fig. 1.—The completed dimming unit.

If three bulbs of equal wattage are wired in series they burn dimly but with equal illumination, and in this form they can be used for working out lighting arrangements. When the correct set-up has been achieved the wiring is switched into parallel and the bulbs burn at full brightness. Using this unit the life of the bulbs is greatly increased because at the time of exposure only are they burning at full brightness.

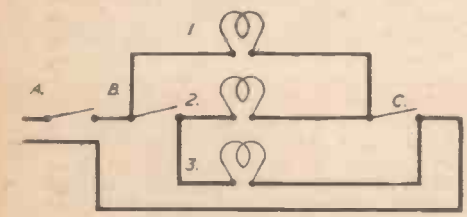


Fig. 2.—The circuit.

The Circuit

The circuit is arranged as shown in Fig. 2. Switch A controls the flow of power to the box and bulbs; switches B and C control the series/parallel arrangements. When switch A is closed and switches B and C are open the bulbs are in series and burn dimly. When all three switches are closed the bulbs are in parallel and burn at full brightness. If switches A and B are closed bulb (3) burns at full brightness and (1) and (2) are off. If switches A and C are closed, bulb (1) burns at full brightness and (2) and (3) are off.

Thus, by using this unit, one can not only use the three bulbs in series or in parallel, but by a simple flick of the switch the main light and the "fill in" light can be studied independently of each other and at full brightness, so enabling highlight, shadow ratios, etc., to be worked out.

Construction

The unit consists of a wooden box 9⅝in. × 3⅜in. × 1¾in. containing three switches which are screwed into a baseboard and wired with 5-amp. insulated wire as shown in Figs. 1 and 3. The completed base is then placed in the box and screwed down. The two-pin sockets are fitted as shown.

If the reflectors are to be earthed, three-pin sockets are used and the three earth wires are connected together inside the box and emerge with the live and neutral leads.

This unit was constructed over a year ago during which time it has given absolutely trouble-free service and the same three No. 2 photofloods are still being used.

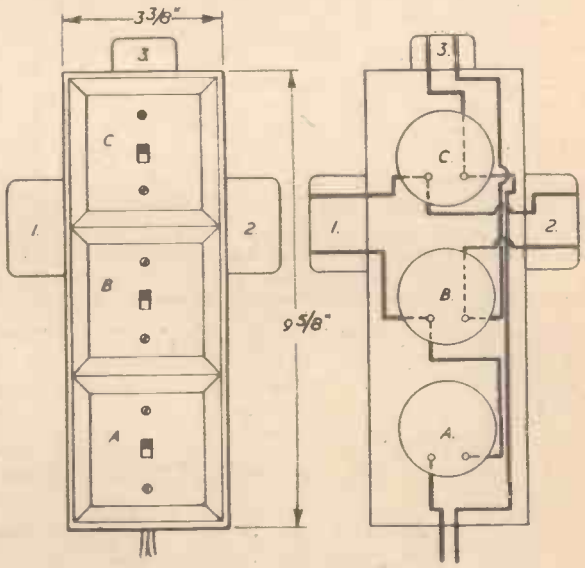


Fig. 3.—Arrangement of components and wiring.

BOOKS Received

The Speedicut Manual of Screw Thread Details. 321 pages, fully illustrated, crown octavo, 30s. net. Published by Firth Brown Tools Ltd., Carlisle Street East, Sheffield, 4.

THIS is a very complete manual on all aspects of screw threads, and it will be of use not only to the professional engineer, but also to the amateur mechanic. It deals with the selection and use of taps, nomenclature, definitions, types of tap in general use, the modification of taps for special purposes, tapping specific materials, tapping speeds, tap drills and sizes, lubrication, sharpening taps, tap faults and failures, formulae, measurement, screw thread forms, basic sizes of screw threads, etc. It is a very complete work on the subject.

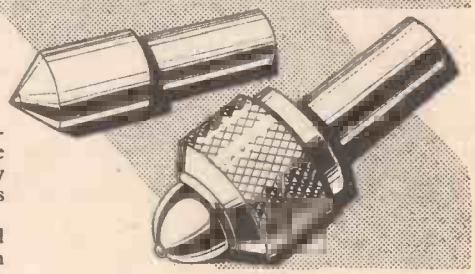
"Scale Model Cars," by Harold Pratley, 77 pages, 43 illustrations, 5s. net. Published by the Aeronautical Press, Ltd.

THIS book is published as one of a series and concisely but adequately details the whole process of car modelling from "Selection of Prototype" in the opening chapter to "The Final Points of Modelling," which is the title of the final chapter.

SPECIAL HARDNESS TESTS FOR METALS

Some Special Machines and Some Very Simple Tests

By ERIC N. SIMONS



IN addition to the standard metal hardness testing machines there are a number of special machines designed to test either particular aspects of a material's hardness, or to give what the makers of the machine consider a more reliable result. There are also simpler and more primitive hardness tests.

The Monotron Testing Machine

One of the most interesting of the more specialised machines is the Monotron tester, which is designed to force a hemispherical diamond indenter of the form shown in Fig. 1 into a testpiece to a depth of 0.045 mm. The load required to produce an impression of this depth is taken as the measure of hardness, and measurement of the depth is effected under load by means of a compensated depth micrometer gauge. The load ranges from 0 to 160 kg. The indenter has a diameter of 0.75 mm.

Alternative Monotron Indenters

Instead of the diamond indenter above, it is possible to use a 1 mm. diamond ball,

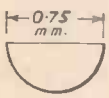


Fig. 1 (Left).—An hemispherical diamond indenter.

a 1/16in. tungsten carbide ball, or a 2.5 mm. carbide ball. The different indenters give, of course, different scales known as M.2, M.3 and M.4, the 0.75 mm. diamond indenter being M.1.

Testing Hard Materials

If the material undergoing test is extremely hard, it becomes essential to reduce the depth of penetration to 0.015 mm. so as to prevent damage of the indenter. In such circumstances the load as measured is multiplied by three to give the hardness numeral corresponding to a penetration depth of 0.045 mm. This step is possible because there is a linear relation between load and penetration depth.

Testing Hot Hardness

One interesting use to which the Monotron testing machine has been put is the testing of hot hardness. This is the hardness of a material at red heat, which is rather difficult to measure. If the results are to be accurate, it is essential to carry out the test while the testpiece is actually at the heat required, and for this reason the testpiece must be inside a furnace, so that it does not lose heat by radiation. Moreover, the hardness at the specified temperature must be measured as rapidly as possible to reduce to a minimum the loss of heat by conduction into the indenter (assuming this to be at a low temperature).

To resolve these difficulties the method adopted by the Union Carbide and Carbon Research Laboratory of Niagara Falls was to design a special furnace which could be placed directly on a Monotron hardness testing machine, which was provided with a special indenter and cap.

Making a Hot Hardness Test

The testpiece measured ½in. or ⅝in. square, and was prepared by the application of a coating of the alloy at least ¼in. thick on to a steel foundation. The hardness was first measured while the material was in the cold state, after which the testpiece was heated to various temperatures up to the maximum required, being maintained at each temperature for a period of one-and-a-half hours before the measurement was made. Fig. 2 shows curves of hardness in relation to temperature obtained in this manner.

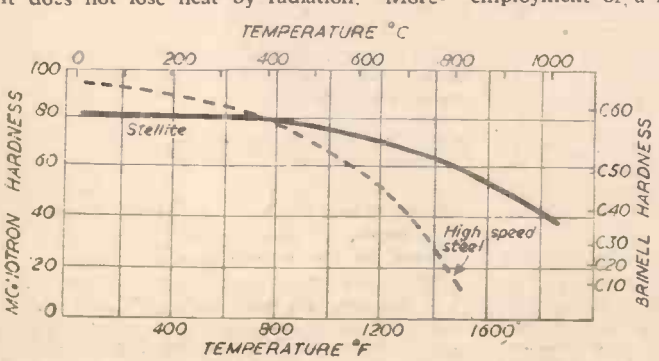


Fig. 2.—Curves of hardness in relation to temperature.

The more recent development is the employment of a hot tungsten carbide ball for this test, and it is considered that this will give more accurate results than the original test.

The Cloudburst Hardness Test

The methods we have so far described show the hardness value at a specific point on the surface of the material tested. They do not, however, show the hardness elsewhere on the surface, and some authorities have argued that this is a serious defect of all indentation hardness tests. With many tests it would be impracticable to take a range of indentation tests on one and the same surface, as this would impair the surface.

While the matter is not of great importance with many tests, which give data that can be relied upon, there are occasions, such as when a steel has been heat-treated and may have soft spots caused by some local steam pocket, etc., where a single indentation, or even half-a-dozen indentations, might not show up the blemishes. Moreover, to take a wide range of indentation tests on one surface would take more time than can usually be spared.

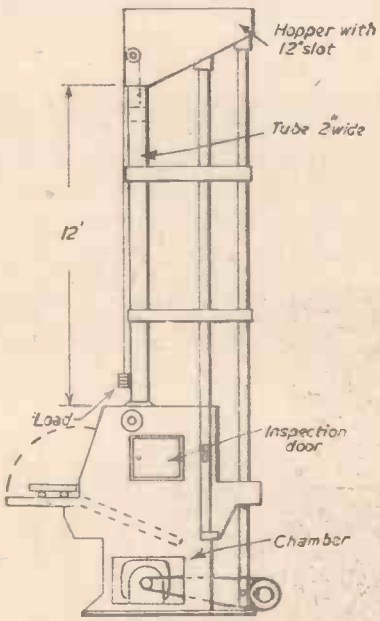


Fig. 3.—The Cloudburst testing machine shown diagrammatically.

The Cloudburst Testing Machine

For this reason a novel form of test was devised in which it becomes possible to measure the hardness of comparatively large areas simultaneously. This is done by allowing a shower of hard steel balls to fall from a predetermined height upon the *entire* surface of a testpiece. The height of the drop is regulated to the particular degree of hardness the material should show, and if any soft spots occur, their presence being shown by a degree of impression roughness, they can easily be discovered.

The machine itself is shown diagramatically in Fig. 3. It is made up of a chamber of vertical type lined with rubber. The testpiece is inserted in this, and a vertical tube is provided down which the balls drop. They can be elevated again to the desired height as required. After impinging upon the surface to be tested the balls glide away into a tray or scoop at the bottom of the camber, whence they are manually conveyed to a hopper enclosing the vertical tube. As soon as the hopper is full it is elevated to the top of the tester and the balls pass into the tube by way of openings. Thence they drop on to a perforated piston in the tube from which they fall on to the next testpiece. The piston height is controllable and a scale on the tester shows its location.

Introducing the Testpiece

The testpiece is introduced into the chamber by way of a door in the side, and at the top of the rubber-lined chamber is a handle for moving the table or anvil so that the entire surface area is subjected to the shower of balls. The anvil measures 8in. sq., and the diameter of the tube is 2in.

In larger machines of this type, capable of taking a piece 12in. square, the piston gives way to a controllable hopper slotted at the bottom, the slot being 12in. long, so that the balls drop through this in a vertical flat stream. Meantime, the anvil is traversed across and under the stream by gearing to ensure coverage of the entire area.

Measuring Hardness Values

In this machine a projection microscope is used in such a way that an image of any part of the surface tested is magnified to 8in. diameter and projected on to a graduated

screen inside a dark chamber, observation of which is by way of a window. The hardness value is measured by the diameters of the indentations, as with the Brinell hardness test.

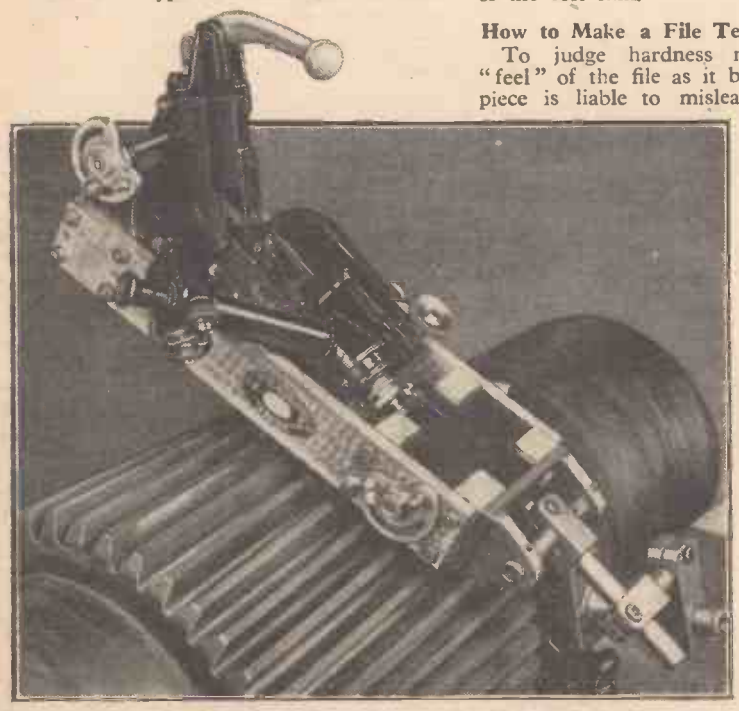
The Bierbaum Microcharacter Testing Machine

Another means of determining the hardness of an alloy known to contain soft and hard particles is the Bierbaum testing machine. This is primarily designed to ascertain the hardness of microscopic points in order to establish the hardness of each type of constituent. This machine is essentially a refined type of scratch-hardness tester. It consists of a diamond cutting-point, which is drawn across the testpiece under a given load. The width of the ensuing scratch is measured under a special microscope. The diamond takes the form of a corner of a cube, and the load upon it is 3 g. The hardness numeral is obtained from the equation $K = 10^4/\lambda^2$ where K is the hardness numeral and λ is the width of the cut measured in microns. This machine is primarily intended for laboratory use and is little employed in routine testing.

The Eberbach Testing Machine

This is a type of indentation hardness machine using the diamond pyramid hardness scales. It embodies a diamond pyramid indenter of 136 deg. The load is applied by springs, and the unit may be readily substituted for the objective of the microscope. In making this test, the field is chosen through the microscope, after which the indenter is substituted for the objective and indentation made by using the microscope focusing arrangement to bring indenter and testpiece into contact. The objective is then restored and the impression measured through a micrometer eyepiece. The loads range from 7.5 to 550 g.

This is a qualitative rather than a quantitative test, but is of considerable value in enabling the comparative hardness of microstructural constituents to be established.



An example of the types of special hardness testing machinery used in industry. This is made by Vickers and specially adapted for use on large gear wheels.

The Scratch Test

The scratch test was devised by Mohr, but has since been extended, and in the modern form of scratch test, such as the Eberbach, mentioned earlier, hardness is defined as the load in grams that enables a cone-shaped diamond to cause a scratch 0.01 mm. wide.

The File Test

The oldest of all commonly employed hardness tests is the file test. Many believe this to be more valuable than the instruments of precision for testing hardness, and it is quite true that, given skill and experience, it is amazing how properties and conditions not shown by any testing machine (with the exception of the Vickers) can be revealed by the file test, and without the necessity of a considerable range of accurate readings. In fact, in many factories, it is often claimed that soft spots can be more readily detected with the file than by machine testing.

The file test has one great advantage. It shows up at once, and in no uncertain manner, the presence, degree and even depth of surface decarburisation. Too often surface decarburisation is mistaken for uniform softness throughout the testpiece when indentation hardness tests are carried out, so that work may be ruined by further heat-treatment without elimination of the cause of the soft skin.

How to Make a File Test

To judge hardness merely from the "feel" of the file as it bites into the testpiece is liable to mislead because of the wide variation in "feel" of differently composed steels. If the operator is experienced, however, he can distinguish between different pieces of steel if he employs only a single file. Files themselves are variable in hardness, and this affects the result. The file cut, also, affects the feel of the material, a bastard file making a piece feel softer than a finely-cut file would.

The File Scratch Test

Because of these variations, it has been suggested that the best method of making a file test is the file scratch test. In this, the tip of a small square or three-square file is sharpened on an abrasive wheel until it is sufficiently pointed to scratch the surface of the testpiece. A range of files all tempered to give a Rockwell hardness of C25 to C65 is taken, and the hardness of the testpiece is taken to be somewhere between that of two files, one of which scratches and the other does not.

Fig. 4.—An automatic centre punch.

The file test has obvious limitations, but as long as it is used solely as a supplement to the more standard machine tests, it can be of great service.

In using the file it should be rubbed gently but firmly, and its teeth must be sharp. Only when it is seen that the file "bites" should more pressure be used. The test is mainly confined to hardened steel parts which have not been tempered. The slower the rate at which the file is used, the more trustworthy will be the test. Pressure should be firm and as constant as possible. Likewise the angle of contact should be as constant as possible. The size and shape of file should be standardised.

With steels of Rockwell C60 or above, variations in composition and heat-treatment are associated with seeming anomalies, e.g., the comparative hardness of two materials may be reversed when tested with the file as compared with an indentation hardness test.

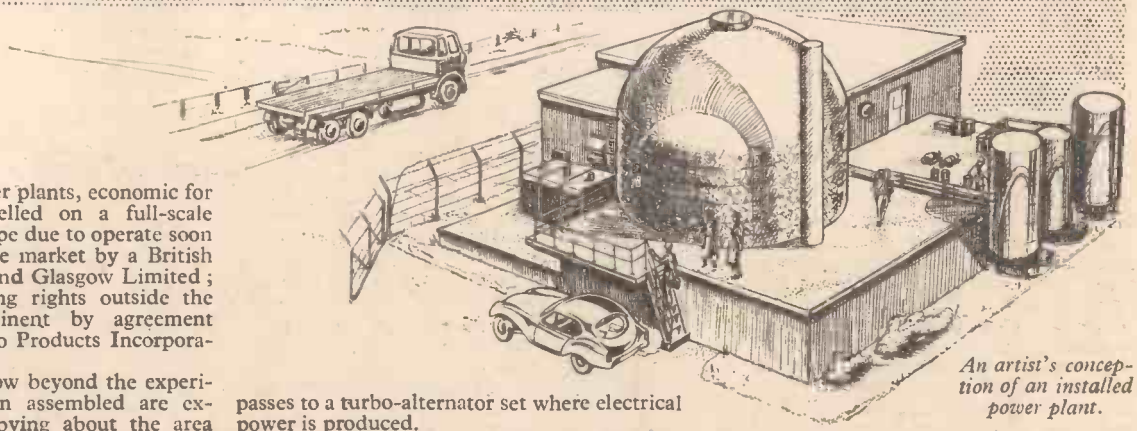
A Portable Hardness Tester

Various portable hardness testing machines and devices have been introduced. These cannot be so accurate as the static machines, but they have great convenience. Normally, they consist of a precision dial gauge with plunger indenter. The gauge measures the depth of indentation under load, for which purpose it is provided with a scale. The load is manually applied, and a stop prevents excess pressure. Another portable hardness testing device has an indenter in which a number of teeth have been formed. These are applied under a specific load to the testpiece or component, after which the hardness is calculated from the number of indentations, which is a minimum for hard and a maximum for soft materials.

Various other designs of these machines are manufactured, but space does not allow a detailed description. The one shown in Fig. 4 is an automatic centre punch for making hardness tests.

ATOMIC REACTORS FOR INDUSTRY

Tennis-court-sized Atomic Power Plants



An artist's conception of an installed power plant.

SMALL atomic power plants, economic for export and modelled on a full-scale American prototype due to operate soon have been placed on the market by a British company, Humphreys and Glasgow Limited; the company has selling rights outside the North American continent by agreement with the designers, Alco Products Incorporated, of New York.

These reactors are now beyond the experimental stage and when assembled are extremely compact, occupying about the area of a tennis court. The reactor works on the pressurised water system, which has been proved for two years in the U.S. Navy atomic submarine *Nautilus*.

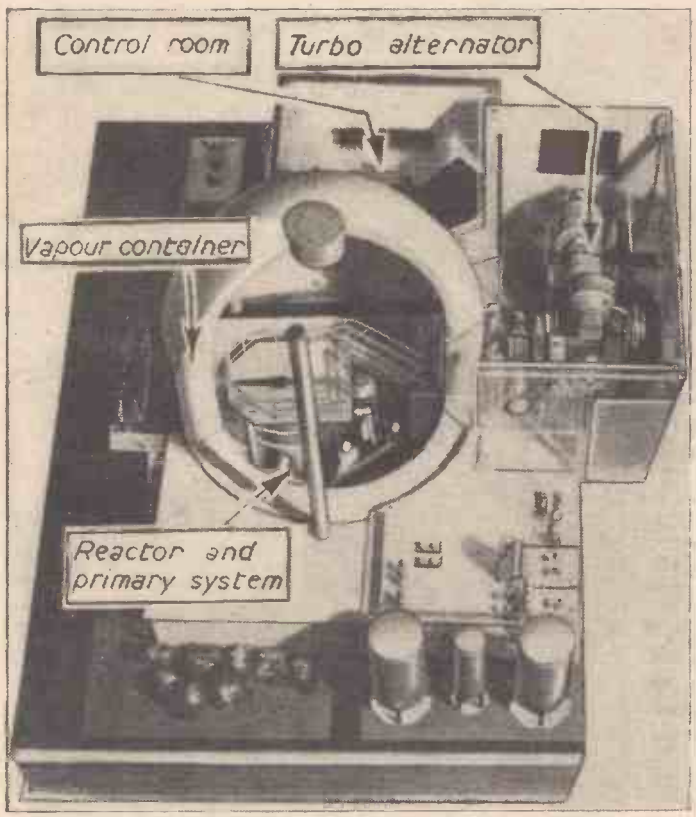


Fig. 1.—A cutaway model of the Alco nuclear power plant.

Although small or medium-size generating stations installed on an average site will cost somewhat more than an oil or coal-fired station of similar size, costs of electricity production will be competitive. A major advantage of the nuclear plant is freedom from interruption of the fuel supply by transport difficulties. A year's fuel charge is such a small package that delivery by air is feasible, if necessary.

Only materials in common use such as mild and stainless steel are employed in the reactor. It uses enriched uranium fuel, now obtainable on loan from the United States under contract whereby supplies are guaranteed for the life of the reactor. The reactor will run from eighteen months to two years without change of fuel elements.

By the circulation of water under pressure, heat is removed from the reactor. On leaving the reactor this water passes through a steam generator or boiler and is then pumped back to the reactor. Steam generated in the boiler passes to a turbo-alternator set where electrical power is produced.

A very high degree of safety is claimed for the design and the vapour container will give complete protection to the surrounding population in the event of any conceivable nuclear incident.

Demand for these small and medium-sized plants is likely to come chiefly from communities or industrial concerns in areas where the cost of fuel is high and long-range transmission uneconomical, for example, in remote or thinly populated country. Reactors of this type are also ideal as prototypes for smaller countries seeking to gain operating experience of nuclear power plant at a low capital cost.

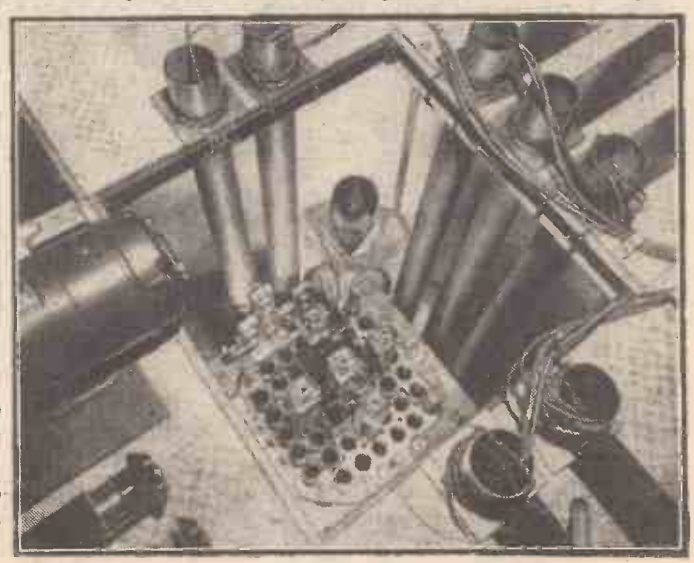


Fig. 2.—(Right) A technician adjusts a control rod in the core of the Alco nuclear power plant.

Technical Data

Alco pressurised nuclear power plants are at present available in three sizes, giving net electrical outputs of 2, 5 and 10 MW. respectively and extension of the range up to 25 MW. is in hand.

Outline specification of the 10 MW. plant is as follows:

General

Thermal power generated	46,000 kW.
Electrical power generated	10,600 kW.
Required for auxiliaries	600 kW.
Net electric power available	10,000 kW.
Thermal efficiency ...	22%
Uranium enrichment ...	4-30%
Core life before refuel at full power	18 months
Core life before refuel at 80% load factor ...	30 months
Control rod number ...	7-9
Average fast flux approx.	5×10^{14}n/cm²sec.
Average thermal flux approx.	10^{14}n/cm²sec.

Primary Loop

This consists essentially of the reactor pressure vessel, steam generator primary coolant, circulating pump and pressuriser. All surfaces in contact with primary coolant and the fuel element cans are of stainless steel. Fixed rate of bleed and equivalent make up through demineralisers maintains the purity of coolant. Control rods are driven by geared motor through rack and pinion, and magnetic clutch.

Moderator and coolant ...	Light water
Water system pressure ...	1,500 psig
Circulation rate varies with enrichment. Typical rate galls. per minute	9,000
Coolant temperature reactor inlet (typical)	485°F.
Coolant temperature reactor outlet (typical)	518°F.
Reactor pressure vessel dia. approx.	4ft. 6in.
Reactor pressure vessel height	16ft.

Primary structures are as follows:

(a) Vapour container, which also acts as biological shield, is approximately 70ft. diameter and 70ft. high and has a domed top.

It is constructed of steel and fabricated by welding. It houses the complete high-pressure primary system, and is so designed that it will contain the products of any conceivable nuclear incident.

(b) Primary shield of the iron/water and concrete type is provided round the reactor pressure vessel.

(c) Secondary shield consisting of 3-4ft. of concrete surrounds the primary loop equipment.

(d) Fuel vault for unused fuel elements.

(e) Spent fuel pit immediately adjacent to vapour container, into which spent fuel elements are transferred after removal from core for cooling off.

Secondary System

This follows conventional power station practice being, of course, variable to suit site conditions and the duty required.

Typical data for a station with condensing turbine and bled steam for feed water heating are as follow:

Steam pressure at turbine...	... 375 psig
Steam temperature ...	... 439° F.
Steam flow from steam generator	174,000 lb. per hr.
Feed water temperature ...	... 280° F.
Condenser pressure... ...	2.5in. Hg.
Turbo-alternator output (net sent out)	10,000 kW.

Control System

The nuclear control circuits provide safety under all operating conditions. The control rods are arranged to drop at 150 per cent. of design power or if the reactor period becomes less than three seconds. The action is extremely fast and the control rods start to drop in about 60 milli seconds and at an acceleration of 24ft./sec. sec.

The pressuriser is operated by electrical heaters regulated by a pressurestat. Pressure, temperature and water level in the pressuriser are all recorded in the control room as are the differential temperatures across the reactor.

The primary coolant blow-down and make-up are recorded on the panel, and conductivity is recorded both before and after the demineralisers. The reactor shuts down on the following signals:

Pressure (high and low) in pressuriser.
Levels (high and low) in pressuriser.
Reactor outlet temperature (high).
Steam generator outlet pressure (high).
Steam generator outlet temperature (high).
Primary coolant flow (low).
Coincidence of two P.C.P. chambers.
Reactor period (short).
Manual.

Operational monitoring is provided at significant points to indicate immediately any abnormal operating conditions which might be hazardous to personnel either within or beyond control areas. All instruments actuate visual or audible alarms on the main control panel.

The Hydro Sled

Details of a New American Aquatic Device

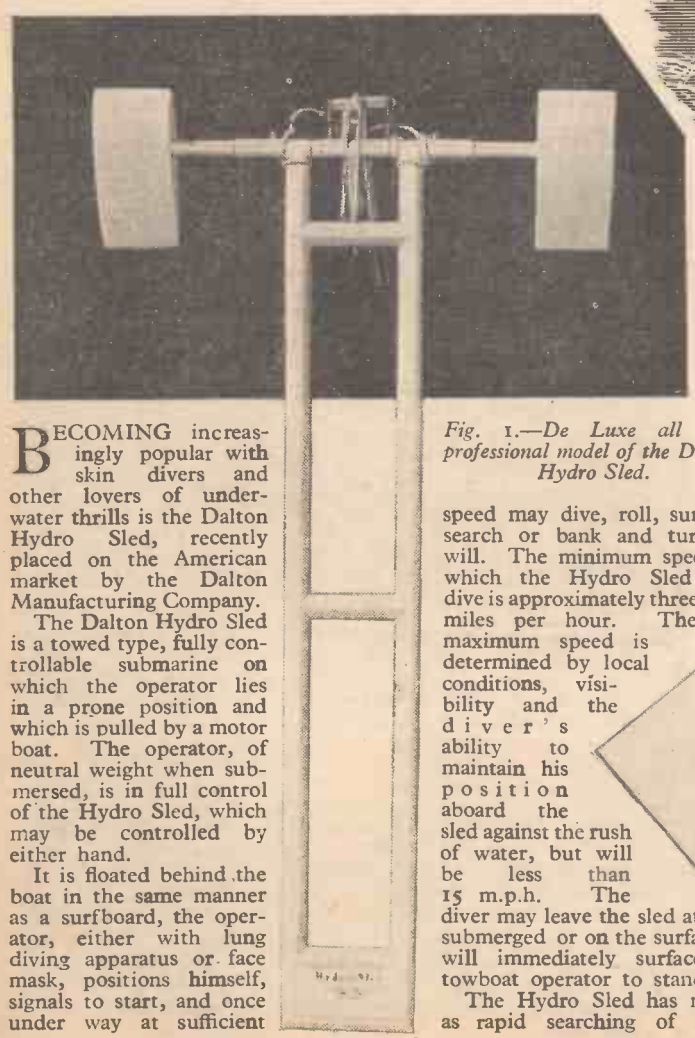


Fig. 1.—De Luxe all steel professional model of the Dalton Hydro Sled.

BECOMING increasingly popular with skin divers and other lovers of underwater thrills is the Dalton Hydro Sled, recently placed on the American market by the Dalton Manufacturing Company.

The Dalton Hydro Sled is a towed type, fully controllable submarine on which the operator lies in a prone position and which is pulled by a motor boat. The operator, of neutral weight when submersed, is in full control of the Hydro Sled, which may be controlled by either hand.

It is floated behind the boat in the same manner as a surfboard, the operator, either with lung diving apparatus or face mask, positions himself, signals to start, and once under way at sufficient speed may dive, roll, surface, search or bank and turn at will. The minimum speed at which the Hydro Sled will dive is approximately three miles per hour. The maximum speed is determined by local conditions, visibility and the diver's ability to maintain his position aboard the sled against the rush of water, but will be less than 15 m.p.h. The diver may leave the sled at any time, either while submerged or on the surface, and the Hydro Sled will immediately surface, thus signalling the towboat operator to stand by for the diver.

The Hydro Sled has many versatile uses such as rapid searching of large areas of bottom for lost articles without disturbing the sediment, conservation of air supply by permitting extensive underwater travel without exhaustive swimming, and several articles of equipment can be lashed to the Hydro Sled and the proper one selected when the objective is sighted.

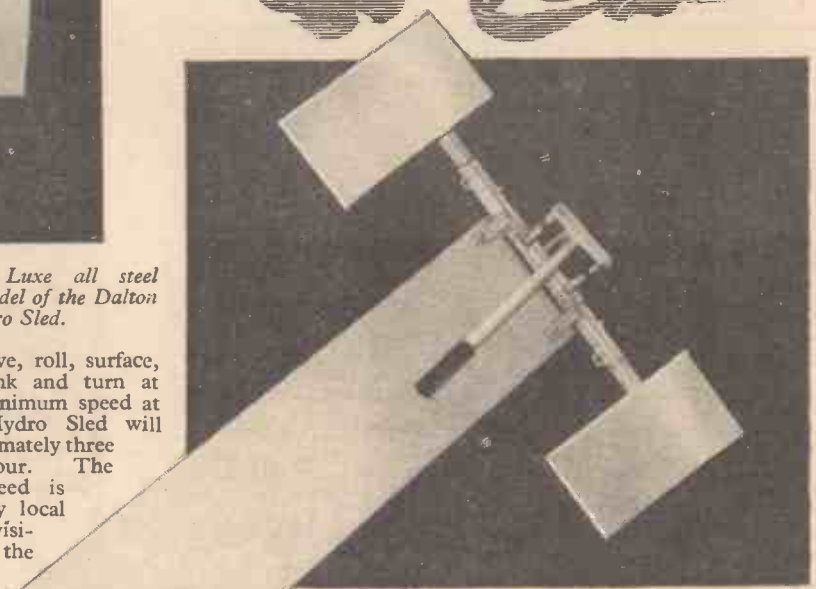
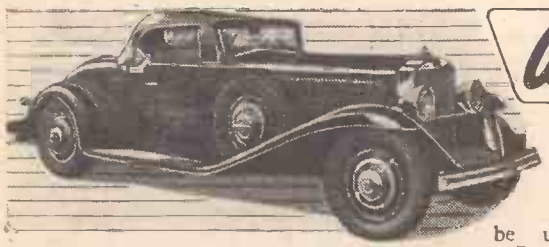


Fig. 2.—An under-side view of the standard model showing control handle.

The Dalton Hydro Sled is manufactured by the Dalton Manufacturing Co., 104 Mill Street, Dalton, Pennsylvania, U.S.A.



Why Not a STEAM CAR?

Its Advantages and Drawbacks Discussed

By C. E. HOOKER

IT is unfortunate that the steam car has not been as popular with the motorist as the internal combustion engine, but this was inevitable. Even the power house engine, where steam had every advantage, including mechanically-stoked boilers, using low grade coal; compound condensing engines with economisers; skilled supervision, etc., is being replaced by the diesel engine. In all branches of steam power—the factories, the farms, the ships and on the road—the same thing is happening; even the ever-popular railway steam locomotive is threatened.

It has been said that the same interest has not been taken by the manufacturer in steam engines as in the I.C. engines, but this is not conceded. The steam engine played an important part in industry for nearly 100 years when the I.C. engine was still in its infancy and the only difference between the steam and I.C. cars are the power units.

In the well-known makes of steam car, White, Stanley, Serpollet, Clarkson, Pearson & Cox, Doble, etc., the engine was usually satisfactory and the engines were of all types, 2, 3 and 4 cylinders, simples, compounds, single and double acting, with slide piston and poppet valves, Stephenson, Joy and Cam valve gears. The real snags were, and still are, the steam generators and burners, although some modern steam cars give good results, with expert handling.

Few generators had sufficient reserve of steam, burners choked, some lit back and few indeed were satisfactory. Solid fuel is not a practical proposition: it would need a heavy boiler, requiring frequent attention and with the present traffic congestion, this would be unsatisfactory for obvious reasons.

It is an interesting fact that steam cars were banned from Brooklands race track because the I.C. engine car could not compete with them, but in those days, the petrol cars had big "slow rev." engines and heavy gear boxes and were in their infancy compared with steam.

Some years ago the author owned several steam cars including two 6 h.p. Serpollets, and 16, 20 and 40-h.p. Whites. The 16 h.p. White and the Serpollets were in bad condition, but the 40 h.p. White gave an amazing performance and was a delight to drive. The snag was an extremely heavy fuel consumption. The 20 h.p. White (Fig. 1) gave the best ever motoring in 52 years of bicycle and motor ownership which commenced with a Benz in 1904. The one disturbing feature was not the steam pressure, set to blow off at 1,200 p.s.i., but the 60 lb. in the petrol and paraffin tanks. With the naked flame of the burner, a fracture of a pipe or tank could have been disastrous.

Anyone, however, not having ridden in a steam car could not imagine the uncanny silence, the terrific acceleration and the apparently effortless progress—the feeling of some invisible magnet drawing the car along. With expert maintenance, driving was simple and there was not a car on the road that it would not overtake. Steam pressure soon fell, however, and advantage was lost within a quarter of a mile. Approaching a hill at speed would also cause the pressure to fall and most likely the car to stall—a failing common to most steamers. If the throttle were opened slowly giving the generator time to warm up thoroughly, high speed could be maintained.

This White steamer would pull any load that the chassis would support; it was a four-seater and often carried over a ton of goods; indeed it appeared to run better when loaded,

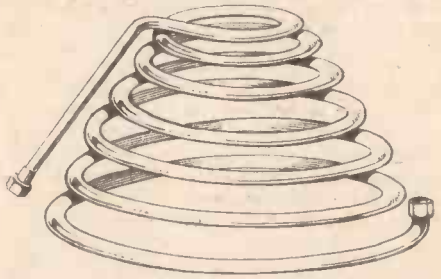
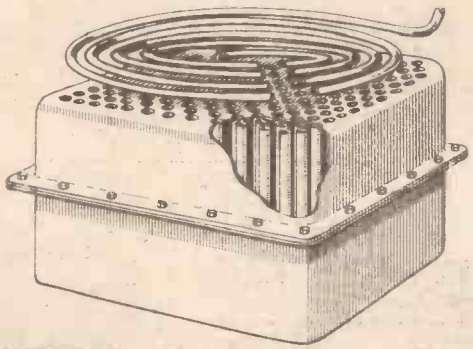


Fig. 3.—Clarkson boiler, made up of sections, with few joints, which are easily replaced.



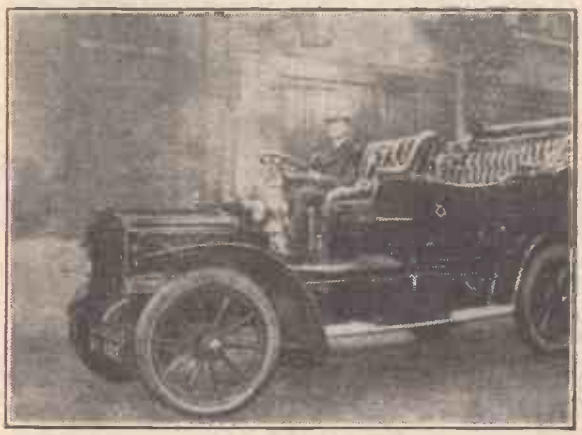
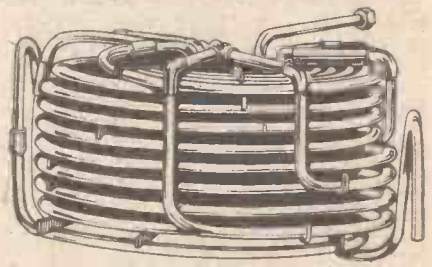
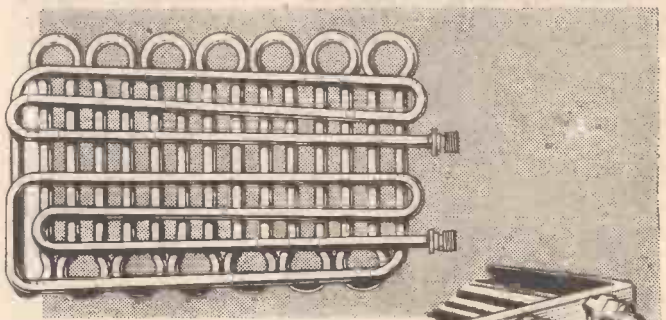


Fig. 4 (Above).—Type of fire tube boiler fitted to Stanley and others but not a favourite type.

Fig. 1 (Left).—The author's 20 h.p. White.

Fig. 5 (Right).—The White boiler consisting of flat spiral coils made from about 140ft. of 9/16in. tube.





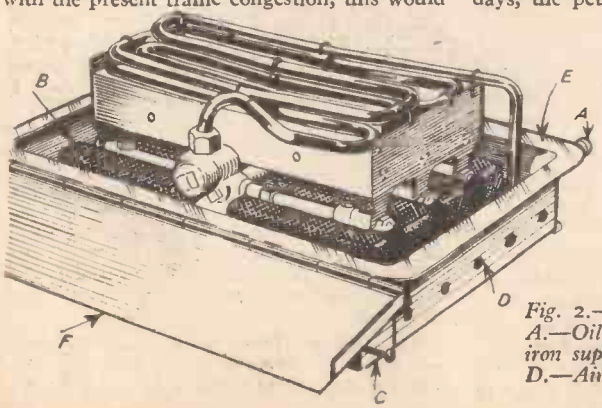
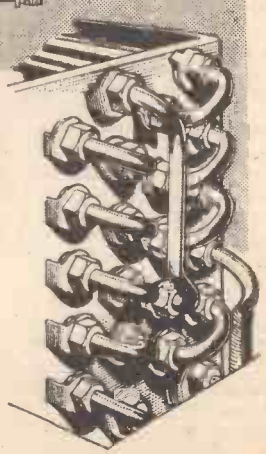


Fig. 2.—Multi jet burners of Serpollet type. A.—Oil entry to vaporiser; B.—Perforated iron supplying air to boiler; C.—Air scoop; D.—Air holes; E.—Sides of burner case; F.—Door of burner box.

Fig. 6 (Right).—The Serpollet type with flat square grids of 10 or more sections, but many screwed joints. Each section consisted of 33ft. of approximately 5/8in. diameter tube.



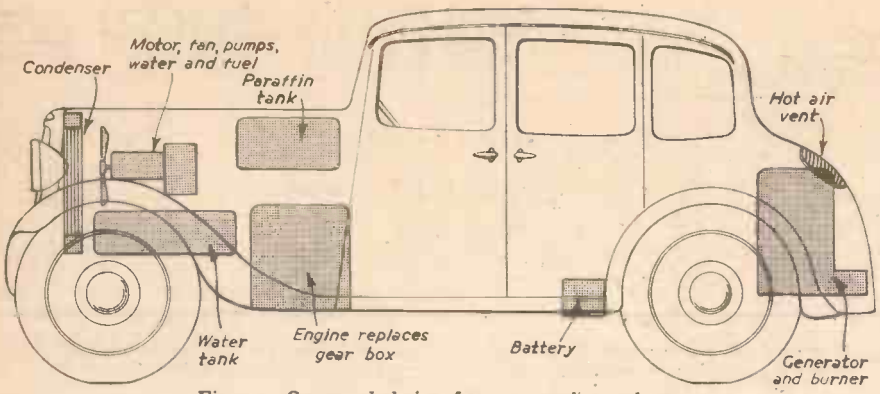


Fig. 7.—Suggested design for converted petrol car.

probably because the boiler warmed up thoroughly. There were no serious mechanical breakdowns, but there were annoying and messy jobs such as skimming oil scum off the water tank, packing glands, adjusting controls, the difficulty of draining the water in the event of frost, and the greater difficulty of getting rid of air locks when refilling.

In expert hands and for pleasure only, the steam car gave satisfaction, but owing to the heavy fuel requirements, the I.C. engine car was more economical for business use.

Building a Steam Car

The foregoing "snags" need not stop the steam enthusiast from experimenting. If means are restricted, the purchase of an old car, say an Austin 10, is recommended. The engine and gear box should be removed and the radiator can be used as a steam condenser. Almost any type of engine would be suitable, but a 3-cylinder single-acting type, with poppet valves is recommended. This could be built with only a few tools. Electrical gear, battery, engine-driven dynamo and motor-driven pumps could be controlled by hand or pressure. A multi-jet burner of the Serpollet type, shown in Fig. 2, could be used for the sake of simplicity. The generator is the heart of the steam car and the monotube circular type, such as the Clarkson, shown in Fig. 3, is recommended; this is about 14 in. dia. and made from at least 140 ft. of ½ in. or ⅝ in. steel tube, stainless if possible. Some other types are shown in Figs. 4, 5 and 6. A suggested layout is given in Fig. 7.

Steam Car Data

The following is included as being of general interest:

Locomobile—Fire tube generator, 14in. x 14in., 300 ½in. tube, 2-cylinder double-acting, slide valve engine.

White—Monotube generator, 2-cylinder double-acting compound engine, 2½in. and 4½in. by 3in. stroke, H.P. press piston valve, L.P. slide, link motion, approx. revs. 900 at 30 m.p.h.

Serpollet—Flat grid monotube generator, about 180ft. of ⅜in. tube, multi-jet burner, 4-cylinder single-acting engine.

Stanley—Fire tube generator, 2-cylinder double-acting, H.P. slide valves.

Doble—Monotube generator of 20 sq. ft. heating surface, 4-cylinder compound engine, down draught atomising burner.

Pearson & Cox—Flat grid monotube generator, 140ft. of ⅜in. tube, three-cylinder engine, single-acting, poppet valves, atomising burner. This was a simple and sensible car but it is understood that there was burner trouble.

The better class steam car in the old days cost more than the average motorist could afford. The smaller steam car cost about double the price of a petrol car and all steam cars had extremely heavy fuel consumption.

Cold Water Aquaria

Size of Tank : Types of Plant : Types of Fish : Feeding

By I. W. BRASSINGTON

WHEN fixing up a cold-water aquarium, it is important to consider carefully what part of the room it will occupy. It is more difficult to keep a cold-water tank healthy than it is to keep a tropical one, because in the latter the temperature is thermostatically controlled, whereas the cold-water aquarium will be constantly affected by variations in room temperature, so that draughty places and windows should be avoided.

A lighting shade should be provided as the plants will need a certain amount of artificial light, apart from the fact that top light gives an added charm to the underwater picture. The tank should be the largest you can afford, and certainly not less than 24in. by 12in. by 15in. It must be remembered that cold-water fish are generally larger than the usual tropical types. Also, a large tank is easier to keep healthy than a small one. The larger the amount of water the slower the temperature change and, of course, it is *rapid* changes of temperature which are most dangerous to fish.

When ordering plants, make sure that you are choosing cold-water plants. One or two species, such as Vallisneria, may be grown as either cold-water or tropical and it is essential to state clearly which it is you want as they are frequently advertised side by side. In the photograph, Fig. 3, the background plants are Vallisneria and the trailing plants in the foreground are Elodea densa. Note that the "rocks" are pieces of well-washed coal. Remember to plant thickly; you are then much less likely to get trouble from algae and the tank will look much better for it. Four dozen Vallisneria as a background planting to a 24in. tank is not too many, and choice should be restricted to not more than three varieties. Below are suitable selections for a 24in. tank.

Fig. 1.—A Veil-tail.

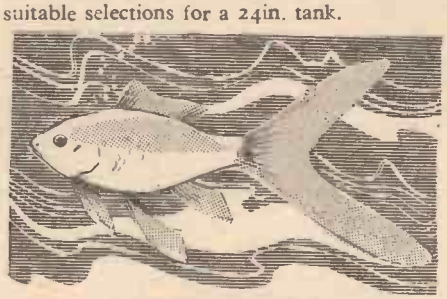


Fig. 2.—A Comet goldfish.

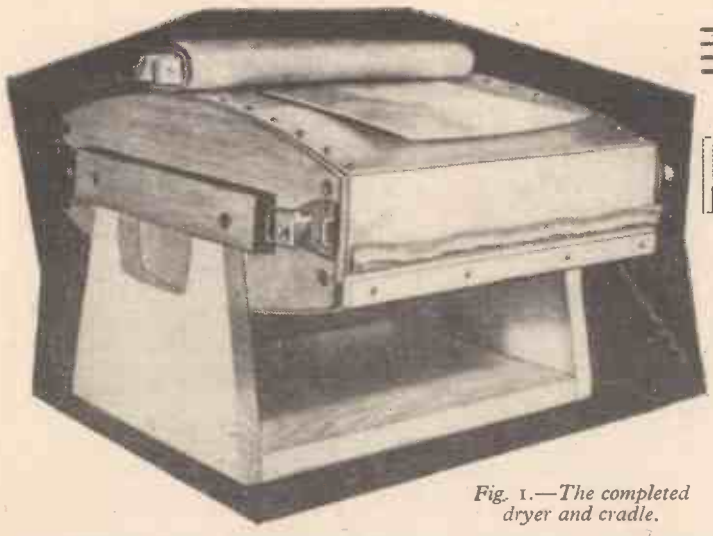
1. 4 dozen Vallisneria. ½ dozen Elodea densa. 2 Ludwigia.
2. 4 dozen Sagittaria. ½ dozen Elodea crispa. 1 bunch Crowfoot.
3. 4 dozen Vallisneria. ½ dozen Myriophyllum. 1 Spatterdock.

Although cold-water fish should be bought while they are young, they rapidly grow to 3in. or 4in. in length, and this must be taken into account when deciding how many your aquarium will support. It is essential not to overcrowd. Multiply the length of your tank in inches, by the width and this will give you the surface area. Divide by 20 and the answer will indicate how many inches of fish you may allow. So a 24in. by 12in. tank gives 24 x 12 = 14.4 (say 15) inches of fish, and this figure should not be exceeded at any time.

Fig. 3.—A typical cold water aquarium.

When you come to choosing the fish, there is plenty of variety both in shape and colour. From the common Goldfish come variations like the Comet and Veil-tail, illustrated in Figs. 1 and 2. Shubunkins are easy to keep, as also are Catfish. Golden Orfes and Black Moors are more decorative as well as being more expensive. Bitterling, Bass and Golden Rudd are among the less commonly kept species. My advice, however, is to start with the cheaper and more reliable kinds and "work up" to the others as experience is gained. A pair of Veil-tails can be bought for about 7s. or 8s. unsexed and will always look well.

Feeding is the same as for tropical fish, with the exception that when dried food is given the coarse grade should be used for the bigger fish. Try and give as wide a variety as possible and arrange for a regular supply of live food.



A DOUBLE-SIDED PRINT DRYER & GLAZER

A Design Incorporating Some Novel Features

By J. C. LOWDEN

Fig. 1.—The completed dryer and cradle.

A DESIGN for a print dryer and glazer appeared in the May, 1955, issue of PRACTICAL MECHANICS, and this employed an ex-Government resistance mat as a source of heat. This heater has, since publication of that article, become unobtainable and the design given here, besides being a Mark II version of the previous dryer and glazer, employs a different form of heater. Instructions for employing the original heating mat are also given.

The Outer Casing

The first requirement is a stout wooden outer casing, constructed as in Fig. 2. No special wood is called for and the measurements are not critical. The two curved ends are cut from pieces measuring 12in. × 5in. × ⅞in. After preparing the wood a line is drawn 1in. from one edge along the length of the wood, and the centre of the edge marked. From the end of the line to the centre spot, on the edge, a smooth curve is drawn and then continued to the other end of the line. The metal sheet used for the heating surface will, if used as a curve-rule, simplify this "marking out." The curve is cut, using a smoothing plane, spokeshave or "Surform" tool. This is the only bit of really important woodworking in the entire job and it is well worth while to take a little care in the cutting. After the first curve is cut it may be used as a template for the opposite end, and so on until the four curves on the two ends are reasonably symmetrical.

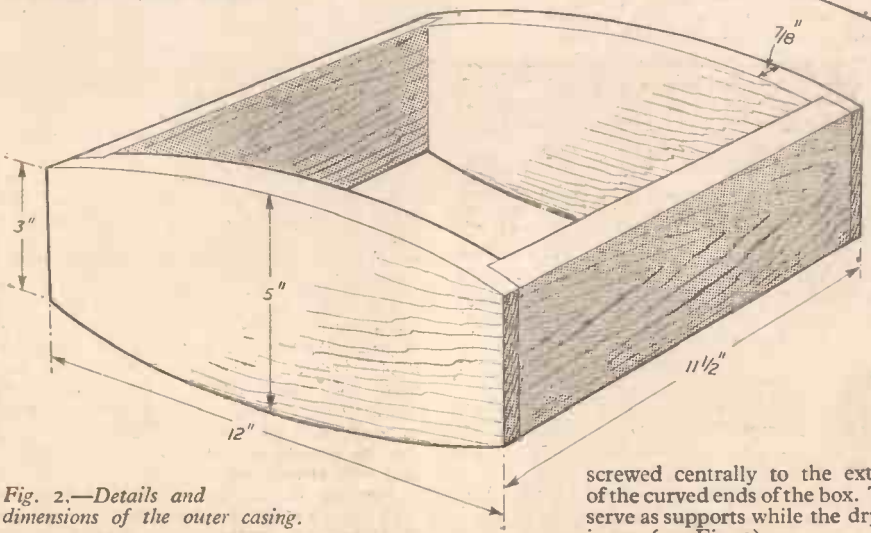


Fig. 2.—Details and dimensions of the outer casing.

The sides of the box, measuring 10⅞in. × 3½in. × ⅞in., are now prepared. Shoulder recesses, ⅞in. wide × ½in. deep, are cut in the end pieces to accept the side pieces in a simple "butt-halving" joint. The joint is secured by driving two stout woodscrews through the box-ends and into the end-grain of the side pieces.

The Cradle Support Bars

Two wooden bars, 8in. × 1¼in. × ⅞in., are prepared and screwed centrally to the exterior of the curved ends of the box. They serve as supports while the dryer is in use (see Fig. 3).

The Stretcher Bars

These are two wooden bars, 11½in. × 1½in. × ¾in. It will prevent wear of the apron fabric if one edge is slightly curved.

The Apron Securing Strips

These are four strips of thin plywood, 11½in. long × ½in. wide. They serve to secure the aprons to the box at one end and to the stretcher bars at the other.

Internal Heat Insulation

To protect the interior of the wooden casing against the heat it is insulated with a lining of asbestos. This is bought in the form of oven mats. The protective tinplate edging is removed and the soft asbestos cut and shaped with a sharply pointed knife or even large scissors. The pieces of asbestos are secured to the inside of the box with large-headed tacks or shoe repair nails. The insulation is very important, but with a little care your box can be made virtually fireproof.

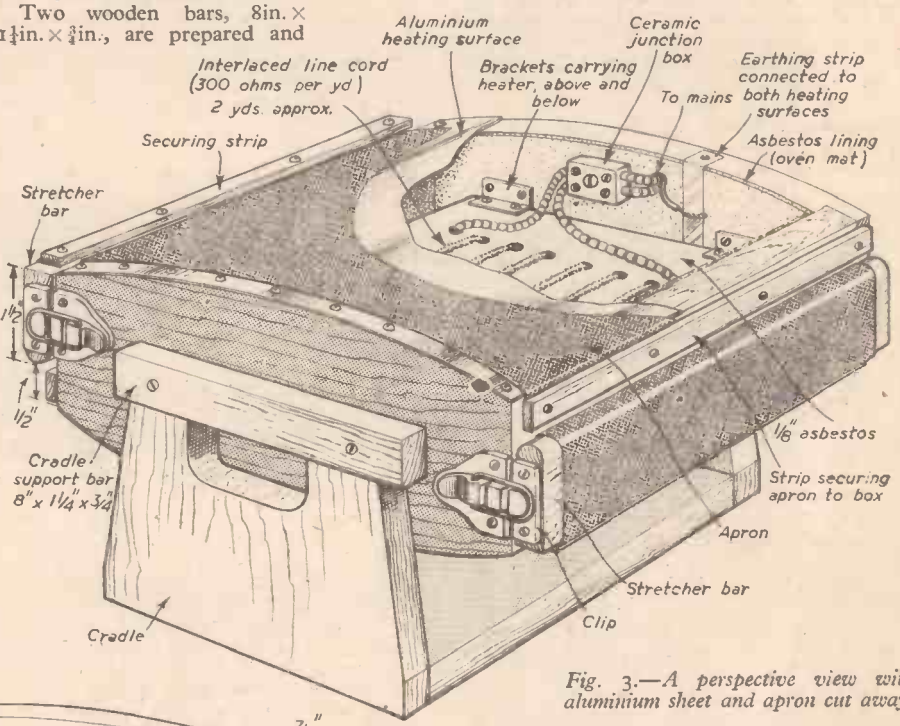


Fig. 3.—A perspective view with aluminium sheet and apron cut away.

The Heater Element

The first requirement is a piece of heavy sheet asbestos, as used for garage construction or roofing, measuring 10in. × 9½in. These dimensions allow for a small airspace around the element when it is fitted into the box. The asbestos plate is drilled with holes about ¼in. diameter which are to accept the line cord used to create heat. The exact size is relatively unimportant, but they should be large enough to permit passage of the cord without undue abrasion of the asbestos wrapping.

Fig. 4 gives layout of the holes which will give a fair-sized area of heat.

The pattern of holes shown takes up some three yards of line cord. In actual practice

it may be found advisable to reduce the length of cord from three yards to approximately two yards. If this is done the vacant holes will have no effect on the performance of the heater.

Four pairs of holes are also drilled in the corners of the plate to accept the round-headed bolts which secure the plate to the brackets. These brackets are secured to the sides of the box by stout woodscrews.

The line cord used to create the heat is supplied by Messrs. Milligans, of Harford St., Liverpool, who advertise in this journal. It is quoted as having a resistance of 300 ohms per yard, and costs 2s. per yard. Three yards were purchased at first and the length gradually reduced by trial. It was found that a little over two yards gave off adequate heat, provided that the dryer was allowed a few minutes to achieve a working temperature of about 110 deg. F. before prints were applied.

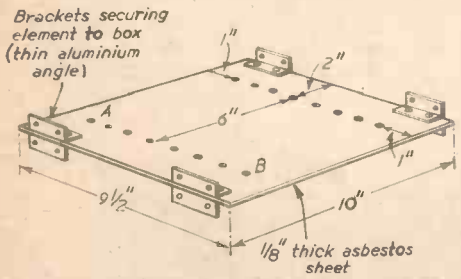


Fig. 4.—Layout of holes for heating element.

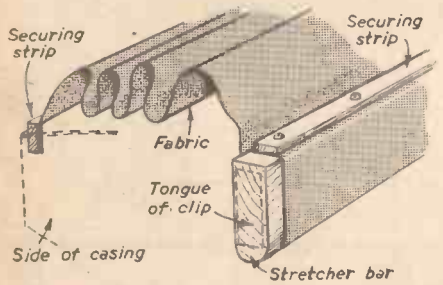


Fig. 5.—Stretcher bar and apron details.

The line cord is woven through each hole in turn, beginning at hole "A" in Fig. 4 and re-emerging through B. The bared ends of the line cord are screwed in the terminals of a ceramic junction box, as supplied by most electrical stores. Choose one centrally drilled to accept a screw, by which it can be secured to the inner surface of one end of the box.

When the element is wound and the brackets bolted on, it is screwed to the inside of the box in a central position. The ends of the line cord are connected to the junction, and this is also screwed to the inside of the end at a convenient position (see Fig. 3). The casing is then drilled through, close to the junction, to permit the passage of a three-core flex. The red and brown lines of the flex are now connected through the junction box. The green (earth) line should be connected to both heating surfaces, preferably by a strip of metal secured at each end to one of these surfaces by a nut and bolt. This affords protection should either surface accidentally become "alive." Before testing, the free end of the flex should be wired to a three-point plug in the usual manner, the green line being screwed to the large (earth) pin of the plug.

Those unused to this type of wiring should normally seek the assistance or advice of a qualified person before proceeding with the work.

The Heating Surfaces

These comprise two sheets of thin aluminium, each measuring 12¼in. × 11¼in. Both sheets were cut from a piece bought from a hardware store, price 3s. The metal was first scored with a sharply pointed knife and straight-edge, after which it "broke" quite cleanly.

After cutting, a line is scratched along the longer edge, about ¼in. inside. Along this line a series of screw holes, large enough to accept fine woodscrews, is drilled. These holes, the first and last of which should be as close to the corners as practicable, should be at intervals of about 1½in. If the metal tends to bulge up along the side of the box it may be advisable to put one or two screws through, but these should be used sparingly.

The metal sheets are screwed to the box, using round-headed screws, and beginning at the centre, driving each screw and its "opposite number" in turn.

The Aprons

These are used to hold the drying prints in contact with the heating surfaces. The material used should be strong, clean canvas, raincoat material, or other closely woven textile. It must, of course, be free of any dye or other substance likely to be affected by heat or moisture. The aprons, two of which are required, measure about 18in. × 11in. One end of the apron is secured to the side

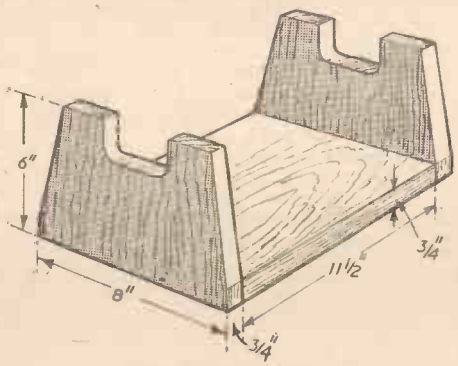


Fig. 6.—The cradle.

of the box, as close as possible to the edge of the heating surface. To fix it firmly it is held under a securing strip of thin plywood, 11½in. long × ½in. wide, as shown in Fig. 5. Screws passing through both plywood and the apron secure the whole evenly to the box. The free end of the apron is drawn tightly over the metal heating surface and wrapped around the stretcher bar. The free end of the apron is screwed to the upper surface of the stretcher bar by means of a securing strip similar to that used to secure the other end to the box.

Tool box clips are used as a means of holding the aprons in position during the drying process. The male portion of a clip is screwed to the end-grain of the stretcher bar, and the female portion to the end of the casing, as close to the metal heating surface as possible. Repeat the operation at the other end of the stretcher bar, and the clips may then be united. The material may then be stretched until it is drum tight and wrinkle free.

When the first apron is in position the dryer is reversed and the second apron fixed in position as shown in Fig. 3.

The Cradle

Since both top and bottom of the box are working surfaces a cradle is required to support the dryer, both to protect the bench

Fig. 7.—The dryer with curved aluminium sheet removed.

(or table) and prints and also to permit free circulation of air (Fig. 6). The base of the

MATERIALS REQUIRED

Wood:
2 ends, 12in × 5in. × ⅝in.
2 sides, 10¾in. × 3½in. × ⅞in.
2 cradle support bars, 8in × 1¼ × ⅝in.
2 stretcher bars, 11½in. × 1½in. × ⅝in.
4 apron securing strips, 11½in. × ½in. ply.

2 thin aluminium sheets, 12¼in. × 11¼in.
2 canvas aprons, 18in. × 11in.
1 piece asbestos sheet, ⅛in. to ¼in. thick, measuring 10in. × 9½in.
2 asbestos oven mats, 12in. square.
3 yds. line cord, mains voltage, resistance 300 ohms per yard.
Ceramic junction box, 3-core flex to suit.
8 pieces each 1½in. long of thin aluminium right-angle section.
4 complete tool box clips.
Small bolts, nuts and woodscrews.

Cradle:
2 ends 8in. × 6in. × ¾in.
1 base 11½in. × 8in. × ⅝in.

cradle is a piece of timber 11½in. × 8in. × ⅝in. The two ends, shaped as shown, are cut from pieces 8in. × 6in. × ⅝in. The recesses are to permit a finger grip under the cradle support bar, as well as to take the flex when it is on the lower side of the bar. The parts of the cradle may be assembled either by the use

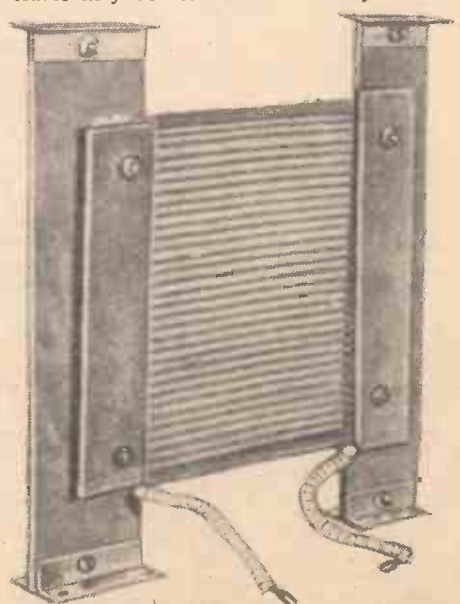


Fig. 8.—Resistance mat mounting.

of screws or nails or by dovetail joints, as preferred.

A further view of the completed dryer is shown in Fig. 7.

The Dryer in Use

The dryer should be allowed a few minutes to "warm up," with the aprons in position. Surface water should be removed from the backs of the wet prints by placing them on clean, white blotting paper. The faces of the prints may be lightly mopped with a clean, much-washed tea towel or similar non-fluffy material. Prints are then placed, face uppermost, on the heating surfaces, the aprons clipped into place, and the dryer replaced on its cradle.

It will be found that in actual service the uppermost heating surface gets the "lion's share" of the heat generated within the box. This discrepancy is common to most double-sided dryers, including commercial models. It is, of course, due to the natural tendency of the heated air within the box to rise. It can quite easily be overcome by reversing the box once or twice during the drying process.

Glazing of Prints

Before a print can be glazed it must, of course, be squeegeed on to a stainless steel or chromium glazing plate. Glazing fluid should be used in accordance with the instructions to prevent "sticking." Glazing time is, of course, longer than straight drying time, and once the drying process is started the prints must be allowed to remain on the sheet until fully dried. Any attempt to peel off the prints will utterly ruin the gloss.

Alternative Heater Element Using Resistance Mat

Although the heater element described above is very suitable for its purpose, those fortunate enough to have secured a resistance mat as described in the May, 1955, article will wish to utilise this. For mounting the mat, two strips of the heavy asbestos sheet, measuring 10in. × 2in., are provided with brackets at each end, in the same way as the large sheet described (see Fig. 8). Holes to accept short bolts are drilled in such a position that the mat lies in a central position when the securing bolts are passed through the holes in the mat. Two further strips of heavy asbestos are then drilled to serve as crosspieces, and the element made up as a "sandwich" of asbestos, resistance mat and asbestos, the whole being firmly bolted together and screwed inside the box.

On account of the much greater heat emitted by the mat this element is especially suitable for a machine used predominantly for glazing purposes.

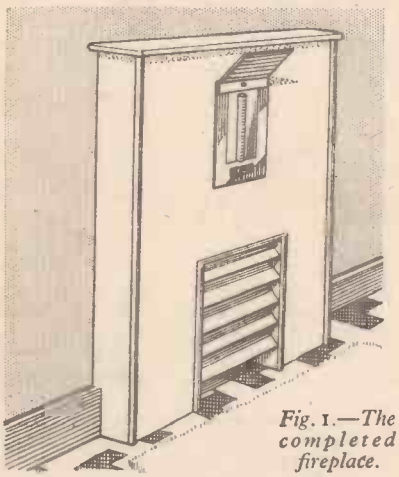


Fig. 1.—The completed fireplace.

A Modern Fireplace

A Design Incorporating an Electric Fire and Adequate Ventilation

By J. J. DOBSON

AN idea for those who wish to remove an old-fashioned bedroom fireplace and replace it with a modern-looking fireplace and electric fire combined. The method described entails the minimum amount of bricking up and retains the necessary ventilation to comform to regulations. The total cost is less than that of a new tiled bedroom fireplace.

After the old fireplace has been pulled out, a wooden framework of approximately the same dimensions as the new fireplace is built into the space left. This framework must be flush with the plaster, and any making good of the brickwork and plasterwork should be made up to it. Fig. 1. shows the finished appearance.

Construction

The fireplace itself consists of a framework of 2in. x 2in., cut to make up the dimensions shown in Fig. 2. The pieces are screwed together with 3in. x 10 screws as shown, those on the outside being well countersunk, filled with plastic wood and smoothed off. The two 18in. lengths (A) are slotted 3in. apart at an angle of 45 deg. These slots are ⅜in. x ¼in. deep and are required to take five strips of hardboard 1ft. 0½in. long by 3in. wide to form a ventilator.

The two pieces (B) will have to be fitted to suit the type of electric fire used. In this case they are 3in. x ⅜in. and are fitted flush to the front of the frame so that when the hardboard is fitted a total thickness of ⅝in. is obtained. A sheet of hardboard is then cut to the dotted lines, the outside measurements being 3ft. 6in. x 2ft. 5¼in., allowing ⅜in. up each edge and round the ventilator for ½in. half-round lip moulding. The mantelshelf is a piece of ½in. timber 2ft. 8in. x 4in. with ½in. round moulding pinned to the front edge and sides.

The electric fire is a Premier 1 kW. Inset Reflector type. It consists of a complete front portion and a box at the back to house the wiring, etc. This box (C) has two flanges as shown, ⅝in. from the front, and it is screwed from the back of the frame (on to pieces (B) to fit flush with the hardboard at the front. The front portion can be connected up and fitted after the fireplace has been fixed in position.

The complete framework, etc., is fixed to the wall by means of flat brackets, screwed first to the frame and then to the wall. It can be decorated as required, e.g., Valspar enamel.

Reflector

The surround of the fire does get rather hot, especially at the top, if it is kept switched on for lengthy periods. A piece of polished aluminium the length of the top of the surround and about 4in. wide, bent as shown and placed between the surround and the hardboard, will reflect the rising heat away from the paintwork above the heater.

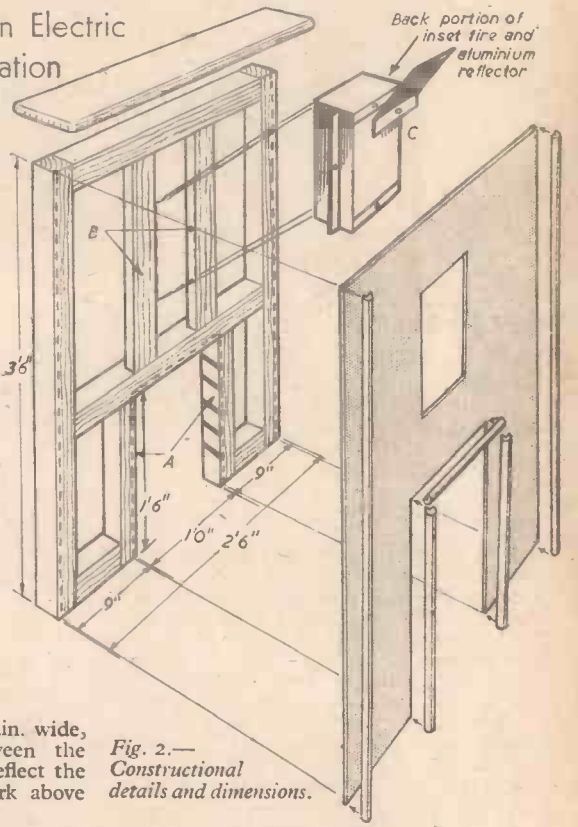


Fig. 2.—Constructional details and dimensions.

THE SPACE SATEL

Some Interesting Details of This Feature of the Geophysical Yea

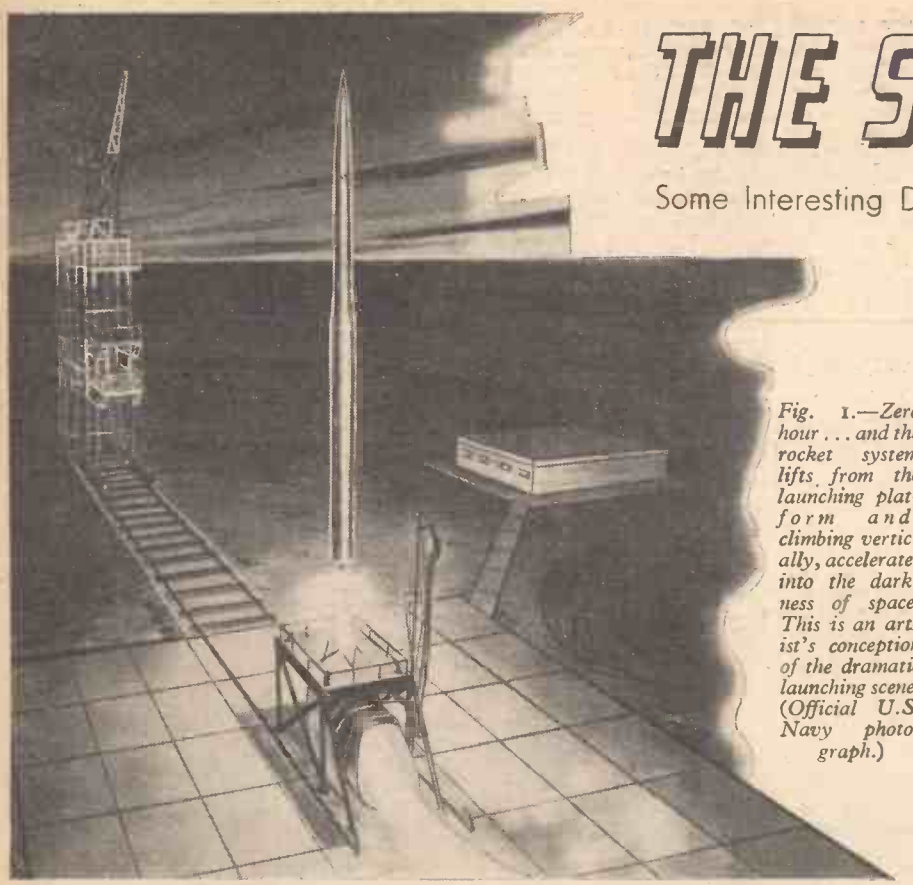


Fig. 1.—Zero hour . . . and the rocket system lifts from the launching platform and, climbing vertically, accelerates into the darkness of space. This is an artist's conception of the dramatic launching scene. (Official U.S. Navy photograph.)

COMMENCING in July of this year and concluding at the end of December, 1958, the International Geophysical Year (I.G.Y.) represents the most ambitious and concentrated attack on natural scientific problems ever conceived. In these 18 months it is considered that research will be achieved which, under normal conditions, would take close on 30 years. Under a special committee established by the International Council of Scientific Unions the researches of approximately 50 nations will be co-ordinated. Thousands of scientists will be involved in the intense efforts to solve the mysteries of man's physical environment. The Earth's interior and crust, the oceans, the complex atmosphere extending hundreds of miles above the planetary surface, the Moon, and last but not least the Sun which, from a physical standpoint, controls our very existence; all these are destined to come under strict and sustained observation. The immense value of the programme lies in the simultaneous nature of individual investigation at pre-arranged points over the Earth's surface. This procedure is, of course, conducive to accurate analysis of the phenomenon under investigation.

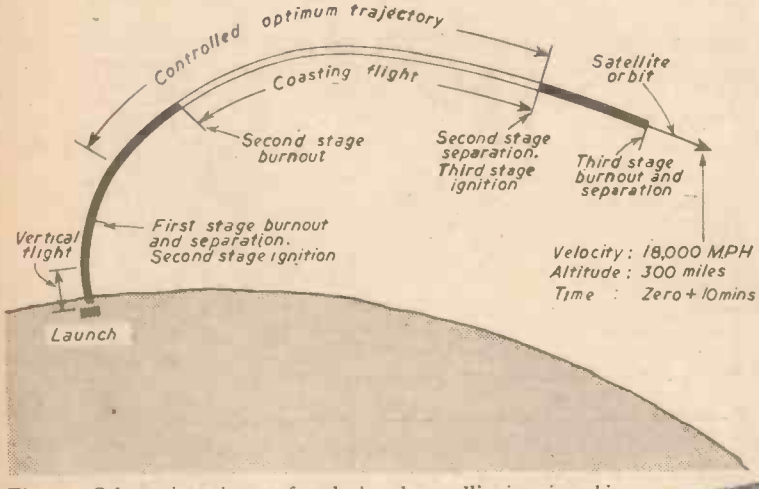


Fig. 2.—Schematic trajectory for placing the satellite into its orbit.

The Satellites

Probably the most important and spectacular project arranged for the I.G.Y. is the launching by the United States of a number of artificial satellites into space where they will orbit the Earth. A superficial view of this project may incline one to believe that its purpose is entirely connected with space flight possibilities. This idea is not quite correct however, for whilst the results of this momentous undertaking will undoubtedly indicate the feasibility or otherwise of man traversing space, the immediate problems to be tackled include those of various radiations acting on the Earth and its atmosphere (a problem of atomic physics), air density, external temperatures, and the distribution and size of meteoritic particles. Also dependent on the satellite project are certain geodetic and mass determinations concerning the true shape of the Earth and composition of the Earth's crust.

The intention of this article is to describe some of the interesting details about the satellites and their launching and the manner in which they will serve in the experiments outlined above.

Design of the System

The U.S. satellite programme developed by the National Academy of Sciences, calls for the launching of 12 satellites in conjunction with the I.G.Y. Civilian scientists in the Department of Defence and in many public and private research institutions are co-operating in the programme. This powerful team is led by Dr. Joseph Kaplan.

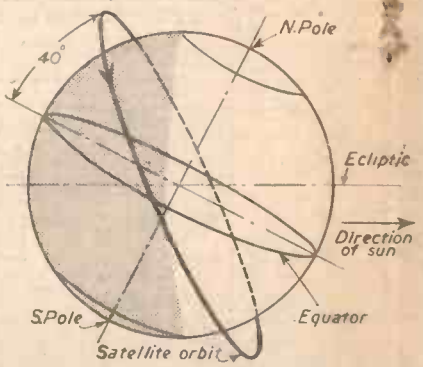


Fig. 3.—Orbit of the Earth's first satellite vehicle.

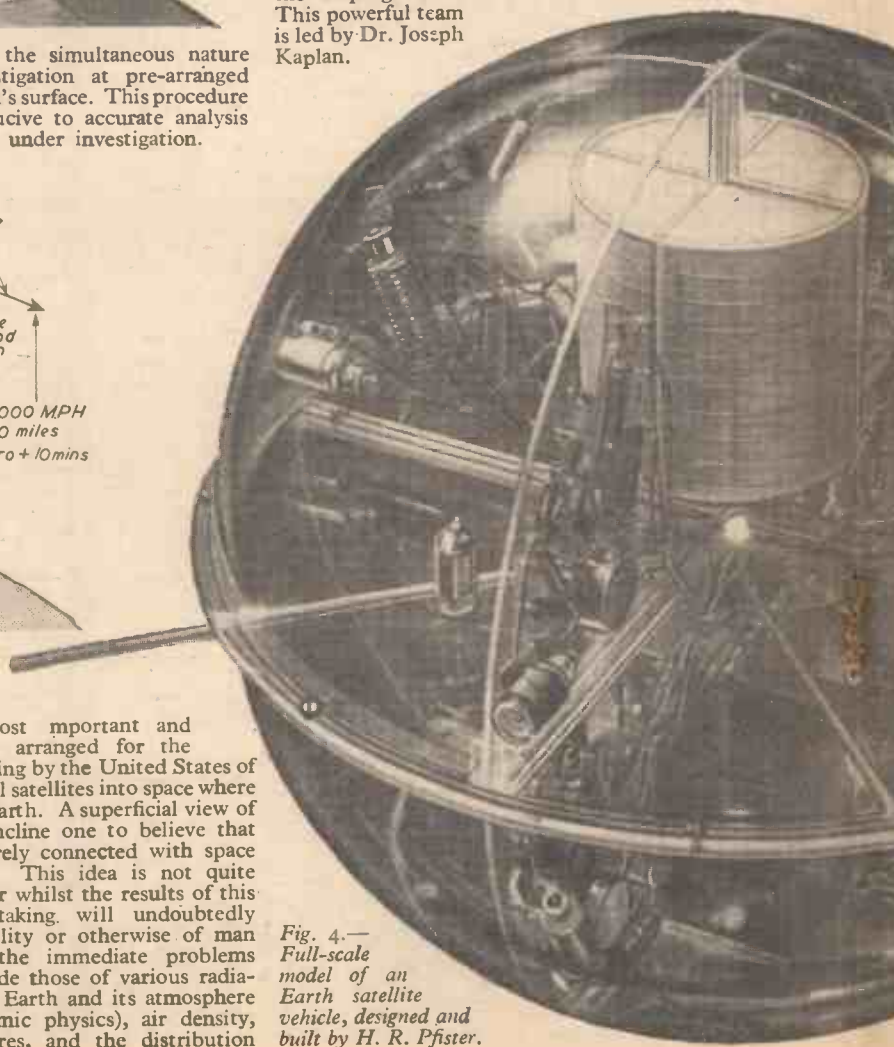
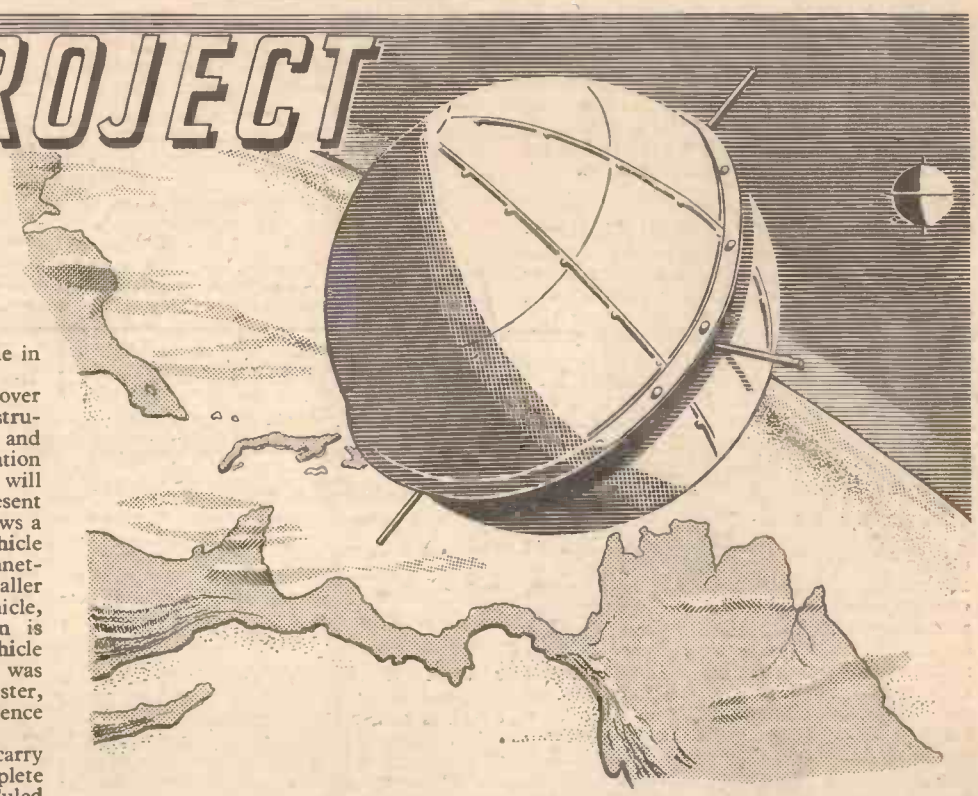


Fig. 4.—Full-scale model of an Earth satellite vehicle, designed and built by H. R. Pfister.

LITE PROJECT



By WILLIAM ELLWOOD

The first satellite vehicle will be of a rigid nature, spherical in form with a diameter of about 30in. Its weight will be almost 21.5 pounds. The spherical form, whilst complicating the design of the overall projection system, is desirable in experiments relating to air density.

Within this sphere, it alone weighing over 10 lb., will be arranged the delicate instruments to record external phenomena, and the essential transmitter with its information coding modulator. The power supply will probably be of a similar type to that at present used in high altitude rockets. Fig. 4 shows a full-scale model of an Earth satellite vehicle which was displayed at the Hayden Planetarium in New York. Whilst it is smaller (18in. diameter) than the proposed vehicle, many scientists believe that its design is similar to the first instrumented vehicle which will be put into orbit. The model was designed and built by Mr. H. R. Pfister, Associate Editor of "Popular Science Monthly."

The remaining eleven satellites will carry various instruments required to complete the sequence of experiments scheduled in the project. The launchings will take place from Cape Canaveral, Florida.

A three-stage rocket system—named the *Vanguard*—will be used to place the satellite vehicle in its orbit. The first stage, about 45ft. long, will incorporate certain features of the *Viking* high-altitude sounding rocket. The pivotal propulsion unit of the latter uses liquid oxygen and alcohol, with a hydrogen peroxide turbo-pump injection system. It produces a maximum thrust of 20,000 lb. which is some 7,000 lb. less than that anticipated for the first stage of the *Vanguard* system. The second stage rocket, of smaller diameter than the first, will possess a cone-shaped nose (Fig. 1), and will completely enclose the third and final rocket with the satellite attached to its nose. The second stage will also include the essential guidance equipment.

The Launching

After being fired from the launching platform, the first stage burn-out and separation will occur some 40 miles from the launching site within two minutes of take-off. By then the system will have attained a speed of 4,000 miles per hour (Fig. 2). The second stage will then take over and push the velocity up to 11,000 m.p.h. at 130 miles altitude. At the "all burnt" state of the second stage, however, there will be no separation, the system continuing to coast upwards and into the required orbit at an altitude of about 300 miles. This is the controlled part of the trajectory. As the critical altitude is approached the second stage will separate and the third and final stage of the *Vanguard* rocket will ignite and impel the satellite into its orbit at a velocity of 18,000 m.p.h. —the satellite detaching from the final rocket at the time of the latter's burn-out.

Satellite Orbit

The first satellite will pursue an elliptical orbit, the plane of which will be inclined at 40 deg. to the Earth's Equator (Fig. 3). There are very definite reasons why this type of orbit has been chosen in preference to a true Polar or Equatorial orbit. It allows an excellent latitude coverage of 40 deg. north and south of the Equator. As the satellite's orbital period will be 90 minutes and the Earth's axial rotation period is 24 hours, it means that the satellite vehicle will be displaced a number of degrees west of the launching point as each orbital revolution is completed (Fig. 5). This westward displacement due to the Earth's rotation would be about 22.5 deg. if the satellite orbit were to be circular. As it is to be elliptical, however, the westward displacement will be approximately 25 deg.

The apparent "twisting" path to be pursued by the satellite between 40 deg. north and south will afford the scientists of a large number of nations situated in North and South America, Africa and Southern Europe, the opportunity to observe and record the

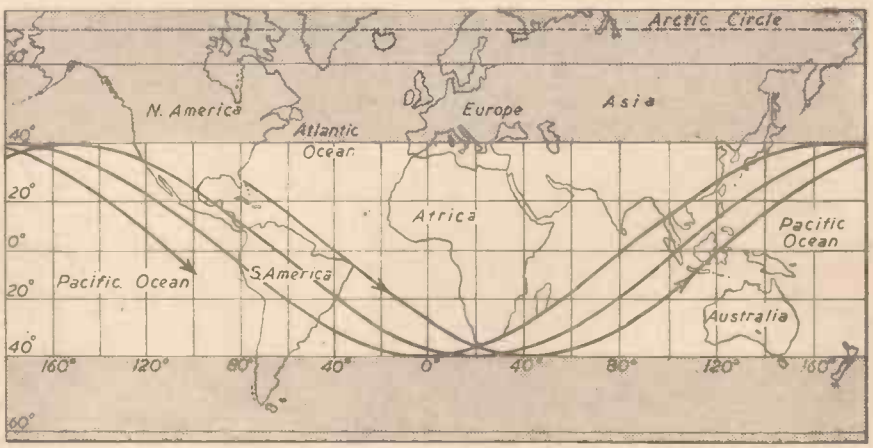


Fig. 5.—The instrumented satellite will be launched from Cape Canaveral, on the east coast of Florida. The apparent twisting path it will pursue is due to the Earth's rotation.

progress and behaviour of the vehicle. In brief, the advantages of continuous observation will be fully exploited. A little reflection will show that neither a true Equatorial or Polar orbit would possess these advantages —particularly an orbit over the Poles, where the satellite would be virtually out of ken for two lengthy intervals in each revolution.

Air Density

It is generally held that the Earth's atmosphere becomes so tenuous beyond 500 miles altitude as to be negligible. In this fascinating satellite experiment, conclusive evidence will be obtained to substantiate or refute this opinion. The manner of obtaining this evidence is beautiful in its simplicity. Air density information will be transmitted by the satellite as it ranges from about 200 miles near the Earth's surface to a distance of some 800 miles away, as it swings out in its elliptical orbit. Thus is seen the excellent advantage of the latter over the circular orbit.

Planetary Mass

With the satellite vehicle installed in its calculated orbit and possessing a velocity of 18,000 m.p.h. relative to the Earth's centre, one may expect the vehicle to continue in that orbit until such times as the drag effect exerted by air (no matter how tenuous) reduces its speed to the critical limit. It will then spiral in towards the Earth's surface under the increasing force of gravity, and be destroyed by vaporisation in the denser regions of the atmosphere. This orbital " balancing act " may be explained as follows : a body in orbit will remain so as long as the centrifugal force acting upon the body counteracts the gravitational pull of the Earth. The intensity of the centrifugal force increases or decreases as the velocity of the orbiting body increases or decreases.

As Earth's gravitational force is related to its mass, we may infer that any variation in density of material extending from the Earth's surface to approximately 2,000 miles from the centre will give rise to a variation of gravitational attraction. Thus the satellite in close orbit passing over relatively dense portions of the Earth will be subject to a relatively greater attractive force. It will in astronomical language experience one or possibly a number of *perturbations* in its orbit (Fig. 6). Hence, from a knowledge of such perturbations, may be deduced some knowledge of the geological make-up of the Earth at depths far greater than those we have been able to probe up to the present day.

In conjunction with the experiment just described, the data elicited from the synchronised observations of the satellite in orbit will help in certain geodetic determinations. From these it is hoped to obtain a more accurate knowledge of the *shape* of the Earth, particularly the extent of oblateness or bulging which exists in the Equatorial zones. This, of course, will improve our determinations of longitude and latitude, the importance of which need scarcely be stressed.

Space Flight Implications

Anticipated experiments of the satellite vehicle project dealing with meteoritic particles, temperatures, ultra-violet and cosmic radiations, are naturally of great moment when contemplating the exploration of space by manned spaceships. From these experiments it may be possible to assess the real chances of man breaking his physical Earth bonds and venturing into interplanetary space—surely the most glorious, albeit awe-inspiring, adventure one can visualise on this plane of existence !

It is estimated that meteoritic particles from outer space arrive in our atmosphere totalling about 1,000 tons per day. Most of these small bodies measure no more than a few thousandths of an inch in diameter. They impinge on the air molecules at very high velocities and are believed to contribute to a measurable extent to ionizing the atmosphere. After impact with the air molecules they drift to the Earth's surface in the form of dust. This cosmic dust is quite often observed after settling on the vast snow expanses of the Polar regions.

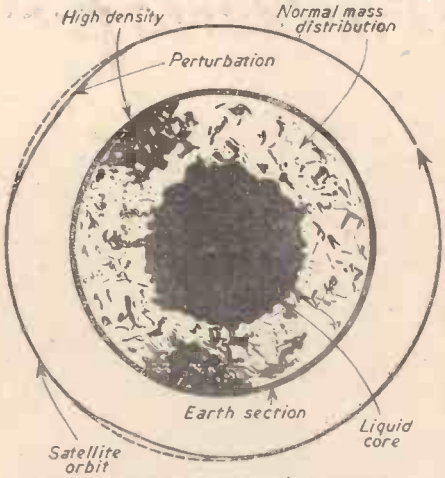


Fig. 6.—Perturbations in satellite orbit due to Earth mass variations. Circular orbit is shown for clarity.

These micrometeorites, as they are termed, will be recorded by impact detectors as they strike the satellite vehicle. Also, as the satellite will be airtight and will contain an inert gas, recorded variations of pressure within the satellite will indicate the extent of meteorite penetration and their approximate size. Ballistic data obtained in this manner will prove extremely useful in the design of future space vehicle or spaceship hulls.

Solar Radiation

Whilst heat within the satellite will be derived to a small extent from its power supplies and from terrestrial radiation; measurement of temperature will be primarily concerned with solar heat radiation. If this proves to be intense, it may in the future prohibit the exposure of human beings outside their elaborately cooled space vehicle, thus curtailing the possibilities of external maintenance or construction of vehicles in space —a proposition which has been seriously considered in recent years. Nevertheless, on the credit side such an ample source of power may be put to propulsive use for journeying within the solar system.

Ultra-violet Radiation

As extreme ultra-violet radiation is largely absorbed by the Earth's atmosphere, the satellite affords an opportunity to study this phenomenon at first hand over a lengthy period of time. It is hoped to establish the emission relationship between ultra-violet radiation from the Sun when the latter is fairly quiescent and when there is abnormal activity in the form of solar prominences or flares.

Such findings, apart from their bearing on magnetic and meteorological problems, will influence the design of protective devices necessary in manned spaceships of the future. However, the investigation of cosmic rays by means of the satellite vehicle is of even greater importance when considering space flight prospects.

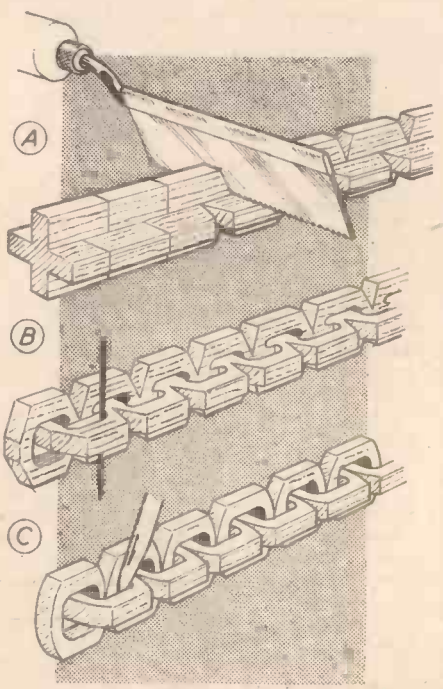
Cosmic Radiation

Cosmic rays are high-energy particles and are emitted by the Sun or come from interstellar space. As these rays—like ultra-violet rays—are largely absorbed in the atmosphere, the effect of them on human beings is as yet speculative. The direct study of primary cosmic rays by means of the satellite, outside the masking atmosphere of the Earth, will therefore provide much needed information on one of nature's great mysteries.

[We hope to publish a further article on this subject next month—ED.]

A Chain Made From Wood

How This Intriguing Novelty is Made



Three stages in making a wooden chain, using a coping saw, a fretsaw and finally a penknife.

PROCURE a straight-grained piece of wood, about 1in. square and as long as you would like the chain to be ; any wood may be used that does not split too easily. Cut pieces out of the corners so as to give the wood a cross shape in section as shown in the sketch at A. Mark off the lengths of each link as shown, the marks on the horizontal arms of the cross being midway between those on the vertical arms, and cut notches at each mark as shown at the far end of A in the sketch. A coping saw can be used up to this stage.

Making the Links

Next cut out with a fretsaw as much of the inside of each link as you can reach and at the same time separate each link from its neighbour in the same plane. The chain should then appear as at B in the sketch, the links being attached by a small piece of wood which cannot be reached by the fretsaw. Separate the links by nibbling these unwanted pieces away with a sharp pointed penknife as shown at C, and breaking them apart when nearly cut through. The rough ends can easily be trimmed, after twisting the separated link to a suitable position, and the square links rounded off to look more like those of an ordinary chain.

The finished chain, with its unbroken links can be puzzling to those who do not know how it is done and they will probably be even more intrigued when they learn the method.

The Patent Office, Chancery Lane.

A NEW SERIES

Applications for FOREIGN PATENTS

By "ATTORNEY"

Valuable Advice to the Inventor on Patent Procedure Abroad. This Month Norway, Pakistan, Union of South Africa, Sweden, Switzerland and the United States of America are Dealt With

Norway

PATENTS are granted for a term of 17 years from the date of application and may be applied for by the inventor or his assignee, which may be an individual, firm or company. In the case of an assignee application, a request signed by the inventor and confirmed by the applicant may be made to ensure that the inventor's name is mentioned in the patent.

If the Norwegian application is filed under International Convention arrangements, i.e., within one year from the date of the earliest corresponding foreign application in a Convention country, e.g., the United Kingdom, it is necessary for an assignment of priority rights to be filed in the Norwegian Patent Office, if the Norwegian applicant is an assignee of the applicant in the United Kingdom.

Norwegian patent law recognises the granting of user rights to third parties who, before the filing date of the Norwegian application or the priority date claimed, have made preparations in Norway for using the invention. Third party rights can only be assigned with the goodwill of the business.

An application is officially examined in the first instance by a Board of Examiners to determine whether the invention is patentable and novel. It will not be considered to be novel if it has been previously disclosed in any prior publication, irrespective of the country of origin. It will also not be novel if it has previously been publicly used or exhibited in Norway. If an application is refused, an appeal may be taken to a Board of Appeal whose decision is final. On acceptance of an application, publication of the specification takes place to enable anyone to lodge opposition to the grant of a patent, within a period of three months from the date of publication. Publication of an application may be postponed for a period up to six months, if applied for prior to the date of issue of the official acceptance of the application.

In the case of a Convention application, an officially certified copy of the basic application must be filed in the Norwegian Patent Office before grant of the Patent. If the certified copy is in the English language, it is generally not necessary for it to be translated into Norwegian.

In order to secure the patent, a sealing fee must be paid within two months from the date of publication of the application.

Printed copies of granted Norwegian patent specifications are obtainable. In the case of patents granted after January 1st, 1946, it is necessary to pay annual renewal fees in order to maintain the patents in force. No renewal fees, however, are payable on patents of addition, which remain in force for the unexpired terms of the main patents to which they relate.

Marking of patented articles is not required under Norwegian law, but the indication "N.P. Number . . ." or "Norsk Patent Number . . ." may be applied.

Application fees are from £5 0 and renewal fees rise from £5 5s. at the second year to £33 10s. for the last year of the patent term.

Pakistan

The Patent Law of Pakistan is based quite closely on that in India and, in general, reference should be made to the foregoing information concerning India. On the question of examination of an application in Pakistan, however, the Examiner's search to determine novelty of an invention is conducted through British Indian specifications, published prior to August 15th, 1947, and through prior Pakistan specifications. Prior publication or prior public use of an invention in Pakistan, but not elsewhere, is detrimental to the novelty of an invention disclosed in a Pakistan application for patent.

Pakistan does not belong to the normal International Convention, but has reciprocal arrangements with certain countries, including the United Kingdom to enable applications to be filed in Pakistan with priority claims based on corresponding United Kingdom applications filed not more than 12 months before the applications in Pakistan.

Application fees are from £30 and renewal fees rise from £7 2s. 6d. at the fifth year to £14 12s. 6d. for the last year of the patent term.

Union of South Africa

The union is a party to an International Convention, which enables recognition of a priority claim based on a corresponding application in a Convention country, e.g., the United Kingdom, filed not more than 12 months before the Union application. Union patents are now granted for a period of 16 years from the date of filing of the complete specification in the Union.

A Convention application must always be accompanied in the first instance by a complete specification. If desired, however, an ordinary, i.e., non-convention, application may be filed and be accompanied by a provisional specification, which must be followed within 12 months by a complete specification. A non-convention application, however, may be accompanied in the first instance by a complete specification. Patents are obtainable in the Union not only for any new and useful process, machine, manufacture or composition of matter but also for any distinct and new variety of plant, other than a tuber-propagated plant, which has been reproduced asexually. In the case of plant patents, the period of monopoly is ten years from the date of filing the complete specification. Applications for plant patents are not only examined by the Commissioner of Patents, but also by the Agricultural Department to determine novelty of the invention.

If an application for patent is made in the Union by an assignee of the actual inventor, it is necessary to file an assignment in the Union Patent Office. An application, however, may be filed in the name of the inventor, either alone or jointly with one or more other parties.

In the case of a Convention application, an officially certified copy of the corresponding basic application must be filed in the Union Patent Office within six months from the filing date of the Union application.

For an invention to be validly patented in the Union it must be novel, i.e., not known or used by others in the Union or not described in a published Union patent specification bearing a date less than 50 years prior to the date of the Union application, or not described in any other publication. At the present time an official examination is not conducted to determine whether an invention is novel but, at some time in the future, the Commissioner will institute novelty examination procedure.

A complete specification must normally be accepted within 18 months from the date of application for patent. Acceptance is advertised in a Patents Journal and a copy of the specification and drawings, if any, are laid open to public inspection at the Patent Office in Pretoria. Within three months from the date of advertisement, anyone may oppose the grant of a patent on one or more grounds set out in the Union Patents Act. Patents must be sealed within 22 months from the application dates, but extensions of time are obtainable, especially in the event of Oppositions.

Patent practice in the Union of South Africa follows that in the United Kingdom in many respects. For instance, there is procedure for a patentee to request endorsement of his patent with the words "Licences of Right." After endorsement, renewal fees are reduced to one-half.

Renewal fees are payable before the end of the third and each succeeding year of the patent term up to the fifteenth year. It is advisable to mark patented articles, etc., with the Union patent number to ensure that the patentee shall not be disentitled to recover damages for infringement by a defendant

who pleads innocent infringement.

Application fees are from £30 and renewal fees continue at £6 5s. from the fourth year to the fifteenth year of the patent term.

Sweden

The term of a Swedish patent is 17 years from the date of application. Patents of addition, however, which can be granted only to the owners of main patents, remain in force for the unexpired terms of the main patents.

A Swedish application may be made in the name of the inventor or his assignee, which may be an individual, firm, company or corporation. In the case of an assignee application, an assignment of the invention, legalised by the Swedish Consul, must be lodged in the Swedish Patent Office before acceptance of the application. A Swedish patent may be assigned after grant.

Sweden is a party to an International Convention, which enables recognition of a priority claim based on a corresponding application in a Convention country, e.g., the United Kingdom, filed not more than 12 months before the Swedish application.

An official examination is carried out by the Swedish Patent Office to ascertain whether the invention is patentable or novel. It will not be considered novel if it has been previously published or publicly used either in Sweden or abroad. Third party rights of prior use of an invention are recognised under Swedish law, i.e., such rights may be claimed by anyone who, before the application date, has made *bona fide* preparations for using the invention in Sweden. Official examination procedure in Sweden is rigorous, particularly as to novelty and patentability. If an application is rejected by the Application Department, the applicant is entitled to appeal first to an Appeal Department and in the event of an adverse decision to the King of Sweden.

After publication of acceptance of an application, anyone is entitled to oppose the grant of a patent. If a patent is granted, the specification is printed within a few weeks after grant. It is necessary to pay a publication or sealing fee within a prescribed period after an application is laid open to public inspection.

Annual renewal fees are payable to maintain a patent in force and commence at the fourth year of the patent term.

Application fees are from £46 10s. and renewal fees rise from £7 2s. 6d. at the fourth year to £44 5s. for the last year of the patent term.

Switzerland

Patents are granted for a term of 18 years from the date of application which may be made in the name of the inventor or his assignee, whether an individual, firm or company. As Switzerland is a party to the International Convention mentioned in the introduction, Convention applications based, for example, on United Kingdom applications may be filed. Patents of addition to main patents may be applied for, providing the applicant and the patentee are the same. Patents of addition remain in force for the unexpired terms of the main patents to which they relate, but are not subject to payment of renewal fees. To keep a patent in force for its full term, renewal fees are payable annually, commencing at the second year. Renewal fees, which have become due for payment before the grant of a patent, must be paid within three months from the date of grant.

A valid patent cannot be obtained in Switzerland, if the invention has been previously publicly used in Switzerland or disclosed in any prior publication, irrespective of its country of origin. Although at present the Swiss Patent Office does not conduct an examination to determine novelty of an invention, the Examiner may refer to prior publications within his knowledge. On the other hand, an application is strictly examined as to formal requirements, patentability and unity of invention.

Third party rights are recognised, so that anyone in Switzerland who has prepared in a *bona fide* manner to commercially work an invention before the application or Convention date may continue to use the invention in his own business. The right of prior use, if established, can only be transferred with the business.

After an application has been officially accepted, a patent is registered without the application being previously laid open to public inspection, as there is no procedure at present for formal opposition to the grant of a patent. A new Patents Act provides, in due course, for examination of inventions with respect to novelty, and for publication of applications to allow for the filing of oppositions to the grant of patents. Swiss patent specifications are available in printed form after the patents are granted. Printing costs for a patent specification up to ten pages of specification and drawings are borne by the Swiss Patent Office but the applicant has to meet costs for pages in excess of ten.

It is advisable to mark patented articles or products with the patent number, although such marking is not obligatory under Swiss patent law.

There is provision for assignment of an application or patent, and for the grant of compulsory licences under patents which have not been commercially worked in Switzerland (except for valid reasons) within three years from date of registration of the patent.

Application fees are from £42 15s. and renewal fees rise from £6 5s. at the second year to £29 5s. for the last year of the patent term.

United States of America

The term of a patent in this country is 17 years from the date of issue and may be granted for a new and useful process, machine, manufacture, or composition of matter or any new and useful improvement thereof. A patent may also be obtained for any asexually reproduced and new variety of plant, but not a tuber-propagated plant.

The applicant for patent must, in general, be the actual inventor or joint inventors. An assignment, properly drawn up and legalised by the United States Consul, will enable the patent to be issued to an assignee (individual, firm or company), providing the assignment is recorded in the United States Patent Office before issue of the Patent.

The United States is a party to the International Convention and priority, on the basis of the first corresponding application in a Convention country, can be claimed but must be supported by the filing of an officially certified copy of the basic application.

A patent will not be granted if the invention was known or used by others in the United States or described in a printed patent or other publication in the United States or in a foreign country before the invention thereof by the applicant. It is to be noted that "the invention thereof by the applicant" is significant and involves the date when the invention was conceived and reduced to practice. This date can be earlier than the actual date of application for the patent. Where the application is filed under Convention, however, the applicant cannot rely for conception date on a date earlier than the priority date claimed.

An applicant will further not be entitled to a patent if the invention was patented or described in a printed publication, irrespective of country of origin, more than one year prior to the date of application. If an application is filed in the United States more than one year after the date of application in another country for the same invention, it is essential for the U.S. application to be filed before the foreign patent issues.

If in the opinion of the Commissioner of Patents an application is made for a patent which conflicts with any pending application or with any unexpired patent, so-called proceedings of interference will be instituted by the Commissioner. After an interference has been declared the parties become involved in complex procedure laid down in the Rules of Practice of the U.S. Patent Office in order to enable an Official Decision to be reached as to which applicant has established priority of invention.

Owing to the U.S. Rules of Practice, it is necessary for a specification and drawings accompanying a U.S. application to be drawn up with great care in order to avoid difficulties in prosecution of the application. Great care must be taken, at the outset, to ensure that the specification provides a full disclosure of the invention, since it is extremely difficult to have new matter added to an application after filing. It is advisable for an invention to be described and illustrated in much greater detail than is necessary for the majority of foreign countries. There are very precise rules concerning the form of U.S. claims and the preparation of claims must, therefore, be given special consideration.

The applicant is informed in writing of the results of the official examination, and patents or publications are usually cited as a basis for rejection of claims. Responses to official actions must be very carefully prepared. A response is normally in the form of an amendment to overcome the cited references or official objections but may be in the form of arguments to refute the Examiner's objections. An official action must be answered within a period of six months and if the reply is not fully responsive there may be a risk of the application being treated as abandoned. No extensions of time are obtainable for replying to official actions. In order to obtain a patent, it is necessary for an applicant not only to show differences between the invention and the prior art cited by the Examiner but also to convince the Examiner that the differences are of an important inventive nature such as would not occur to a person having ordinary skill and knowledge in the art to which the invention relates.

If, subsequently, it is found that a patent is partly or wholly inoperative or invalid for various reasons, e.g., through faulty or insufficient description or owing to error or mistake or because the claims in the patent are defective, the patentee may offer to surrender the patent and apply for a so-called re-issue patent which, if granted, will remain in force for the unexpired term of the original patent. Very special procedure has to be followed in applying for re-issue patents.

An application is not laid open to public inspection for opposition purposes and, if the applicant is entitled to a patent, a notice of allowance is issued. Within six months from the date of the notice a final fee must be paid to secure the Letters Patent which remains in force for a period of 17 years from the date of grant, without the payment of renewal fees.

In order to enable a patentee to recover damages for infringement of his patent, it is necessary to establish that the defendant was aware of the patent. Consequently, it is advisable for the patented article to be marked with the patent number. If any unauthorised party sells a component of a patented apparatus or material or the like and the component is an essential part of the invention covered by the patent, the party will be liable to be sued as a contributory infringer, especially if he is aware that the component is to be used in a manner which would infringe the patent, and thus actively induces infringing acts.

Application fees are from £40 and there are no renewal fees.

Further particulars concerning applications for patents in the foregoing and other countries can be obtained from Patent Agents practising in the United Kingdom.

A MODEL YACHT

Our Junior Section

Constructional Details of a Simple Design

ONLY two pieces of wood are used in the construction of the hull, details of which are shown in Figs. 1 and 2. Begin by cutting a cardboard template to the measurements given in Fig. 4. Then select a piece of straight-grained wood 15in. x 5in. and at least 1in. thick. Thicker wood, up to 1½in. thick, would be better, but more cutting and shaping would be involved. Draw a centre line longitudinally upon this piece of wood. Place the straight side

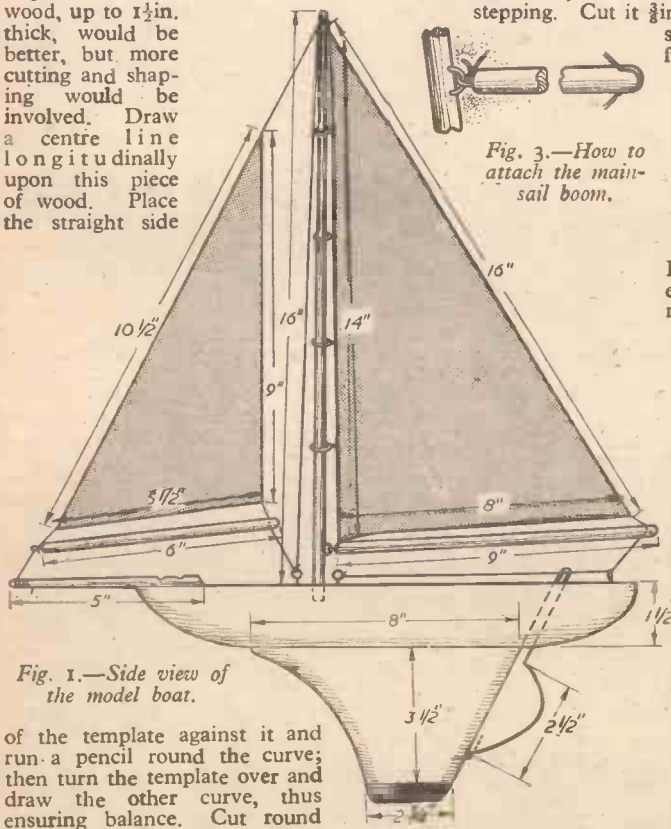


Fig. 1.—Side view of the model boat.

of the template against it and run a pencil round the curve; then turn the template over and draw the other curve, thus ensuring balance. Cut round the outline with a fretsaw, and the hull is ready for shaping.

Shaping the Hull

The best tool for this purpose is a small metal plane. Work lengthwise, first rounding the edges and continuing until the hull is shaped like the cross-section in Fig. 2, but leaving flat a portion along the centre for the attachment of the keel-fin. Shape the bows and the stern with a sharp penknife, and finish off the hull with sandpaper. The keel-fin is cut from ⅜in. wood to the measurements given in Fig. 1, the front and back edges being rounded as indicated by the shading. It is secured to the hull by three 1½in. brass screws, the heads of which are sunk flush with the deck. Cast a lead keel slightly larger than required, and screw it to the bottom edge of the keel-fin, afterwards trimming it down with a file.

The rudder and rudder-post are cut in one piece from ¼in. wood, the post being rounded and a hole bored through the hull to receive it. The lower end is pivoted upon a right-angled brass wire staple as shown by the dotted line in Fig. 1.

Fig. 2.—Cross-section of the hull.

The Mast, Spars, etc.

The mast is 16in. high, measured from deck level, but is cut ½in. longer to allow for stepping. Cut it ⅜in. square, then plane and sandpaper it until perfectly round and smooth.

Fig. 3.—How to attach the mainsail boom.

Dowel rod would be an easier alternative. The mast fits tightly into a hole made at a point on the centre-line 5in. from the bows. The bowsprit is 5in. long and is secured by two small nails. The mainsail boom is 9in. long and is attached to the mast by means of a small brass screw-eye and a brass wire staple as shown in Fig. 3; the other end being rounded and a saw-cut made in it for securing the sail. The jib boom is 6in. long and is similar in construction to the main boom.

The Sails

The sails may be made from any convenient white material, or the special fabric sold for the purpose may be used. Cut a paper pattern before cutting the material, and allow an extra ¼in. all round for hemming. Four rings made from brass wire are sewn at equi-distant points along one edge of the mainsail, and a length of thin cord is fastened to each of the corners of the sails for attaching them to the spars. The top of the mast has a saw-cut made in it where the cord passes over it, and three brass screw-eyes screwed to the deck shown complete the yacht.

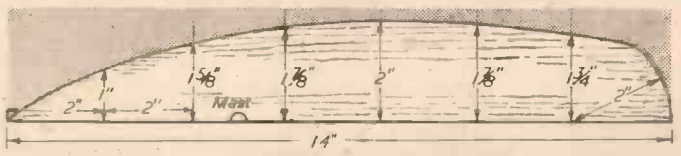


Fig. 4.—Cardboard template for the hull.

Looking After Your Boat

A few moments attention given to your model after sailing it on the pond or on the sea will greatly prolong its life. On returning home, carefully swab over the decks and hull with fresh water to remove any water line. Some ponds, especially those in big towns, have a sooty deposit on their surfaces which, if allowed to dry on, is difficult to remove without damage to the enamel.

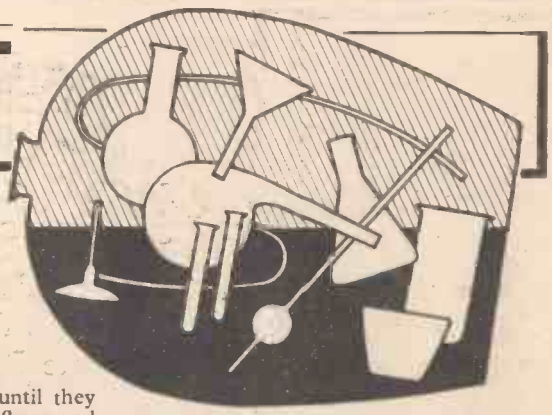
If the sails are made detachable, hang them when they get wet in a drying cupboard or warm room to dry, having washed off any water lines or dirty marks. Do not put your boat in the drying room. Never put a wet sail away to dry rolled up, as this speedily rots the canvas. Check the rigging periodically for signs of fraying.

Making Gas Bombs

GAS bombs, the joy of the practical joker, are very simply made. Prepare glass bulbs as described in our "Junior Chemist" series, drawing out the necks fairly fine. The rest of the operation is best performed out-of-doors, or well away from the household, for obvious reasons.

Procure from a chemist a small amount of ammonium valerianate, which is a most evil-smelling substance. Dissolve this in the minimum amount of water. Make a bulb quite warm, hold the neck under the surface of this solution until it becomes cold again, when it will be found that contraction of the residual air in the bulb has caused some of the solution to be drawn upwards into the latter. Seal the "bomb" by fusing the neck into a solid mass of glass.

THE JUNIOR CHEMIST



No. 5.—Experiments With Sulphur

IN Sicily, sulphur occurs mixed with volcanic rock and pumice, from which it is separated by melting by low heat, and run into moulds, where it sets as roll brimstone. Some sulphur is itself burned to provide the necessary heat, but this method is wasteful. The best method, used in Louisiana, is worthy of description as it is a clever example of chemical engineering. The sulphur occurs in a bed about 1,000ft. beneath the surface of the ground and a boring is made, admitting four concentric pipes to the deposit. Water, superheated under pressure, is forced down the two outer pipes. This is followed by compressed air down the central pipe, when melted sulphur and water are driven up the third pipe. The yield is trapped at the head of the shaft, and the sulphur allowed to solidify.

The fumes given off by heated and burning sulphur are pungent and suffocating. On this account an open window is necessary while experimenting. A piece of roll sulphur and some flowers of sulphur are required for the experiments.

Sulphur Is Audible

Take a piece of roll sulphur in the hand and hold it near the ear. A succession of clicking noises will be heard emanating from it.

How Heat Affects Sulphur

Sulphur behaves curiously when heated. Place a little in a test tube and heat it gradually. At first it melts, forming a yellow liquid, then suddenly it becomes dark brown and as thick as treacle. As heating is continued, the thick consistency disappears and the sulphur boils, giving off choking vapours.

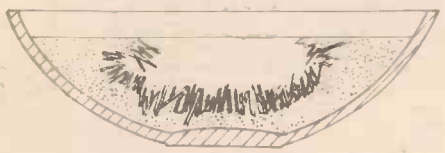


Fig. 1.—How sulphur crystallises.

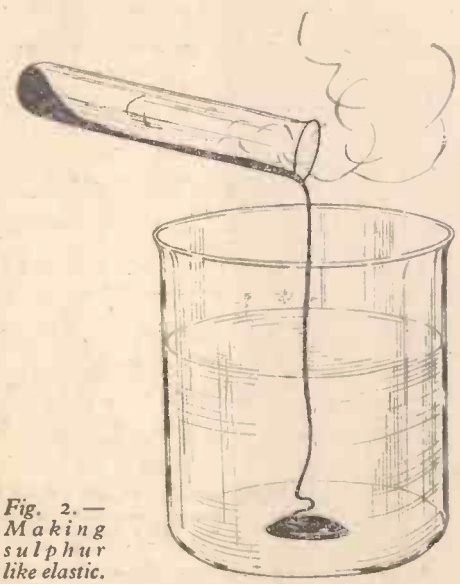


Fig. 2.—Making sulphur like elastic.

Crystals of Sulphur

Place a few pieces of sulphur in a porcelain basin and heat them until they melt. Remove the basin from the flame and allow to cool. Immediately a solid crust is seen to form on the surface, break a large hole in it with a piece of wood and invert the basin, when liquid sulphur will run out, leaving a shell of solid sulphur adhering to the sides of the container. Examine this shell, and it will be seen that it is composed of beautiful needle-shaped transparent crystals similar to those depicted in Fig. 1. If the basin and crystals are put aside for a day and then examined it will be seen that the crystals are no longer transparent but have turned yellow. This change can be speeded up by rubbing them gently. The transformation commences at the point of contact.

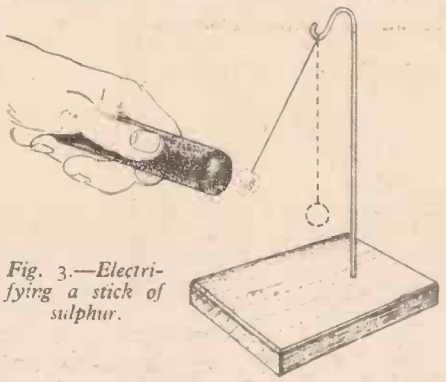


Fig. 3.—Electrifying a stick of sulphur.

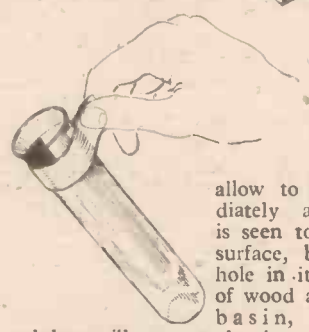


Fig. 4.—How a test tube may be held with a piece of paper.

How Sulphur Can Be Made Like Elastic

Roll sulphur is very brittle; the slightest strain causes it to fracture. Place a quantity in a test tube and heat it until it boils. Then quickly pour it into cold water (see Fig. 2). When you remove it from the water you will find that it is dark in colour and can be stretched like rubber. After a few days this further variety of sulphur becomes quite hard and brittle, changing back almost completely to its original form. This experiment is an interesting example of supercooling, that is, the sulphur is brought from its boiling point and through its freezing, or solidifying, point so quickly that crystallisation does not have time to begin, and the mass possesses only a semi-rigidity.

Electricity From Sulphur

Sulphur has exceptionally good insulating properties, and on this account can be made the source of frictional electricity. Rub a roll of sulphur vigorously with a fragment of fur or even a dry duster. The sulphur will now be found in an electrified state and will readily attract bits of tissue paper, or can make a suspended pith ball cut a few capers (see Fig. 3).

Sulphur and Iron Filings

Mix together iron filings and flowers of sulphur. A yellowish-grey mixture results. Now by sweeping a magnet through this mixture it is possible to separate the iron filings from the sulphur, as the filings all cling to the magnet. Now mix the sulphur and iron again and drop the mixture in a large test tube. Hold in the Bunsen flame, heating strongly. When the correct temperature is reached a chemical action will be seen to be taking place in the tube, the contents glow from end to end and a large amount of heat is developed—much larger than the amount put into the mass (see Fig. 5). When the reaction is complete and the tube is cool, place it in a basin and smash it, thus gaining access to the result of the experiment which is too firmly united with the sides of the tube to be shaken out. The mass is almost black in colour and

(*Continued on page 357*)

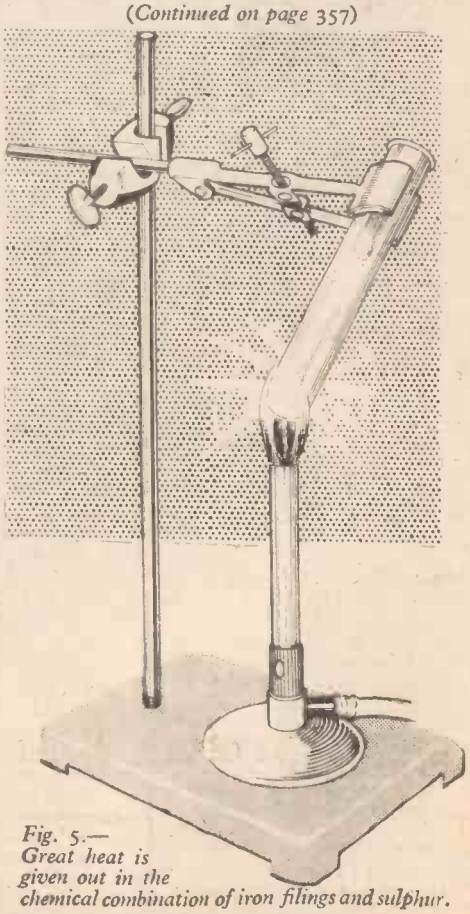


Fig. 5.—Great heat is given out in the chemical combination of iron filings and sulphur.

resembles neither sulphur nor iron. Moreover, a magnet has no effect on it. It is, in fact, a chemical compound, and it is known as ferrous sulphide. This experiment demonstrates the difference between a mixture of chemicals (not firmly united and readily separated), and a compound (two or more substances united and forming a substance with different properties to its constituents).

Making "Bad Egg" Gas

If your compound of ferrous sulphide from the last experiment be dropped into a test tube and a little dilute hydrochloric acid poured upon it, effervescence takes place and a gas is liberated, the "fragrance" of which will be noticed and remarked upon throughout the house. This gas smells most abominably and actually is the gas which is present in rotten eggs and gives them their offensive stench. Having learned this, the amateur chemist who is also a practical joker will doubtless use his imagination in finding methods whereby he can inflict upon his friends discomforting evidence of his knowledge of chemistry. As a suggestion —a little ferrous sulphide and dilute hydrochloric acid in a pot hidden behind a plant stand will rapidly clear a roomful of people.

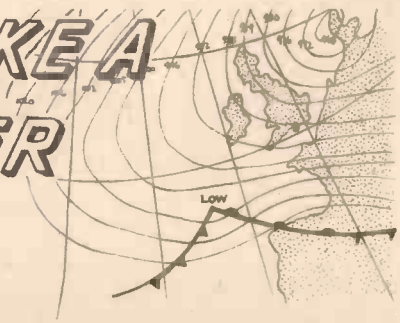
Making Flowers of Sulphur

Put a few fragments of sulphur in a test tube and apply heat to it by means of the Bunsen. A useful way to hold the test tube is to fold a piece of paper two or three times so that it forms a strip, and, holding the extremities between finger and thumb, grip the neck of the tube in the loop thus formed (see Fig. 4). When the sulphur is seen to be boiling, hold a cool dish over the mouth of the tube. The sulphur vapour will condense on the cool surface of the dish in a fine yellow powder. This powder is flowers of sulphur and is prepared on the large scale in a similar manner. The process of cooling vapours and obtaining from them a solid is known as "sublimation."

How to Make Milk of Sulphur

Make a solution of photographic "hypo" and add to this a small amount of dilute hydrochloric acid. A choking smell of burning sulphur will be noticed, and at the same time a white precipitate will be seen forming in the liquid. If this precipitate is allowed to settle and the liquid poured off, the precipitate washed with water and the pouring off process repeated, it will be found, when dry, that the residue is milk of sulphur.

HOW TO MAKE A BAROMETER



An Easily-made and Reliable Barometer that Any Handyman Can Make

THE ordinary aneroid barometer—with the circular face and two hands—is a delicate and intricate instrument, but a different, though equally reliable, one can be made by the amateur who likes to dabble in chemistry. It costs very little and consists, as seen in Fig. 1, of a tall tube of mercury resting upside down in a test tube. There is a vacuum made at the top of the long tube, and the change of atmosphere will affect the height of the column of mercury and so provide a reliable reading of the "weather."

Fig. 1 (Left).—The completed barometer.

The main requirement is a 3ft. length of stout glass tube with a bore of 5/16in. The test tube must have an interior diameter a little larger than the outside of the larger tube, so it will slide over the end easily. The only other requirement is about 1½lb. of pure mercury and a small filling funnel. It is first necessary to close one end of the long glass tube, and this can be done in a lab. over a Bunsen burner, by gradually heating towards one end and twisting off a length of about 3in. to seal the long portion thoroughly.

The next operation is to fill the tube with mercury, but it is essential to get rid of all the air first and have the tube thoroughly dry. Clean the tube thoroughly with water, and then fill with methylated to absorb the water remaining in fine particles on the glass.

Filling the Tube with Mercury

Next the tube is filled with the mercury, only a little being put in at a time. Arrange the tube on the slope and run the liquid in gradually a little at a time and pour down the side of the tube. Tap the tube as each quantity, is run in, to get out all air-bubbles. Mercury, of course, is heavy and the tube will become weighty as it is filled. When almost full, put a finger over the open end, grip tightly and turn the tube upside down so the air may run up to the other end and collect any bubbles. Turn the tube the right way again and repeat the process two or three times. Then finally fill quite to the top with mercury, put the test-tube over the end and quickly invert the whole thing.

It will be found the mercury in the long tube drops somewhat, but will come to rest when the pressure on the open end of the test-tube has brought a state of equilibrium. The barometer itself is now complete and ready for fixing to some suitable holder. For this, a strong piece of ½in. or ¾in. thick wood, a little longer than the instrument, is cut. It can be either a long plain piece as shown in Fig. 1 or shaped. The test-tube must be securely fixed at the bottom by a shaped block, each side covered at the front by thin plywood, as shown in Fig. 3. The top of the test-tube must not be enclosed, and the plywood can be decorated with a transfer or piece of mirror. The long tube is supported between two long strips of ½in. square wood glued and screwed securely to the back, whilst brass strips are screwed over to hold it from falling forward. (See Fig. 2.)

At the top end another and wider block of wood is added upon which the height of the barometer is marked for reading. The height of the column is measured from the top of the mercury in the test-tube. It is standardised with an ordinary barometer and the rise and fall marked on a paper or cardboard chart at the top. A pointer can be made with a piece of sheet brass sliding on a wire to show when the instrument is "set" and the difference in reading.

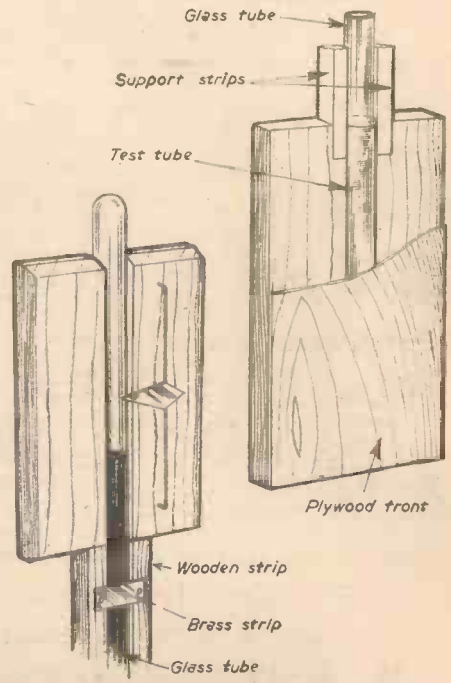


Fig. 2 (Left).—The top of the barometer. Fig. 3 (Right).—The bottom end.

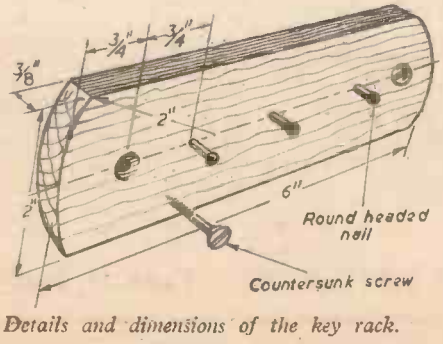
Making a Key Rack

By A. B. GARBETT

REQUIREMENTS for the job include a small piece of wood, two screws, and a few nails.

Beech or oak looks well if a plain polished surface is desired, but any piece of wood will do the trick if a stained finish is planned.

Square the wood up to size. In the drawing it is 6in. x 2in. x ¾in. Drill a hole ¾in. from outer edges and slightly countersink to take the screw head. Finally hammer small round headed nails part-way in as pegs for the keys. If fixing to a wall, Rawlplug fixings should be used.



Details and dimensions of the key rack.

Letters to the Editor

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

Blotting Paper Impressions

SIR,—In reply to your reader in "Information Sought," January PRACTICAL MECHANICS, who asked about "Blotting Paper Impressions," he may be interested to know that the principle that he describes, i.e., that of impressing a drawing or material through a sheet of paper on to another sheet below and then "developing," is used commercially in the manufacture of children's magic painting books. A pencil is rubbed gently over the apparently blank surface of a page and a picture appears. This is brought about by the impression on the paper's surface, the pencil only marking the high spots.

A crayon, preferably of wax, should be used. The crayon should be rubbed gently back and forth in one direction over the surface; the amount of rubbing necessary being dependent on the size of paper and the depth of colour required.—J. E. KNELL (B.A.O.R., 39).

Making Dowels

SIR,—I think you missed two rather important points in your article on "Dowels" in the January issue. These are:

1. A light saw cut down the length of the dowel should be made to allow "trapped" glue to escape and prevent splitting the joint.

2. To facilitate easy entry of the dowels it is usual slightly to round the ends by paring or using the special brace tool available for this purpose.—D. T. WALSH (Ireland).

A Swinging Garden Seat

SIR,—Mr. A. J. Stael ("Information Sought," January issue) seeks advice on the construction of a swinging garden seat without the need for welding.

He will find he can make a very satisfactory frame from 1in. galvanised pipe, using standard tee joints and elbows. His local builders' merchant should be able to supply all the parts and his plumber will run the threads on and do any bending for a few shillings.—KENNETH H. OKEY (Bournemouth).

Status of the Inventor

SIR,—I regret that I was not present at the Morgan-Morgan Memorial Lecture, but have read your editorial on the "Status of the Inventor" (December, 1956, issue) with great interest.

Recently I was in communication with my local M.P. on the subject of infringement disputes and came to a dead end when the Parliamentary Secretary to the Board of Trade was approached. The 1949 Patents Act gave the comptroller of the patent office power to settle infringement disputes provided both parties agree to arbitrate. However, in the case of a deliberate infringement it is not likely that the infringer would agree. In such a case the comptroller is not allowed even to give an opinion to the patentee as to whether or not a certain feature of the invention is protected. If, as is usually the case, the inventor cannot afford litigation, how is he protected? Yet he must continue to pay for what he is unable to sell, or make the infringer a present of his idea by abandoning the patent.

Is this the encouragement mentioned in Letters Patent?

I sincerely hope that your desire for a British Institute of Inventors fructifies.

In order to accomplish this desire would it not be helpful if the Institute of Patentees circulated a letter to its members instructing them to sign and send it to their local M.P.s?—W. H. HAUGHTON (Surrey).

Will Steam Power Return?

SIR,—*Re* "Fair Comment" in January PRACTICAL MECHANICS, this topic of steam power should be well ventilated and younger engineers reminded of what was so successfully done with steam cars half a century ago.

I well remember the Tilling-Stevens buses that ran between Knightsbridge and Hammersmith and also a lively little fleet of single decker steam buses at Harrogate; I think both used solid fuel.

The 6-ton Sentinel is, I believe, still running with its solid fuel boiler, and I remember trying to dodge the hot cinders when driving behind one.

The boilers are, I believe, a problem that to-day could easily be surmounted with new metals, and better smokeless fuels now available. This is a matter that I would commend to the Ministry of Power for investigation towards further improvement.

The small boiler fired by solid fuel certainly has one disadvantage, there being little reserve for rapid build-up for hill climbing, and although it may appear to be ridiculous to suggest, why not try a small jet of highly-inflammable fuel in powder form under compressed air to give that extra boost when required. This is something for the fuel experts and designers to think about.—S. N. SHURMAN (Salford).

SIR,—Referring to your editorial in the January issue on steam power for automobiles, I would make the following comments. The advantages of the steam car are:—

The engine has a very much better torque/speed ratio, i.e., the torque does not fall off at low speeds as in the case of the internal combusion engine.

The output of the engine is higher for a given piston diameter at constant stroke, for instance a two-cylinder petrol engine of normal design having a cylinder diameter of 3 1/16in. and a stroke of 4in. has according to Treasury rating an output of 9.4 b.h.p. at 2,500 r.p.m. approximately, whereas the same engine as a steam engine has an output of approximately 20 b.h.p. at 2,500 r.p.m.

The absence of the products of combustion in the cylinder reduces cylinder wear.

The disadvantages of the steam engine are:

Low combined efficiency (boiler and engine), and in this respect a thermal efficiency of from 5 per cent. to 7 per cent. is optimistic whereas the thermal efficiency of the petrol engine used for car propulsion is from 15 per cent. to 22 per cent.

The necessity for the use of drain cocks when starting from cold and the disastrous results if same are not used.

The main deterrent, however, to the use of steam for car propulsion is the specialised knowledge required to give the necessary attention to the boiler. Extreme care is necessary where the feed water used is "hard," as scale, consequent incrustation and, eventually, burst boiler tubes are inevitable, unless either the water is softened or frequent scaling is carried out.

If softened water is used, having a high oxygen or carbon dioxide content, it is essential to de-aerate the water, or corrosion will take place. Similarly a water having a chlorine content (very prevalent nowadays, being widely used for purification) will cause corrosion and cupro-solvency.

From the above it will be realised that the steam boiler is not a device which can be operated by the unskilled and the essentials for correct boiler operation are water treatment descaling, de-aeration, if necessary, and above all periodic inspection. Whilst the steam engine on the whole has some advantages over the internal combustion engine the boiler at the present time does present many difficultics.—C. H. NICHOLSON (Hull).

SIR,—*Re* your comments on "Will Steam Power Return?" in the January editorial, I very much doubt if the car owner of to-day could ever be convinced that a steam car is anything other than a traction engine or something like that. As one who has ridden and driven one, I do know that as far as they went they were far superior to the I.C. engine. The snag, of course, was starting, but so many people mistakenly think that the I.C. engine was always the quick starter it is to-day. Years ago to take anything up to 15 minutes to start was not unusual.

For years I have tried to think of some way to do without the cumbersome boiler and I fancy I may be on the right track with something totally different to standard practice. I have no real facilities to make one, but the boiler (if called that) would only supply sufficient power for one impulse. Whether the impulses could be made to come often enough is the question. It is on the lines of the Humphrey engine of very many years ago, and would be extremely easy to make.—C. V. THOMPSON (W.14).

(*Continued on page* 361)

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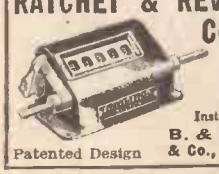

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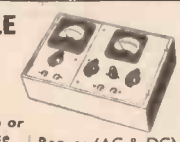

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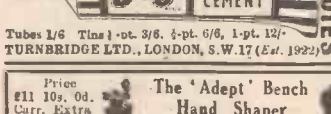

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SIR,—During the past few months I have noticed letters from readers regarding the design, etc., of steam cars. Such readers would be well advised, in view of their interest to contact the British Light Steam Power Society.

I have been giving some thought to the design and construction of a suitable power unit of this type suitable for fixing in the smallest of cars, i.e., an Austin 7 or similar.

My idea is to have a four-cylinder radial engine, single-acting with poppet valves, cam-operated. No clutch or gear-box would be used, the engine being directly coupled to the transmission shaft. A power output of around 20 h.p. is aimed at.

The boiler would not be of the monotube type as these can be difficult to construct, but of the water-tube (Derr) type.—A. SMITH (Somerset).

Dyeing Fur

SIR,—For Mr. H. T. Leaver's information (page 218, January issue) Pyrogallic acid (Pyrogallol) is used for dyeing fur dark brown and black. He can obtain this from Toxane Ltd. at 47, High Street, Edgware, Middlesex.—J. C. WILLIAMS (N.W.1).

Taking Stereoscopic Photographs

SIR,—With reference to R. J. Shailer's request ("Information Sought," February issue) for a stereo attachment for his single lens camera, as the Viewmaster requires two separate transparencies the attachment will not suffice, as this takes two pictures, slightly off-set on the same format as the normal. Then these two stereos are looked at through a viewer of similar pattern to the attachment which separates the pictures so that each eye gets a different view. As your correspondent knows, any picture he takes with his camera will have to be considerably reduced to fit the Viewmaster.

If he requires two pictures he must either get a stereo camera or purchase or make a stereo stand on which he can place his ordinary camera. This device limits his photographs to "stills." A stereo slide can be purchased from Wallace Heatons for £2 13s. 6d. or a stand of wood could be made. It needs only a small stand to fix on a tripod, on which the camera can be moved, between shots, from one end to the other. The distance the camera has to be moved is that which will move the centre of the lens 2½in. All one has to do then is to choose the subject, make one exposure, turn on the film, move the camera to the other end of the platform and make the other exposure. The two pictures, when transposed, can then be looked at through a viewer.—F. W. EASTON (Birmingham, 27).

Dangerous Solvents

SIR,—In the February issue of PRACTICAL MECHANICS, I see that a correspondent has been told that he may heat certain solvents because they are not inflammable. Vapours from certain dry-cleaning fluids immediately decompose, with sufficient heat, into poisonous gases. The plain vapours are liable to cause unconsciousness in poorly-aired spaces, and when heated decompose into Phosgene-type gases which very quickly damage the lungs irreparably. Extinguishers containing these fluids should be used carefully or not at all.—V. J. IVORY (Coventry).

Making Wall Fixings

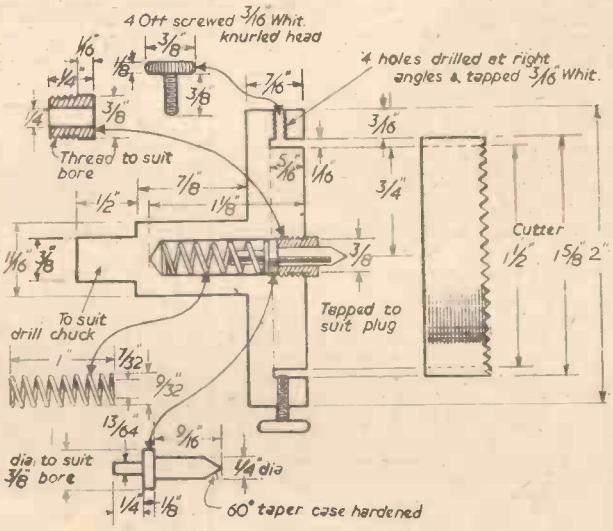
SIR,—*Re* your article in the December, 1956, PRACTICAL MECHANICS, entitled "Making Wall Fixings," we should like to comment.

We note your contributor recommends making a triangular shaped hole and wonder how he would propose setting about this?

The holding power of an expansion bolt, as described, would be extremely poor for the reason that there is really only a point contact between the smooth strips of mild steel and the masonry and we think that a Rawlbolt of comparative size would carry at least ten times the load. A Rawlbolt can be purchased for as little as one shilling.—THE RAWLPLUG COMPANY, LIMITED.

Cutting "Perspex" Discs

SIR,—In reply to your correspondent seeking information regarding a tool for cutting Perspex discs in your December issue I have made one which cuts the discs out in the same way as the Picador, but instead of the hole in the centre (which makes them washers) I have put a spring-loaded centre which retracts in the barrel as the pressure is put on the cutting blade and hardly leaves a slight impression in the centre of the disc.



Mr. E. S. Payne's "Perspex" disc cutter.

The body is made from either brass or steel to the dimensions in the sketch. The cutter is made from a piece of new 12in. hacksaw blade heated and bent round a piece of 1½in. diameter steel so that the teeth cut when run in a clockwise direction, the blade is still hard enough to cut several hundred discs with the application of a spot of oil before it requires renewing.

The four knurled headed screws which are tapped into the body at right-angles are to hold the cutter in position.

The hole in the centre of the body is drilled 1½in. deep, 5/16in. diameter and tapped ⅜in. B.S.F. to a depth of a ½in., then a coiled spring 9/32in. outside diameter and 7/32in. inside diameter is inserted. After that, the centre is put in so that the small end is fixed in the spring and the shoulder slides in the hole. The retaining screw is made from a piece of ⅜in. B.S.F. bolt which is cut so as to leave 3/16in. of thread and 1/16in. of plain then a ½in. hole is drilled through the centre. The retaining screw is next put on the centre piece (which is made from steel with the point case hardened) and screwed up to the shoulder which stops the spring from pushing the centre piece out. The cutter will cut out "Perspex" discs up to a ¼in. thick, using either electric or hand drill.—E. S. PAYNE (Rotherham).

Space Visitors

SIR,—In answer to Mr. Kershaw (February issue of PRACTICAL MECHANICS). If a meteorite is large enough to penetrate the earth's atmosphere, and low enough for its shock wave to destroy an aircraft, then it is bound to hit the ground, and as its path is in a curve or in a straight path towards the earth, it will strike the earth only a short distance away, also if such a meteorite could destroy an aircraft in such a manner, it would cause considerable damage. Can Mr. Kershaw tell me where the meteorite crashed, and how much damage it caused? If it had been a meteorite as low as Mr. Kershaw suggests, the Air Force would not have had enough time to send up any planes, and Mantell could not fly above 20,000ft., owing to a lack of oxygen. There are many details which Mr. Kershaw does not appear to know. A large object was seen by people living about 170 miles apart, the police at Fort Knox contacted Colonel Hix, the C.O. at Godman Air Base, who with other officers and ground staff watched it through binoculars and Captain Mantell and two other pilots were ordered to investigate. At one time the object was stationary over the airfield. Mantell described the object as of tremendous size and metallic. At one time it was travelling at half his speed, but it accelerated upwards and a few minutes later had disappeared.

Does Mr. Kershaw know that only 100-150 years ago scientists were saying that meteorites did not exist and were only a figment of the imagination!

His answer to the Captain Howard case is also wrong. Both Captain Howard and the second pilot have had well over 15 years' experience as pilots. The crew say that the objects they saw were hard solid objects that were *silhouetted* against the light of the setting sun, they were flying off the port side and followed their aircraft for 20 minutes a distance of about 80 miles at about 264 m.p.h., the six small objects were continually flying around the very large object. When Captain Howard contacted a fighter pilot who was 20 miles away, the six small objects merged with the large one, and in 30-45 seconds it completely disappeared. In all their experience none of the crew had ever seen such objects. Twenty-two people (seven crew, 15 passengers) saw it. The crew were convinced that the objects were intelligently controlled. The way the objects behaved ruled out any idea of reflection, since the objects were moving completely in a different way to the aircraft, *and only solid objects* and not reflections are silhouetted against such light.

Has Mr. Kershaw ever heard of the three aircraft that took off from Norway two years ago, full of scientists, to photograph the eclipse of the sun? One of the men was the Norwegian Astronomer Royal, and so that no reflections would upset the photography, all the glass was taken out of all the windows in the fuselage.

Two large round objects were sighted and photographed; they were travelling very fast and very high.—R. W. J. ANSTEE (Bristol).

Life on Mars?

SIR,—Books on astronomy are good sellers to-day. Some are résumés of our recent Astronomer Royal's "General Astronomy," "Worlds Without End," "Life On Other Worlds," and similar works, but each eclectic adds *some* of his own ideas. Some hark back to the 1880 and 1920 periods, and indulge in wishful thinking. Then—

Mars was a planet embowered in green! This was luscious vegetation, bordering sparkling streams. Oxygen was plentiful, making breathing easy for a race of beings, who were far more intelligent than any race on earth had ever been.

The modern professional astronomer has, however, relegated Mars! It is now worse than the Sahara, the deserts are larger, and there is no water! There is hardly any oxygen. Future space voyagers will venture at their peril upon Mars.

There not even grass exists, nor algæ or humble salt-worts. Only mouldy old lichen, and a thin poisonous atmosphere. No wonder the brilliant and fascinating Venus is now the attraction! Mars has lost its place! I wonder if there are not springs upon Mars? This would explain the oases, and the wide bands joining them up. The latter might be marshy watercourses, with lines of straggling vegetation situated at some little distance on either side. Might not some form of life exist within such environs?

The 200in. telescope was going to solve the mystery of Mars! Apparently the worrying vagaries attendant upon magnified air currents and changing temperatures, have greatly hindered here. So we are as wise as before.

The 82in. Macdonald reflector in Texas seems to have been more successful upon planets than the 200in.! With it Kuiper has discovered that the equator of Venus is tilted at an angle of 32 deg. to its orbit.

In photography of the planets the giant refractors more than hold their own. Those of Mars obtained with the 36in. Lich instrument are considered to be the best ever! See reproductions in "Life On Other Worlds," by Sir H. Spencer Jones.—A. TROWBRIDGE (Staines).

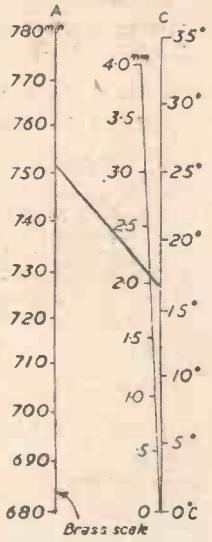
Barometer Adjustment

SIR,—*Re* the query in "Information Sought," by F. Fisher, about Barometer Adjustment, in the February PRACTICAL MECHANICS, Mr. Fisher's drawing indicates that it is an antique wheel barometer he wishes to adjust. This type of barometer only gives approximately correct readings, since friction caused by the weights and pulley causes the pointer to lag in its movements.

Atmospheric pressure decreases by 1/10in. for every 100ft. above sea level, so that, being originally set at Plymouth, Mr. Fisher's barometer would now be reading about 0.6in. too low. To correct this is quite simple. There are two methods. For the first, unscrew the glass covering the dial, and try, with care, to lift the pointer off its arbor by inserting two screwdrivers between it and the dial, one on each side. If it comes off, merely replace it to read 0.6in. higher than its original position. If it does not come off, the second method is the solution. Open the door at the back of the barometer, lift the weight off the mercury, unfasten the barometer tube and take this out carefully. Hold the open end over a non-metallic vessel and tip out some mercury. Replace the tube and weight, hold instrument vertical and note reading, which will very likely be much too high. If so, add some of the mercury little by little until the pointer reads 0.6in. higher than its original position, when all will be correct.—M. M. DAWES (Margate).

SIR,—Your correspondent, Mr. F. Fisher, in February's issue, asks for information re barometer adjustment.

One way is to study those found in most public buildings such as public libraries and large scientific instrument manufacturers. The instruments are usually seen at about eye level outside the building. If you are lucky enough to live in a district displaying one of these, and your house is more or less at the same level, then measure the height from ground level to top of mercury column which is shown in inches by the pointer on the dial; then all you have to do is set your own instrument to show the same height by pushing the pointer around to point at the same figure.—A. WARNE (Newcastle-on-Tyne, 5).



The Mehinke Method of barometer correction.

SIR,—*Re* "Information Sought," February issue, with regard to the query about mercury barometers the use of a barometer is to measure air pressure and if the barometer was originally adjusted correctly there should be no need for further adjustment because of the decrease in pressure.

The barometer may need to be corrected for temperature, which falls 1 deg. every 300ft. above sea level.

This correction can be done by Mehinke's Method. Assuming the scale is graduated at O deg. C, Mehinke proceeded as follows: Suppose the observed reading is 751mm. mercury at 17 deg. C. By means of a straight line join these points on a scale A & C as shown in diagram. The intercept on the scale B=2.1mm. then gives the amount to be subtracted from the observed height in order to reduce the reading to O deg. C.—B. A. KING (Worcs).

Lamp Device

SIR,—In reply to the query in "Information Sought" (January issue), from W. G. Such, the two liquids in the container are most probably aniline, a liquid which has the same specific gravity as water (the other liquid) at the temperature of 30 deg. C. (about) and is lighter above this temperature and heavier below it. Aniline is quite a cheap substance, but if required colourless it must be distilled (B.P., 184 deg. C.), because it turns a dark brown after exposure to the air and light for any length of time. It would be quite difficult to do this operation if the person concerned had not the necessary apparatus. Aniline as bought always contains some darkening. (It is poisonous and may be taken in through the pores of the skin).—C. S. M. WIGZELL (Sussex).

Electrifying an Organ

SIR,—In reply to A. Davies (Shrops.) "Information Sought," February issue, who asks for data in converting a small organ from manual to electric blowing, it must be remembered that the 25 cu. ft. of air per min. quoted is not required all the time, but is a continuously variable demand according to how many keys are pressed at any given moment.

Therefore, the upper unit known as the reservoir is still of great importance in promptly providing this instant demand, and it is worth mentioning that organ builders of hundreds of years ago discovered that "the nearer the pipes are to the reservoir the more promptly do they speak."

Also remember that the variable degree of suction attainable by manual pedalling is part of the expression of the instrument which is lost by converting a small organ to mechanical blowing. This can be achieved with some success by using a vacuum motor well insulated in a double walled box with suitable outlet.

A more correct type of blower could be constructed by mounting a 15in. diam. rotor on to a ¼ h.p. motor running at some 1,400 r.p.m.

Vanes fitted to the rotor should be roughly 3in. x 1in. Provide a suction duct of slightly larger bore than the existing aperture leading from one of the feeder bellows to the reservoir, and pay due attention to sound insulation from the blower which of course must be carefully balanced to ensure maximum silence in operation.

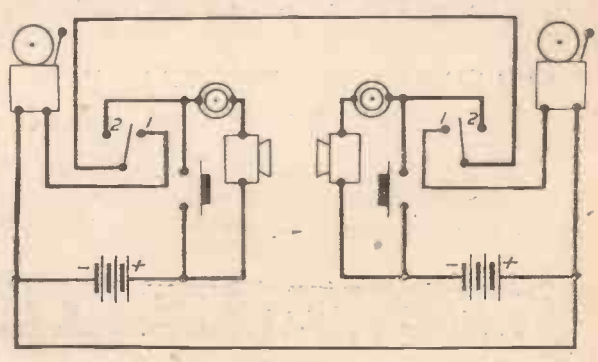
Common organ construction practice is to include a roller blind device inserted at the mouth of the suction line at the blower.

This blind is connected to the reservoir by a control wire so arranged that when the demand is least, the roller shuts down the aperture thus preventing over suction during light passages and consequent unnecessary function of the escape valve, which would tend to be noisy.—L. SIMMONDS (Aylesbury).

SIR,—Some time ago I successfully installed a blower into an 18-stop Estey Organ and used the following: a 24-volt ex-R.A.F. blower, connecting the suction intake to the reservoir of the organ. A 250-volt to 30-volt transformer for power.—W. SCALES (Scarborough).

"Simple Telephone"—Correction

REGARDING your article on constructing a simple telephone in the Junior Section, February issue of PRACTICAL MECHANICS, I have noticed two mistakes in the circuit. The diagram shows them corrected. You will notice that I have reversed the contacts marked 1 and 2 respectively to comply with the text under the heading "The Panel" on page 264. Also I have altered the connections to the battery, so that the polarity is correct, i.e. the positive end of one battery is connected to the negative of the other via the earth wire, and so that the other end of the battery connects to the push-button switch.—J. C. CAMPBELL (Orkney).



Telephone circuit corrected.

8ft. Sailing Dinghy Corrections

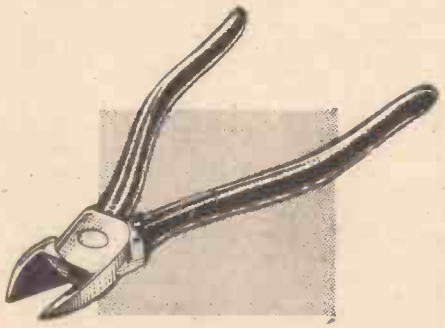
WE regret that two mistakes occurred in the series of articles on "Building an 8 ft. Sailing Dinghy." In col. 1, page 27, October, 1956, issue, the centre board slot was mentioned as being positioned 9in. forward of Frame No. 2. This should have read 6in. forward of Frame No. 2.

The other mistake was in the Table of Offsets on page 464, August, 1956, issue. Under the heading, "Height from sheer," the dimensions under the sub-headings "To chine" and "To keel" at Station 0 (bow) should have been 11⅛in. and 12⅜in. At Station 4 (transom) they should have been 11⅜in. and 15in. to correspond with Fig. 3.

TRADE NOTES

New Wire Cutters

MADE by the well-known firm of J. Stead & Co. Ltd., Manor Works, Cricket Inn Road, Sheffield, 2, these new "Diagonal Nippers" are intended for cutting hard wire. They are made from Sheffield steel and have insulated handles, as shown in the sketch below. They are made in two sizes, 6½in., which cost 6s., and 5½in., which cost 5s. 6d.



"Diagonal nippers"

Self Adhesive Nameplates

FROM Millett, Levens (Engravers) Ltd., Stirling Corner, Barnet By-pass, Borehamwood, Herts, comes news of a new line—self-adhesive nameplates, etc., intended for use in the engineering and electronic industries. Chemically engraved brass, anodised, printed and embossed aluminium, steel or plastic plates can all be supplied self-adhesive, and designed to hold permanently on to almost every kind of surface.

Midget Adjustable Spanner

THIS tool copes with all the small B.A. size nuts used on small appliances and fittings in the home and is useful for any small non-standard size for which no

The midget adjustable spanner.

spanner is available. It is light and small and can be carried in the pocket with ease. It is available from the makers, Scott Engineering (Bournemouth) Ltd., 68, Old Wareham Road, Parkstone, Poole, Dorset, price 1s. 3d., plus 3d. postage.

Autoplax Locknut Cement Kit

AUTOPLAX Locknut Cement is a simple, cheap and reliable system for the locking of threads to prevent nuts, bolts, studs, etc., and all other types of fastenings from becoming loose through mechanical vibration. It also provides a very effective oil seal, which when hardened is highly resistant to solvents and oils. On steel bolts, etc., its use reduces the risk of rust formation.

The material is extremely economical in use, as any desired quantity can be mixed. It can be used successfully on every material normally used for screw threading, including steel, light alloy, brass, etc., and will withstand use in constant temperatures up to 100 deg.-120 deg. C.

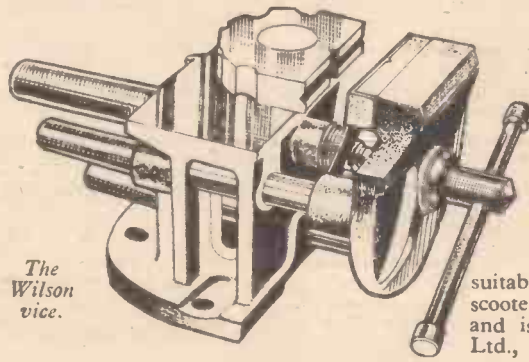
The cement is used with a hardener. By mixing the two pastes together and applying the mixture to screw threads, allowing time to harden after the nut has been screwed on, the resulting bond will effectively prevent any loosening in service.

The properties of Locknut Cement are such that they will allow any desired or necessary subsequent removal of the nut by using normal tools. It is important to note that the thread is not damaged in any way by this treatment and all parts can be reused without waste or difficulty.

Kits are obtainable from Automobile Plastics Co., Ltd., 62, High Street, Barnet, Herts, price 10s. 6d.

The Wilson Bench Vice

THE makers of the Wilson Turret Jaw Bench Vice are W. H. Colt (Engineers) Ltd., 219, Grand Buildings, Trafalgar Square, London, W.C.2, and they claim many advantages for it over the standard fixed-jaw type. It can be operated as a normal parallel vice by use of the locking-pin provided, but the jaw can be turned as required to suit particular needs. Work can pass up vertically from the floor through centre of hardened steel vice jaws; note vertical groove. Horizontal work is held in the long vee across the jaw without end droop. Tapered and all awkward work can be gripped. Rod, angle iron, tubing, etc., is securely held in the vertical position, giving greater convenience and efficiency. Brass soft-jaw, which is loosely attached to the vice, can be placed in position when required. The vice is equipped with quick release triggers for the screw and turret and the screw is protected by a volute spring guard. All the essential components are replaceable.



The Wilson vice.

The vice is made in four sizes—2in., 3in., 4½in. and 6in. jaw widths, and prices range from £2 10s. for the 2in. size to £21 for the 6in. size.

"Aireze" Major Cycle Pump

THIS pump weighs less than 6oz. and its overall height is 5¾in. It is made from non-inflammable plastic with self-lubricating nylon piston rod, wire clip, cup washer of oil-resisting rubber and spring of high tensile steel. The connector is 12in. long and is fitted with a removable adaptor making the pump suitable for either cycle or Schrader - type valves. It can be hand or foot operated and the wire clip keeps the piston rod depressed or acts as a stand. It is particularly suitable for cycles, scooters and mopeds, and is made by Universal Metal Products Ltd., Langley Road, Salford 6, Lancs.

The "Aireze" cycle pump.

Your Queries Answered

Rubber Floor Adhesive

I WISH to lay a rubber floor covering on to tiles, which have a dull appearance owing to use. Is "Bostik" suitable for this purpose, or would you advise anything else? The rubber will be laid in small pieces to make up a pattern.—F. Seed (Lancaster).

THE preparation which you name is quite suitable for sticking down rubber floors, since, in this instance, actual mechanical strength of the adhesive or cement is not required. A mixture of equal parts of rubber solution and a thickened bituminous paint can be used for the purpose, or even a thickened bituminous paint alone, the paint being applied to both contacting surfaces and allowed to become tacky before the rubber is laid down. A suitable paint is "Mariolene," which is manufactured by British Asphalt and Bitumen, Ltd., The Docks, Preston.

A more expensive, but very excellent, adhesive is "Portex" Universal Cement." This is based on a synthetic resin. It is practically colourless and is fairly quick-drying. It is manufactured by Portland Plastics, Ltd., Wear Bay Road, Folkestone, Kent. We understand, too, that various cements of a similar nature are manufactured by Vinyl Products, Ltd., Butter Hill, Carshalton, Surrey.

Since you propose to lay the rubber in small mosaic-like pieces, we suggest that it might be well worth your while to go to the expense of using one of these synthetic resin cements, since they are quick-acting and do not stain.

Weather Indication Paint

I WISH to paint plaster figures with a composition which will turn pink or blue according to atmospheric changes. Can you tell me what this material is?—A. C. N. Weeks (Weston-Super-Mare).

DISSOLVE one part of cobalt chloride in three parts of water. Brush the resulting pink solution liberally on to the unglazed plaster figures, so that the figures absorb as much as possible of the solution and are tinged pink by it. Allow the figures to dry out slowly. The pink colour will persist in wet, humid weather, but in dry weather the coloration will change to blue. The colour change is reversible an indefinite number of times, but after this treatment the surfaces of the figures must not be varnished or lacquered, otherwise the colour change will not be manifest.

Cobalt chloride can be had from most pharmacies, or from any firm specialising in laboratory chemical supplies, such as Messrs. Griffen and Tatlock, Ltd., Kemble Street, Kingsway, London, W.C.2.

Re-staining and Polishing Furniture

I WOULD be grateful for your comments and advice on the cleaning off old stain and polish, and re-staining furniture. The use of ammonia 880 and caustic soda is effective, but I think too harsh.

My efforts at re-staining—although the cleaned woodwork appears free from old stain, polish and grease, etc.—are not always successful. I have used water and oil stains, oak colour usually, and I find a patchy appearance often results. How can one achieve an even shade?—P. Haxell (Ipswich).

QUERY SERVICE 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.

WE agree that a mixture of caustic soda solution and strong ammonia is far too harsh for polish removal from woodwork surfaces, since this mixture is liable to attack and soften the wood. It is far better to rely solely on ammonia, using it strong or dilute as occasion demands. The great advantage of this method is that the ammonia evaporates, leaving nothing in or on the wood which may subsequently be injurious to it. Hard polish is best removed by scraping, using for this purpose the upturned edge of a copper coin. This removes most of the bulk of the polish, so that the ammonia treatment afterwards need not be very vigorous or prolonged.

The trouble of unequal staining of the stripped woodwork is a common one. It can readily be caused by the presence of caustic soda in the woodwork, for this would tend to destroy the stain and also to increase the permeability of the wood in some areas for the stain, so that more stain is absorbed in these areas than in others. You will get much better results if you rely on the ammonia treatment only, followed by a speedy rinsing in cold water. The wood is then dried out and gone over thoroughly with fine sandpaper. Do not use water stains. These are absorbed very incompletely and unreliably. Use a spirit stain made by dissolving a dye or mixture of dyes in methylated spirit, or, alternatively, use an oil stain. The spirit stains are usually the better, however. Do not apply the stain too liberally. Use it thinly, endeavouring to get a good spread of the stain rather than a heavy colour. If the stain needs to be intensified (i.e., if it is not dark enough), repeat the process. This will give you an even shade.

Remember, however, that old wood sometimes undergoes internal changes, which render it unwilling to take stains evenly. One often comes across this sort of thing when re-staining antique furniture and it is a defect which is quite irremediable. The trouble, however, will not usually occur with furniture woodwork which is less than a 100 years old, but you can expect it on older woodwork of any kind. The two big precautions to take are to avoid the use of caustic soda, and to lay on the stain as thinly as possible.

Making Asbestos Cement Sheets

I AM greatly interested in the manufacture of asbestos cement sheets, ¼in. thick, measuring 8ft. x 4ft. Would you kindly let me have the composition of this, and method of making?—George Johnson (Worcestershire).

VARIOUS compositions are used for the making of asbestos sheets. A very good mixture is one of equal parts of powdered asbestos and Portland cement. This will give a high quality sheet. If necessary, a portion of the asbestos may be replaced by any other mineral filler, such as crushed stone, ground spar, etc. We advise you, however, to keep the asbestos content as high as possible, since this not only improves the quality of the material but also renders the sheets much less liable to crack. The mixture is merely slaked with water, as in making ordinary concrete, and then run out into sanded trays to a depth of about ¼in. On the large scale this is, of course, done mechanically.

Portland cement can be obtained from any builder's merchant. Powdered asbestos (medium coarse) is obtainable from any of the following firms:

Messrs. Turner Brothers Asbestos Co., Ltd., Rochdale, Lancs; Messrs. J. Milne Cooper and Co., Ltd., Kobar Works, Bradford, Yorks; Dick's Asbestos Co., Ltd., Cory Buildings, Fenchurch Street, London, E.C.3.; Asbestos and Engineering Products, Ltd., Winchester House, Old Broad Street, London, E.C.2; Messrs. A. M. MacCarthy, 37, Sandford Road, Moseley, Birmingham, 13.

Cleaning Mica

WE have an anthracite stove with 12 mica windows. These windows continually become sooted up and being very delicate to handle we are able to clean them only by scraping—which ruins them in a short time.

Could you suggest an acid or other preparation that could be lightly rubbed on to remove this accumulation of soot ?—H. W. Groves (Wilts).

MICA softens at extreme temperatures, and the dirt which adheres to it sometimes tends to become bound to the mica. Also, mica contains iron as an impurity. This oxidises and gives the indelible reddish-brown stain which the mica often acquires after prolonged exposure to heat. The surface dirt can be removed from the mica by brushing with a soft brush or by wiping with a cloth soaked in paraffin or solvent naptha. There is, however, no known acid which will actually dissolve carbon, and because carbon is the chief constituent of the adhering dirt, it follows that there can be no acid treatment such as you suggest. There is, in fact, no stain and dirt removing agent with which to treat mica. Strong hydrochloric acid would remove the red-brown stain of iron oxide, but the mica would have to be *boiled* in the acid, since iron oxide stains are most difficult to dissolve away after they have been exposed to high temperatures.

We think, however, that you will still have to have recourse to careful wiping of the dirt away from the mica windows, using scraping, perhaps, as a last resort. At the same time, the mica windows should not be too thin. You should be able to obtain better and thicker sheets of mica for this purpose from either British Mica Co., Ltd., Bedford, or from Mica and Micanite Supplies, Ltd., Mica House, Barmsbury Square, London, N.1.

Resistances for Stage Lighting

I WISH to make up some wire resistances to be used as dimmers for stage lighting. Please tell me the best type of wire to use and the amount required.

Dimmers are required for circuits carrying 480, 400 and 250 watts, also a main dimmer for a total wattage of 2,000-3,000 watts. The supply is 230 volts A.C.—E. W. Carr (Norwich).

THE resistance elements could be constructed from Brightray Nickel-chrome resistance wire, as supplied by Messrs. Henry Wiggin and Co. Ltd., of Wiggin Street, Birmingham, 16. The following sizes and lengths are suggested :

Capacity	Size	Length
480 watts	28 s.w.g.	27ft.
400 ,,	31 ,,	20ft.
250 ,,	34 ,,	20ft.
2,000/3,000 ,,	16 ,,	120ft.

The wire for the three smaller dimmers could be mounted on a metal tube, which is insulated with asbestos, and provided with a sliding contact. The life of the dimmer would be prolonged, however, if the wire was looped at intervals to contact studs on a tapping switch, instead of using a sliding contact. In any case a solid contact should be provided in the full on position. We suggest that the wire for the main dimmer be wound in spirals which are supported between porcelain or similar insulators in a well ventilated case of expanded metal or the like. The wire should be looped to a large number of contact studs on a tapping switch.

House Generator Switching System

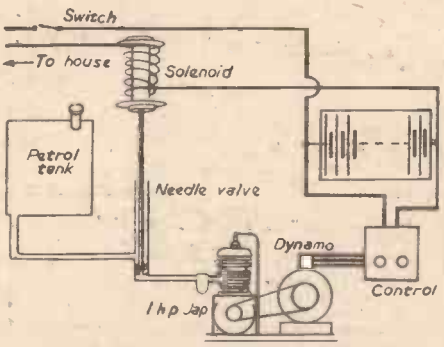
I GENERATE my own electricity by means of a 1 h.p. J.A.P. and Crypto dynamo (9 amp. 14-32 volt).

I have storage cells 30 volt 84 amp. hr.

My engine shed and batteries are 50 yards from the house (cable 7.029).

At night I wish to shut off the engine by stopping fuel supply—and *not* by means of ignition.

I hope to be able to fix an additional needle valve in the petrol supply line and to hold this needle off its seating by means of a solenoid energised when the engine is running (see sketch). The solenoid need not lift the needle. I am prepared to do that when I start the engine by hand.



Solenoid-operated needle valve.

Is it possible to wind a solenoid that will operate on limits of, say, 1½ amp.-20 amp. at 25 volt-40 volt?

If I can put this solenoid in the main supply line, a flick of my house switch would break this circuit and drop the needle which would remain dropped until lifted by me next day. Lights could be used in the night from the batteries without lifting the needle, as the gap would be too big for the solenoid.—E. R. Raymond Bond (Devon).

THE proposed scheme would appear to be practicable provided that little power is needed to hold the needle valve open. It would, of course, be important to use a coil of low resistance so that there would be little volt drop across the coil, otherwise the voltage at the house will be reduced, an important matter on a supply of low voltage. If you use an open type needle valve, as indicated in your sketch, a low resistance solenoid could probably be used. An alternative arrangement would be to use a small electromagnet, such as an electric bell movement, the lower portion of the armature having a small catch on which a hook on the needle valve rod rests when the valve is open and the electromagnet energised. In this case we would suggest that you rewind each bobbin of the electromagnet with about 16 turns of 15 s.w.g. wire, connecting the two coils in parallel with each other in such a way that the two poles have opposite magnetic polarity. Two disadvantages of the scheme as proposed are, first, there will be loss of power in the coil which will reduce the voltage at the house somewhat to a degree which depends on the load ; secondly, there will be a tendency for the valve to be released on light load.

If the wiring is not connected to earth at any point a possible alternative would be to use a spring loaded valve which was released and closed when a fairly substantial coil was energised, this coil being connected between one pole and earth. The coil could then be energised momentarily by means of a switch used to connect the other pole to earth in the house. This arrangement would have the advantage of reduced loss of power, it would be independent of the load, and would necessitate no interruption of the load when stopping the engine.

Immersion Heaters for Hot Water Tank

IS it possible to use two 1,500 watt type kettle immersion heaters in a house hot water tank and at what temperature should a thermostat be set at to cut-out?—H. Wright (Birmingham, 24).

PROVIDED the water supply is soft it would be a practicable proposition to fit two 1,500 watt kettle type immersion heaters in the hot water tank. We would suggest that the elements be mounted near together, but not touching, near the bottom of the tank. The thermostat could be set to switch off at 140 to 150 deg. F.

It is quite likely, however, that the life of these elements may be appreciably less than that of the standard type of immersion heater.

Removing "Potash" Stains

PLEASE inform me how to remove permanganate of potash stains from "Trubenised" poplin shirt collars.—J. Walters (Manchester).

THE removal of potassium permanganate stains is quite a simple matter and it can usually be done without any injury to the fabric.

Obtain 1 oz. of potassium metabisulphite. Dissolve a few crystals of this in a little warm water—say a third of a teaspoonful in an eggcupful of warm water. Or, alternatively, dissolve a like quantity of sodium sulphite in a similar amount of water but, in this instance, add a few drops of acetic acid to acidify the solution.

Either of these solutions may be used. The metabisulphite is to be preferred to the plain sulphite because it need not be acidified. Take a little of either solution up with a plug of cotton wool, and apply it repeatedly to the permanganate stains. The latter will rapidly disappear.

Afterwards, it is essential to wash the material most thoroughly in order to get rid of every trace of the chemical.

Both sodium sulphite and sodium metabisulphite are photographic chemicals. You will, therefore, be able to obtain either of them from any good photographic suppliers.

Information Sought

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

Drill-operated Food Mixer

I POSSESS a Wolf ¼in. power drill and wonder if it would be possible to use it to operate a home-made food mixer. The commercial attachment I have seen for this purpose is too expensive for me. Can you supply constructional details of such a device ?—T. FLAY (Bristol).

A "Cuckoo" Device

PLEASE send me details of a simple device for making the "cuckoo" sound of a cuckoo clock. If possible, I should like the sound to be louder than the usual clock cuckoo.—G. J. GALLEY (Sheffield, 8).

Motorising a Sewing Machine

PLEASE give me full details for motorising a treadle sewing machine, using, if possible, an ex-Government surplus electric motor. I am more interested in the mechanical and electrical side of this conversion than in the cabinet work involved.—G. ORD (Northumberland).

THE Cyclist
Editor : F. J. CAMM

VOL. XXV APRIL, 1957 No. 417

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

Phone: Temple Bar 4363
Telegrams: Newnes, Rand, London

WHAT I THINK By F. J. C.

The Oats

THE 1,000-mile amateur cycle race—the Oats—will not be held during 1957 owing to difficulties caused by petrol rationing and the non-publication of the Government's regulations controlling cycle road racing in Britain. Begun as an eight-day event in 1954, and organised by the BLRC, it rapidly became established, and particularly in 1955 and 1956, as the leading cycling event in Britain. It was a nine-day race in 1955, but reverted to an eight-day event in 1956.

BLRC Handbook for 1957

THE BLRC Handbook for 1957 has just been published at 2s., or by post, 2s. 3d. It deals with the rules and the races organised by the League and contains a list of clubs. It contains 140 pages. Orders should be sent to the BLRC, 169A, Brent Street, Hendon, N.W.4.

No Tax on Bicycles

THE Chancellor of the Exchequer has announced that there will be no tax on bicycles in the Budget. He has thus followed the practice of previous Chancellors. In the House of Commons it was stated that the revenue likely to be secured would not justify the cost of enforcement and collection. Successive Governments—Labour, Liberal, Conservative and Coalition—have each endorsed this view.

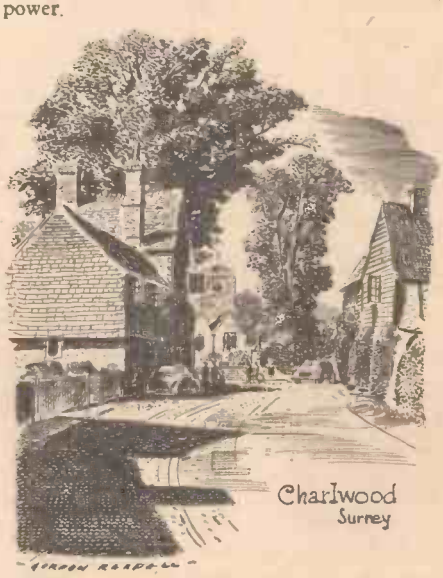
Death of Lord Hore Belisha

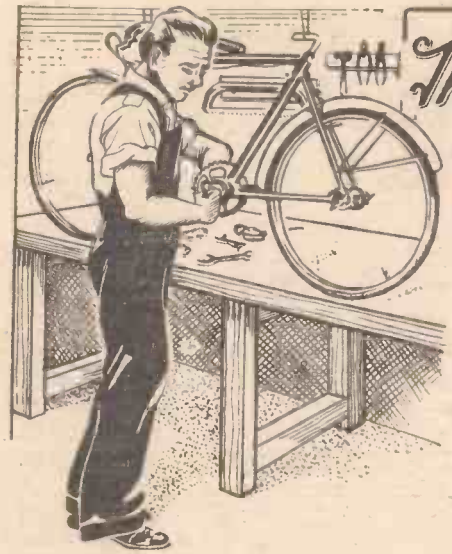
LORD HORE BELISHA, who died with tragic suddenness during February, was mostly noted for the introduction of the pedestrian beacons, as we prefer to call them (since he did not invent them, but imported the idea from overseas), and for his attitude towards the road problem when he was Minister of Transport. When he raised the speed limit from 20 miles to 30 miles an hour in built-up areas (which he was compelled to do under a regulation passed by his predecessor), he said that if a speed limit was necessary at all, 30 miles an hour was too high. He it was who gave pedestrians an absolute right of way on a pedestrian crossing, and I remember at the time taking this matter up with him with some vigour. I maintained that he had not the power to grant an absolute right of way to a particular section of the public on any of the roads, and that everyone, including animals, was free to use them on lawful occasions. I postulated a set of circumstances which puzzled him. I pointed out that if a motorist knocked down a pedestrian on a pedestrian crossing, the motorist was automatically guilty of manslaughter and that a plea of contributory negligence would not hold. It is well known that people commit suicide and thus invalidate insurance policies. Instead of jumping under a train, cutting their throat or taking poison, they merely have to step in front of a car on a pedestrian crossing to ensure a verdict of accidental death under which the insurance companies would be bound to pay. I remember that the debate ended up one evening in Hore Belisha's house and he was compelled to admit, as indeed legal friends of mine also agreed, that I was right. He did nothing about it, however, but it was noted that there was a general easing up thereafter of police activity on pedestrian crossings. In an article entitled "Is Hore Belisha a Friend of Motorists?", which I contributed to *Pearson's Weekly*, I drew attention to his various activities and statements which had led the motoring public to believe that he was an anti-motorist. He was especially in favour of cycle paths, and when the first was opened on the Western Avenue one of the cycling organisations declined the invitation to be present. The other used the occasion for propaganda purposes. Looking back on his term at the M.O.T., it cannot be said that he contributed very much to road safety. I am as opposed to pedestrian crossings and beacons as I am to cycle paths. He did, however, succeed in making the whole country aware of the seriousness of the accident problem, and by his introduction of The Highway Code, of which he was the sponsor, did much to force local councils to take action. He was a colourful and forceful character, and did not hesitate to express the views he held, however unpopular.

Bidlake Prize Awarded

I AM glad that Ray Booty has been awarded the Bidlake Memorial Prize for 1956 for his superlative ride of 3hrs. 58m. 28s. in the Bath Road Hundred. As I stated at the time, this was the first occasion upon which 100 miles had been ridden in under four hours on a bicycle in an out-and-home event. His speed averages over 25 m.p.h., an achievement of which some motorists might be proud.

His achievement in beating the four-hour mark for 100 miles was almost equalled by Wight in his 24-hour performance. Nineteen-fifty-six was undoubtedly a great year for cycling sport. Records and distance times were repeatedly smashed, and women showed a marked improvement in speed and staying power.





The Spring Overhaul

Dismantling : Cleaning : Repairs and Replacements : Reassembly

NOW is the time to dismantle completely, clean and overhaul the machine. It may have been laid up through the winter and heavily greased to protect it against rust or it may have been regularly ridden through all types of weather, but whichever is the case, an overhaul will be necessary before the summer season.

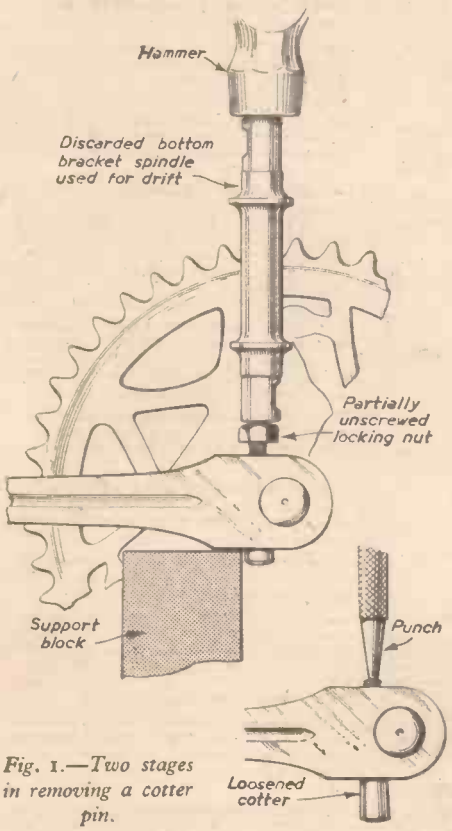


Fig. 1.—Two stages in removing a cotter pin.

Preparations

In addition to a full array of tools necessary for complete dismantling, five or six old tins, some paraffin and several pieces of clean rag will be required. It is advisable, too, before starting the work to apply a barrier cream to the hands as a protection against grease and dirt.

Dismantling

To make a thorough job this must be done completely. The saddle pillar and saddle may be removed as one, and the handlebars and extension. Brakes should be taken off in one piece and accessories, such as lamps and pump removed and laid aside. The chain is removed by undoing the spring link and placed in one of the larger tins. The cranks are dismantled next and this is done as shown in Fig. 1. Take the wheels out and then the mudguards, this being followed by the major operation of dismantling the headset and bottom bracket. All the balls and ball-races, etc., are placed in one of the tins and all the parts of the bottom bracket in another. Finally, the wheel hubs are taken down and the parts from each placed in separate tins, the parts from the pedals occupying the final tin.

Cleaning

Into all the tins containing ball-bearings, etc., tip paraffin to cover and leave to soak. When the chain has thoroughly soaked in its bath of paraffin clean it with an old toothbrush, wash in some more clean paraffin and hang it up to dry. Clean the accumulated mud and grease from the frame with paraffin and dry with a clean cloth.

Rust can usually be removed from the chainring and cranks with a paraffin-soaked rag, but there are proprietary rust removers available for tackling more stubborn corrosion. The same sort of treatment will remove most of the dirt, rust and grease, etc., from the rims and, provided that the rust has not gained too firm a hold, the original chrome-work should be completely restored. Caliper brakes must be completely dismantled to be cleaned properly.

A stiff brush is best for removing the accumulated dirt from the inside of the mudguards. The celluloid type of guard can be finally cleaned by washing in warm water and a detergent, while the aluminium alloy type can be restored to brightness by means of wire wool and metal polish.

Repairs and Replacements

Pump up the inner tubes and hang them in a dry corner so that punctures may be detected and attended to. Inspect the tyres for embedded flints, which should be removed and the holes filled with a stopping compound. Tyres that are badly worn or perished should be replaced at once—trying to make them last just another few months is never worth while.

Dry and clean up all the cones, washers, races and balls and inspect them for wear. A ball-cup that is pitted as illustrated in Fig. 2 should be replaced, but a polished track which often appears in races, should not be confused with wear. Worn balls have a rough, pitted or chipped surface and should be renewed. Wheel and pedal cones should also be examined for pitting in the same way.

Replace brake cables which are frayed—do not wait for them to break. This is a good opportunity too for replacing worn brake blocks. Examine the chainring and rear sprocket for wear and test the chain as shown in Fig. 3 for stretching and side flexibility denoting loose side plates. Make sure, too, that the chainring has its full complement of pins.

This is a good opportunity too for examining the frame enamel for worn and chipped places. These should be retouched with a good cellulose paint.

Reassembly

This should be done in approximately the reverse order to dismantling. Refit the bottom bracket first, setting all the ball-bearings in thick grease or petroleum jelly and making sure that the correct number of balls is replaced. Adjust so that the bottom bracket spindle can be turned in the fingers without any tight spots, while at the same time there is no play.

Replace the wheel spindles, taking the same care to set the bearings properly, and achieving fine adjustment as in the bottom bracket. Remember, however, that the fixed cone is always replaced on the right hand or "off" side of the machine, facing forward. Before the tyres are replaced, spin the wheels and test the rims for truth. If necessary, correct any defects with a spoke key, not forgetting to file off any protruding spoke ends inside the rim.

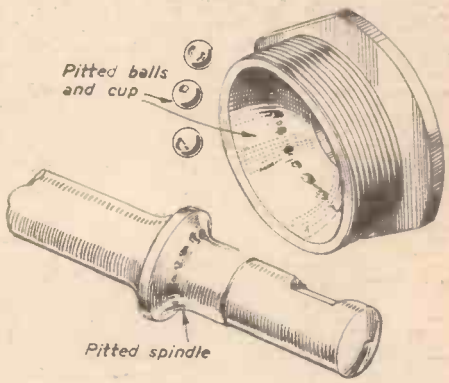


Fig. 2.—A pitted bottom bracket spindle and cup.

Replace tyres and tubes and inflate. Now fit the wheels back in the frame temporarily.

The chainwheel and cranks are put back next, only using the old cotter pins if they are not badly worn. Replacement cotters must be filed to fit—a job which can only be done satisfactorily in a vice.

The pedals must be replaced next, setting the balls in clean grease and taking care to achieve a fine degree of adjustment. Put the mudguards back, loosening the wheels if necessary. At this point the chain may be thoroughly greased and oiled and replaced, taking care to achieve right chain tension—approximately ¼in. of slack.

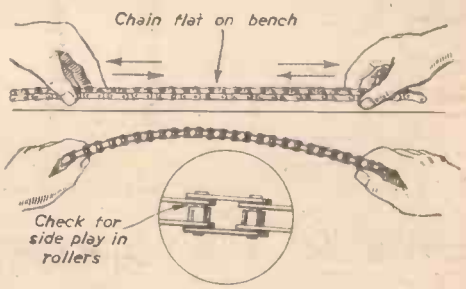


Fig. 3.—Testing chain for stretch, rivet and roller wear.

Grease the saddle pillar and handlebar extension before replacing them, so that they will come out easily next time. Replace and adjust the brakes, but before replacing the cables either grease the inner wire or squirt oil down the outer cable until it runs out the other end.

Finally, check all points of adjustment and all nuts to see that they are properly tightened, give a final clean and polish and the machine is ready for the road.

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Just connect with twin flex for 2-way conversation. 9/- per pair. Twin Flex 4½d. yd. Post 1/6. One pair each end will avoid changing over from mouth to ear. 18/-. Two pairs each complete with cord, plug & socket. 27/6.

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BELL SETS.—G.P.O. type. 25 available at 17/6 each. **RINGING GENERATORS** for same, 10/6, post 2/-.

BATTERY CHARGERS.—Output up to 22 v. 10 amps controlled by two 4-position rotary switches for fine and coarse control. Input 200/250 v. A.C. 50 cy., fused for A.C. & D.C., clear, scaled ammeter. Brand new, made by S.T.C. £17.10.0., carriage 15/-.

CHARTBOARDS.—With pantograph arm, perspex scale, protractor head as used in the R.A.F. for navigation purposes, 17" square. Brand new, will make a useful drawing board. 25/-. post 3/-.

HEADPHONES.—High resistance 4,000 ohms. Type CHR. 12/6 pr., post 1/6.

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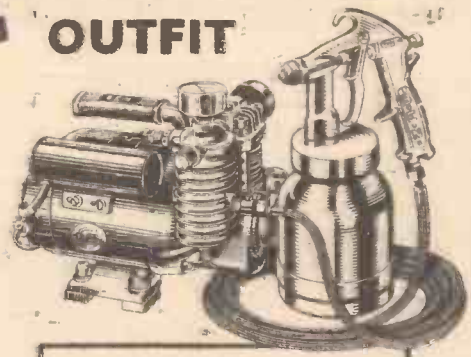

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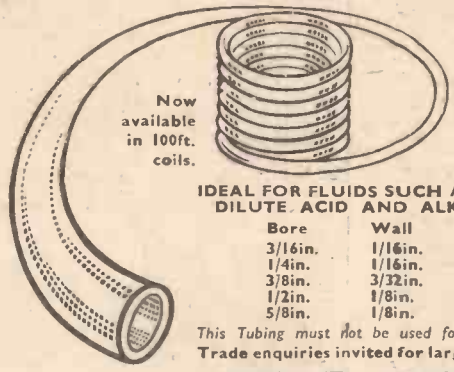

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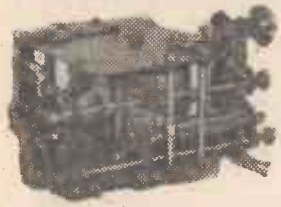

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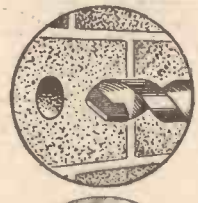

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