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PRACTICAL MECHANICS

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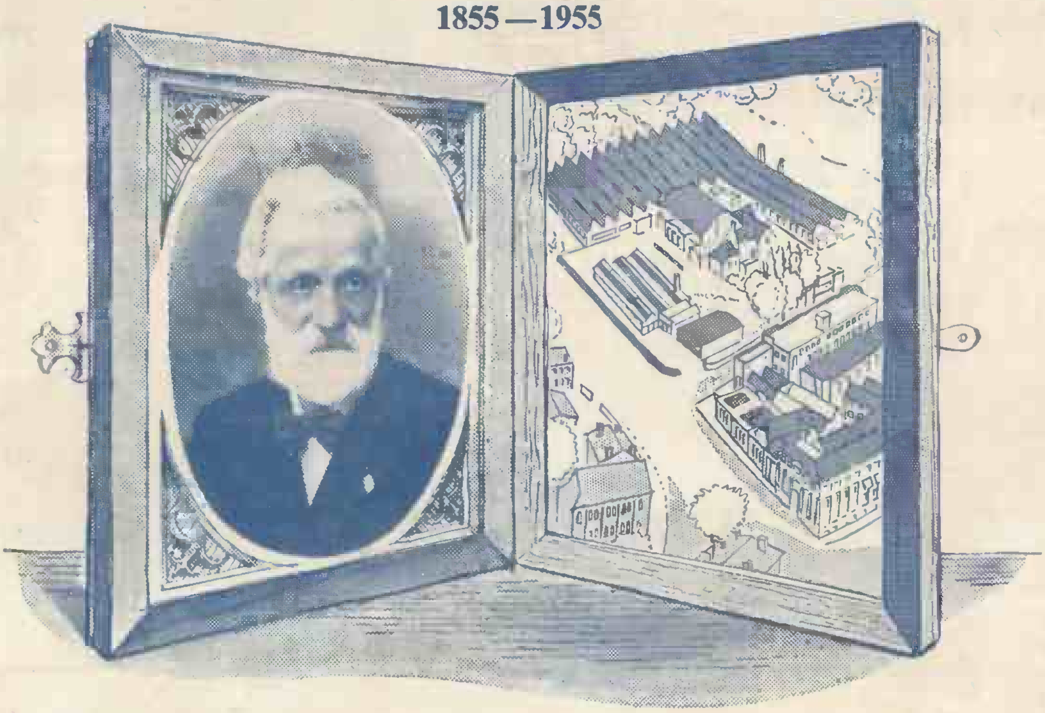
EDITOR: F. J. CAMM

SEPTEMBER 1955

1855—1955



Victorian ...WITH VISION

IT WAS 1855 . . . Balaclava, Sebastopol, the Alma, were making the headlines . . . the Great Exhibition was still fresh in men's memory . . . and a young Herbert Terry was hanging out his sign as "Maker of Presswork and Springs".

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He chose well his locale . . . in Redditch, where the green Worcestershire fields march with Shakespeare's county, near Birmingham, the growing manufacturing centre of Victorian England. The world of 1855 was very much an enterprising young man's oyster . . . the Industrial Revolution in full flood . . . overseas markets opening with every packet that sailed . . . new trades, new outlets for his wares.

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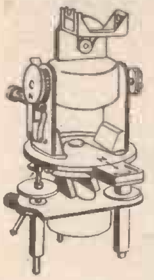

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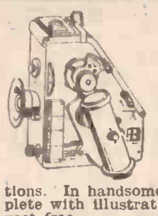

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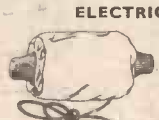

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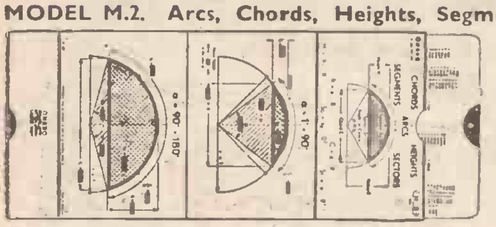

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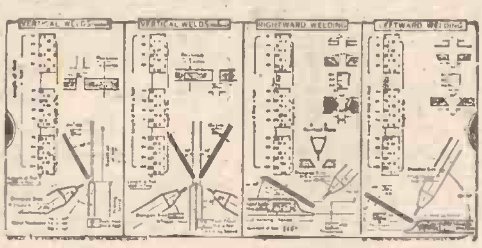

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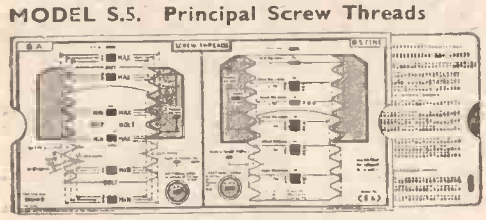

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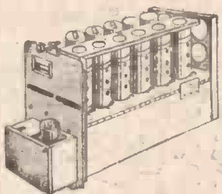

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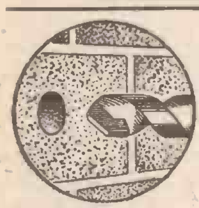

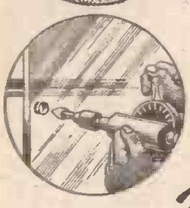

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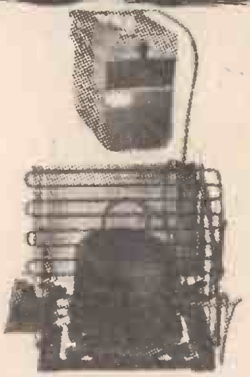

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PRACTICAL MECHANICS
The "Cyclist" and "Home Movies" are temporarily incorporated
VOL. XXII. No. 261
Editor: F. J. CAMM
SEPTEMBER, 1955

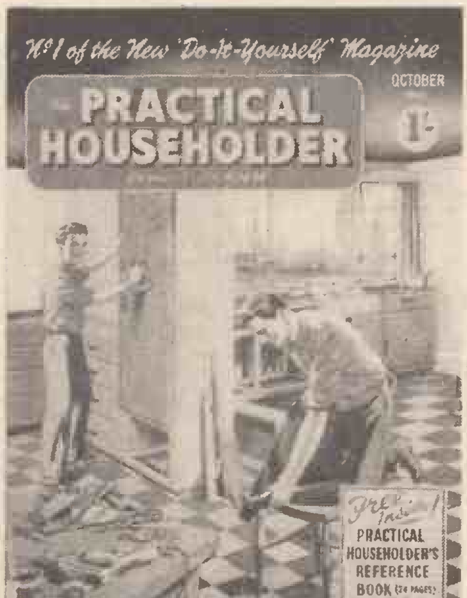
"The Practical Householder"—Our New Companion Monthly!

ON September 8 we shall publish the first issue of *The Practical Householder*, an illustration of the cover of which is shown on this page. The newcomer joins our group of practical journals to cater for the pressing need for a monthly magazine that will co-ordinate the "do-it-yourself" movement now sweeping the country and now catered for by an important and growing industry. It will deal with every practical aspect of the household and its equipment. It will teach you how to lay linoleum, repair and maintain the hot-water system, build a shed or garage, tile a roof, install and repair electrical apparatus, refrigerators and vacuum cleaners, how to re-upholster the suite, overhaul the sewing machine and the lawn mower, how to re-enamel a bath, make furniture, do painting, graining and wall-papering, lay and repair brick work, lay crazy paving, and how to make home fitments, even to build your own house, to mention but a few of the subjects with which it will deal. As with PRACTICAL MECHANICS, the text will be illustrated on a generous scale.

The wide scope covered by PRACTICAL MECHANICS does not afford sufficient space for us to include all the articles in demand by practical householders. We have in the past described the construction of pieces of household equipment, but the flood of enquiries made it evident that this reader interest could only be satisfied by publication of a separate journal.

In every copy of the first issue is a 24 page pull-out booklet entitled "The Practical Householder's Reference Book," containing facts and figures about wall paper, paint, glass, screws, french polishing, brickwork, slates, tiles, electricity, gas, and dozens of other subjects. It is a valuable booklet which will be preserved for daily reference.

We shall deal more fully with the new journal next month, but it is essential to place an order with your newsagent for its regular delivery *now*. In these days of economy of paper we only print copies ordered by newsagents, and you will help your newsagent to assess demand by going to him to-day and placing a regular order with him. We are giving readers this early opportunity of avoiding the disappointment experienced by thousands of readers of our other companion journal, *Practical Motorist and Motor Cyclist* (sales of which now exceed 275,000 copies each month), who were unable to obtain the early issues because they failed to take this elementary precaution.



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To the Moon ?

THE simultaneous announcements by America and Russia that they will launch within two years experimental satelites which will encircle the earth at a speed of 18,000 miles an hour to provide data for the larger venture of a voyage to the moon, provides the answer to all those captious critics who thought that moon ships were moonshine. It is over fifty years since H. G. Wells first published his famous, almost prophetic novel "The First Men in the Moon," a story based on sound scientific principles, and it will be interesting to see how far his prophecies come true. He forecast radar over forty years before it was produced and he was right not only to the year, but to the month.

It is disappointing that this country, which pioneered the new science of astronautics and inter-planetary travel, should be lagging behind in this interesting and most imaginative venture. At present, we are restricting our activities to the launching of rockets to an altitude of about 60 miles from the Woomera district of Australia. We have the knowledge and the ability to produce artificial satellites : what is lacking is a Government order to proceed. The country which first succeeds in landing on the moon will gain enormously in scientific prestige. It is a pity that our scientific team cannot be directing a portion of its time to this fascinating new field which opens up enormous possibilities. Neither the U.S.A. nor U.S.S.R. has greater knowledge of the subject and of the problems involved than England.

I.T.A. Converter

A FREE blueprint showing the construction of a very efficient I.T.A. converter to enable standard television receivers to pick up the commercial TV programmes is included in every copy of the October issue of our companion journal, *Practical Television*, now on sale. The October issue of P.T. now has the first of the new three-colour covers.—F. J. C.

RADIO CONTROLLED MODELS

2.—A Single-valve Super-regenerative Receiver

By MEMBERS OF I.R.C.M.S.

IN the first article in this series it was explained how a model boat could be steered by the operation of a single relay. It is the job of the receiver in the model to operate this relay and for reliable operation the receiver should be designed to give the biggest current change possible within the limits of the batteries carried. A drop from 3 mA down to, say, 1 mA is sufficient to ensure good clean operation of the contacts of most sensitive relays, and, of course, some of the special polarised versions which can be bought will work on much less.

A receiver for model control must be light in weight yet robust and capable of giving the required current change on receipt of a signal. A very popular receiver for some time was the soft-valve type making use of a gas-filled miniature thyratron. For aircraft use this type can still not be beaten, mainly on the score of lightness, but for model boat work the hard-valve receiver is to be preferred, as it gives a much longer valve life and is more stable in operation.

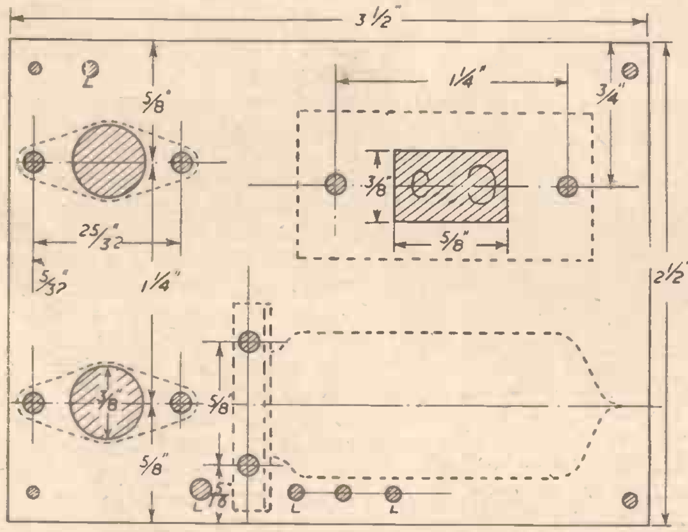
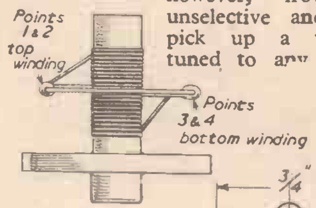


Fig. 1.—Drilling plan for single-valve model control receiver. The drawing is full size. Holes marked "L" are for leads

The receiver is of the super-regenerative type characterised by a high frequency oscillator, tuned to the transmitter, which is thrown in and out of operation at a much lower frequency called the quench frequency. When the transmitter is switched on the operation of the receiver is modified and the anode current falls from a standing value of 3 or 4 mA (according to H.T. voltage) down to approximately 1 mA or slightly less. For reasons already explained the bigger the drop the better. In fact, the super-regenerative receiver is a truly remarkable device, as with only one valve it can equal the signal amplification of a multi-valve superhet and at the same time produce the necessary current change to work the relay. It is, however, notoriously unselective and it will pick up a transmitter tuned to any frequency in the 27 Mc/s model control band. For our purpose at present, however, this is a good point as it simplifies the transmitter design and eases the always present problem of going out of control.



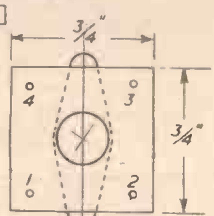


Fig. 2a.—The tuning coil (wound with two 10-turn windings of 24 s.w.g. enamelled copper wire) and the paxolin terminal board.

Construction

The prototype of the receiver was built on a paxolin base $3\frac{1}{2}$in. $\times$ $2\frac{1}{2}$in. $\times$ 1/16in. thick, but this can be reduced if space is very tight. However, it is not recommended that the design be altered if this is the reader's first attempt. Commence by drilling the base in accordance with the plan given in Fig. 1. The two $\frac{7}{8}$in. diameter holes at the bottom are to take the two $\frac{1}{4}$in. diameter Aladdin formers and the rectangular hole above is for the tuning meter socket, which should be of the two-pin polarised type (i.e., one thick and one thin pin). The valveholder, which is of the B7G type, should be mounted on a small

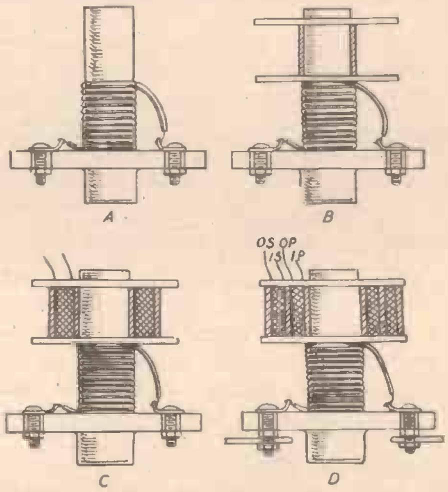


Fig. 2b.—The build-up of the sensitivity and quench coil unit. A.—Winding the sensitivity coil. B.—Mounting Paxolin discs. C.—Quench coil primary winding. D.—Quench coil secondary completes coil.

A selection of batteries suitable for radio control use. Top row left to right—(a) Cycle lamp battery—suitable for steering motor and general intergear work. Can also be used for driving small boats. (b)—Type D18 1.5 volt cell—an excellent L.T. source for single-valve receivers. (c)—U.2 unit cell—can be connected in parallel to provide L.T. for multi-valve receivers or transmitters.
Bottom row left to right.—(a) — Small type Nife battery (2.5 volts) makes a good small current battery for intergear work. It is rechargeable. (b) (c) (d) (e)—Deaf-aid type H.T. batteries suitable for receivers 30 volts (with plug), 30 volts, $22\frac{1}{2}$ volts and 15 volts respectively. (f)—Larger type of Nife battery (Type 5J1961). This is a first class battery for all intergear and drive motor work (2.5v.).

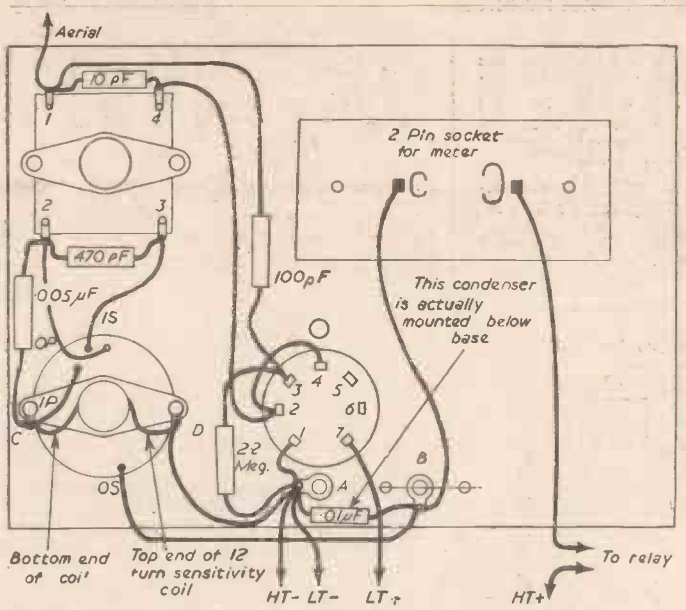


Fig. 3.—Wiring diagram of single-valve model control receiver. For clarity, the valveholder is shown mounted flat. Note that this drawing shows the quench coil leads as being brought out through holes. The text describes an alternative, simple method using a radial slot.

aluminium angle bracket so designed that the valve (1S4) will lie flat, spaced about ¼in. above the paxolin. The valveholder should be fastened to the bracket, but not mounted on the paxolin until the wires have been attached. The next stage is to make the coils, of which there are three—the tuning coil, the quench coil and the sensitivity coil (see Figs. 2a and 2b).

The Tuning Coil

This consists of two ten-turn windings of 24 s.w.g. enamelled copper wire placed one above and one below a paxolin terminal board. The board, which is ¾in. square, should be cut first from 1/16in. paxolin. The centre hole should be drilled out to about 3/16in. diameter and then carefully filed so as to be a tight fit on the ¼in. diameter Aladdin former on which the coils are to be wound. Four 1/16in. diameter corner holes should then be drilled to anchor the ends of the coil windings. Position the paxolin approximately half-way down the former with the sides of the square parallel to the base of the former. Now with the former base in 12 o'clock/6 o'clock position mark the bottom right-hand hole in the paxolin "2" and insert the end of a length of 24 s.w.g. enamelled copper wire previously stripped for about ½in. of its insulation. The end should be brought round and pushed through the hole again, then pulled tight, so as to make a firm anchorage and soldering point. Now wind on ten turns in a clockwise direction up the top half of the former (looking down on the coil) and cut off the wire, leaving about 1½in. to spare.

This should be stripped, then pushed into the bottom left-hand hole in the paxolin and a firm anchorage made as before. Mark this point "1." The process should be repeated for the second coil wound on below the paxolin, starting at the top right-hand hole (mark "3") and terminating at the top left-hand hole (mark "4"). Note that the coil wound below the paxolin board should be wound on in the anti-clockwise direction (looking from the top of the former). The effect of this is that if Nos. 2 and 3 are joined together we should have one continuous coil from top to bottom (i.e., it would not change direction in the middle).

Sensitivity Coil

This is also wound on a ¼in. diameter Aladdin former. Commence by bolting two small solder tags to the base of the former through the two mounting holes. If the bolt shanks point downwards it will be possible to mount the coil later by using two more nuts. Solder a length of 24 s.w.g. enamelled wire to one tag and commence winding a 12-turn coil up the former in a clockwise direction, keeping the turns together and as close to the bottom of the former as possible. Terminate by soldering to the other tag. It is important that this winding is kept down the former as the quench coils are to be wound on the top half (see Fig. 2b (A)).

Quench Coils

Make two 1/16in. paxolin discs about ¾in. diameter and carefully make a hole in the centres so as to be a tight fit on the top of the sensitivity coil just wound. One disc should be sawn through from perimeter to centre at one point only, later to take coil leads. It will be found that this procedure also makes the disc easier to fit to the former as it permits a little flexibility. Push the uncut disc down on top of the sensitivity coil, then wind on about 3 turns of paper strip ¼in. wide so as to make a spacing washer to separate the other disc, which should then be mounted and glued in place (B). Now remove the tuning slug and push a large bolt through the former. Fasten with a nut and hold the end of the bolt in the chuck of a drill. This arrangement permits the quench coils to be wound in a matter of a few minutes.

The primary should now be wound on and it consists of 350 turns of 36 s.w.g. wire. Leave about 3in. of wire for connecting up later and label the start "IP" (Inside Primary). Depending upon the gear ratio of the drill for the number of revolutions required, then wind on the coil and label the end of the winding "OP" (Outside Primary). The wire ends should pass through the sawcut on the top disc (C). Insulate the winding with sellotape or paper (about 3 layers) and wind on 150 turns of 36 s.w.g., in the same direction, to form the secondary. Label the start "IS" (Inside Secondary) and the finish "OS" (Outside Secondary). A layer of paper completes the coil, as shown in Fig. 2b (D).

The components should now be mounted on the base as shown in Fig. 3, with the exception of the valveholder on its bracket which should be wired up first, when the tags are more accessible.

Using 22 s.w.g. tinned copper wire and pieces of 1 mm. Systoflex insulated sleeving, commence wiring the valveholder. Numbering the valve pins 1 to 7 counting from the gap clockwise round the circle and looking at the connecting side.

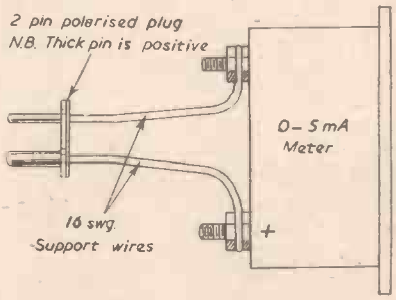
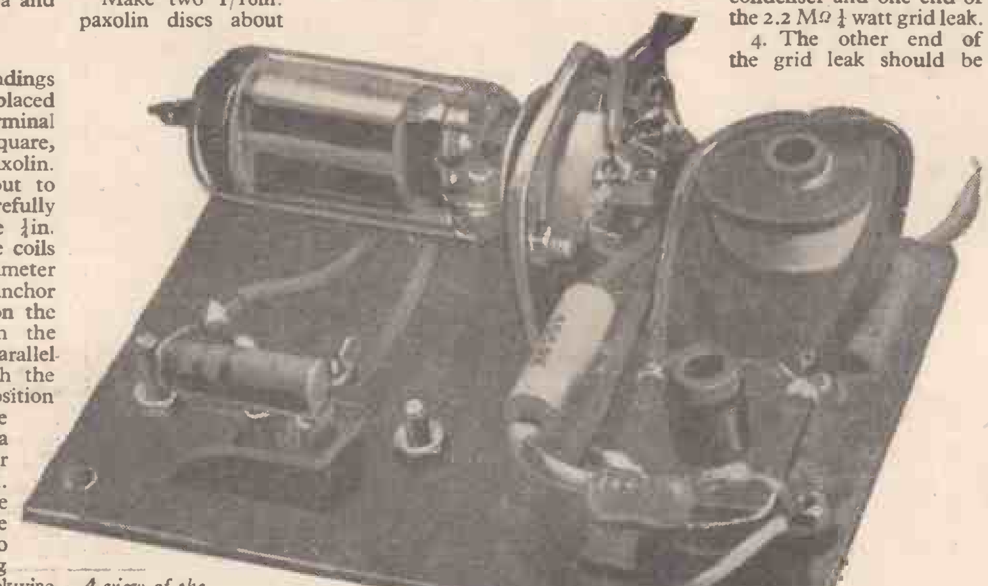


Fig. 4.—The two-pin polarised plug.

1. Join pin 1 to a solder tag fixed under the bolt, holding the valveholder to the bracket (A in Fig. 3).
2. Join pin 2 to pin 4 and join a 3in. length of wire to pin 2 for later connection.
3. To pin 3 join one end of a 100 pF grid condenser and one end of the 2.2 MΩ ¼ watt grid leak.
4. The other end of the grid leak should be soldered to solder tag "A."
5. To pin 7 solder a 12in. length of flexible wire for the L.T. positive connection.



A view of the completed one-valve receiver.

The valveholder and bracket can now be mounted on the base with 6 BA nuts and bolts and the remainder of the wiring carried out as follows:

6. From pin 2 of the valveholder, connect the wire mentioned in "2" to point No. 4 on the tuning coil.
7. To point No. 1 solder a short length of flexible wire to which the aerial is to be attached later and connect the other end of the 100 pF condenser.
8. Between points 1 and 4 connect a 10 pF ceramic condenser.
9. Between points 2 and 3 connect a 470 pF ceramic condenser.

10. To point 2 solder one end of a 0.005 μF condenser and join the other end of it to the solder tag fastened under the mounting bolt of the sensitivity coil (C in Fig. 3).

11. To the other tag of the sensitivity coil (D in Fig. 3) join a short piece of wire and connect to tag A.

12. Now wire the quench coils as follows: OS—to a solder tag bolted to the paxolin base (B in Fig. 3).
IS—to 3 on the coil.
OP—to 2 on the coil.
IP—to tag C in Fig. 3.

13. Between tags A and B solder a 0.01 μF condenser. In the original this was mounted below the base for convenience.

14. Join B to the small pin of the meter socket.

15. To the large pin of the socket attach a flexible lead to be connected to the H.T. battery via the relay connections.

16. To tag A join two flexible leads for H.T. and L.T. negative.

The wiring is now complete. A 0-5 mA meter is essential for testing and it should be attached to a 2-pin polarised plug as shown in Fig. 4 for easy insertion in the meter socket. Note that when the meter is withdrawn the circuit is broken and it is therefore necessary to replace it with a similar 2-pin plug which has been shorted out by a loop of wire. Alternatively the socket can be bridged by a 220 Ω ½-watt resistor, which obviates the need to use a shorting plug but which slightly reduces the meter readings. The latter course is the better.

To test the unit it is obviously necessary to have a transmitter (which will be described next month), but if one can be borrowed in the meantime the receiver can now be tested.

Attach approximately 30in. of wire to the short aerial lead and connect up to the battery supplies. A single type D18 cell with a plug top connection makes a good L.T. source (1.5 volts) and two B105 30 volt deaf-aid batteries connected in series to give 60 volts are suitable for H.T. Alternatively a combined H.T./L.T. type battery can be used.

PARTS LIST

1 small sheet of 1/16in. thick paxolin.
1 type 1S4 valve.
1 B7G valveholder.
2 ¼in. Aladdin coil formers with tuning slugs.
1 quench coil unit—see text.
1 2.2 MΩ ¼ watt grid leak resistor.
1 100 pF ceramic condenser.
1 10 pF ceramic condenser
1 470 pF ceramic condenser
1 0.005μF midget paper condenser (or ceramic).
1 0.01μF midget paper condenser (or ceramic).
1 2-pin polarised meter socket.
2 plugs for the above (or else 1 plug and a shorting resistor of 220 ohms—see text).
22 s.w.g. tinned copper wire for connecting up.
1 mm. Systoflex insulated sleeving.
24 and 36 s.w.g. enamelled copper wire for coils.
Nuts, bolts, tags, solder, etc.
Approximate cost of the above parts: Not more than £1, plus cost of valve 7s. 6d. to 8s. 6d., if bought through advertisement columns of *Practical Wireless* and *Practical Television*. (The £1 stated is for all new parts.)

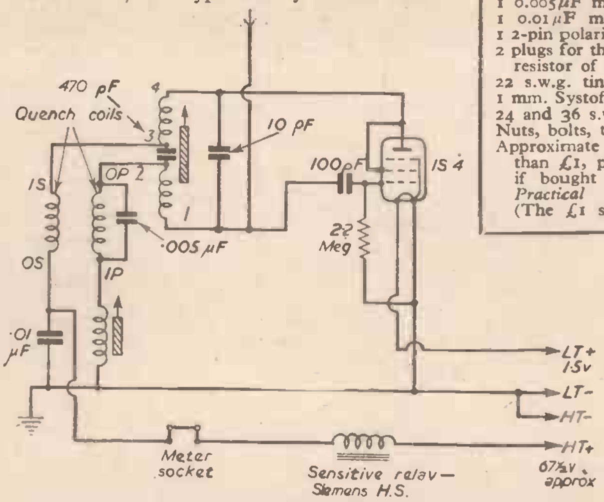
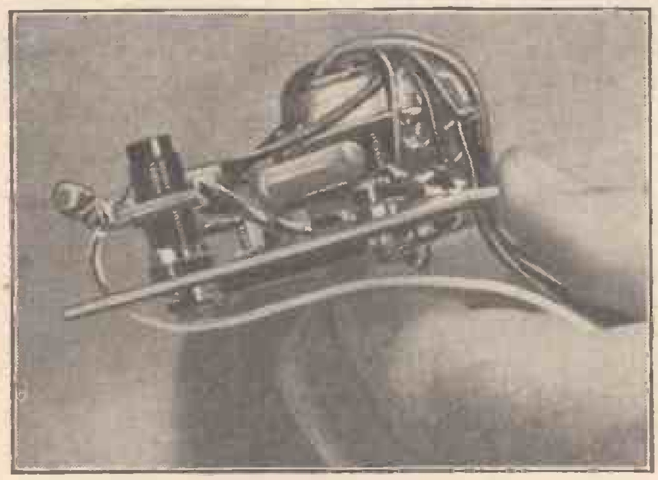


Fig. 5.—The theoretical circuit.



A further view of the completed receiver.

The relay (Siemens 3,400 ohm) is placed in series with the H.T. positive connection and the receiver. Plug in the meter and the 1S4 valve, when a reading of approximately 32 mA will be obtained. If it is lower screw out the slug of the sensitivity coil until this reading is obtained.

The transmitter (which should be accompanied by the licence holder) should then be switched on and the tuning coil slug adjusted until a drop is obtained on the meter. The sensitivity coil slug should then be screwed in until maximum drop is obtained, but this should not be overdone as it will be found that the current will not then rise when the transmitter is switched off.

All receivers of this type are sensitive to aerial length adjustments and experiments should be carried out by cutting down the length given in stages of 3in. at a time until the best results are obtained. It may even be found that a longer length than 30in. is necessary. The aim should be for a drop from about 3½ mA down to below 1 mA. Using 90 volts H.T. an even greater change can be obtained, but is not really necessary.

Range tests should be carried out at the full normal operating distance, which in the case of boats can be taken to be about 100 yards maximum due to the difficulty in seeing the models' movements satisfactorily at much greater ranges.

Increasing the Tuning Range

Many receivers of this type have been built and operated and the design has always proved very successful. However, if you find that the receiver will not quite tune into the model control band replace the 10 pF condenser with a Philips "Bee-hive" 3-30 pF trimmer and work this in conjunction with the tuning slug. The two variables will now enable a greater tuning range to be covered and the receiver should operate satisfactorily. Readers will quickly learn how to handle the tuning adjustments of the receiver, but a little patience may be necessary before the correct combination of control positions and aerial length is achieved.

For tuning up use the end of a plastic knitting needle or crochet hook which has been filed to a screwdriver shape as these receivers are very sensitive to hand capacity effects.

Next month we will describe a two-valve transmitter unit which will work very satisfactorily with this receiver.

Desalting Water by Solar Energy

Australian Engineer's Invention

An ex-marine engineer living at Neutral Bay in Sydney claims to have perfected a method of distilling brackish water, using the sun's rays for power, which is both cheap and effective. Mr. Brunt uses a device of his own invention which is very like a glasshouse in appearance and which he calls the "Solaray."

Working Details

The size of a Solaray machine to produce 600 gallons per day at 90 deg. F. is 100 x 7ft.; as the sun gets hotter the machine works faster. The Solaray starts to work when the atmospheric temperature reaches 40 deg. F. and increases as the temperature rises; it boils at about 120 deg. F. sun temperature. Then the output of distilled water would be over 1,200 gallons per day, heating area is 2,200 sq. ft., total heat obtained from the sun's rays 896,940 B.T.U.s per hour.

Principles

The Solaray machine combines an evaporator, a heat exchanger and condenser, all tuned in harmony to the wave-length of the infra red and cosmic rays by a special type of plate glass to reflect and concentrate the solar energy.

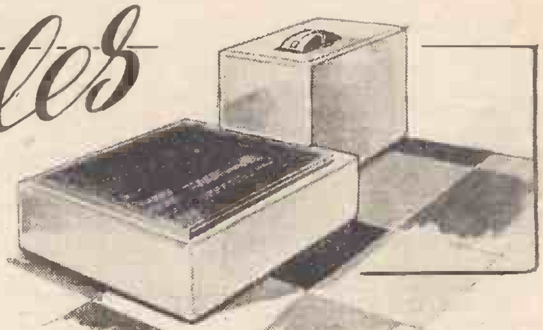
The inventor is installing these machines on stations in Australia for stock and all drinking water uses and has received orders for machines to produce 12,000 gallons per day for some big sheep stations.

He has also discovered that by a method of blending the distillate and brackish or salt water back together, a great reduction in size of plant can be obtained. Sheep will take up to two ounces of salts per gallon, cattle one and a half, and horses one ounce per gallon.

The inventor says that he has had it working on a day when no sun was visible but humidity was very high; hot winds will also make the machine operate.

The ideal installation would be on a hill when impure water could be gravitated into the machine from above, the pure distilled product running into a storage tank at the lower end. If the machine is built on the level a small pump could be used to fill an overhead tank with impure water, or as an alternative an underground reservoir could be used for the pure water.

Making Bathroom Scales



By G. F. PAYNE

Drawings and Notes on Construction for a Suggested Design

THE easiest method of building reasonably accurate bathroom scales is to construct a device which employs a spring balance and a lever system which gives a ratio of 14 : 1, thus pounds weighed on the balance equal stones on the platform. A 20 lb. spring balance should be adequate.

The drawings should be self-explanatory, but a few additional notes will be of use to the constructor. Figs. 1 and 2 are front, side and plan elevations, showing general arrangement details.

All the outer framework, the platform and the fulcrum blocks are of seasoned oak, cut to the sizes stated, and all edges are dead square. Screws used in oak should be of brass, and steel in contact with it painted, as oak will corrode ferrous metal very quickly.

The levers and links are of strip steel cut to the sizes given and bent whilst hot; the drilling of holes should be done after bending.

All bearing edges are well rounded, i.e., on fulcrum plates and connecting links (Fig. 3 (A), (B) and (C) and Fig. 4).

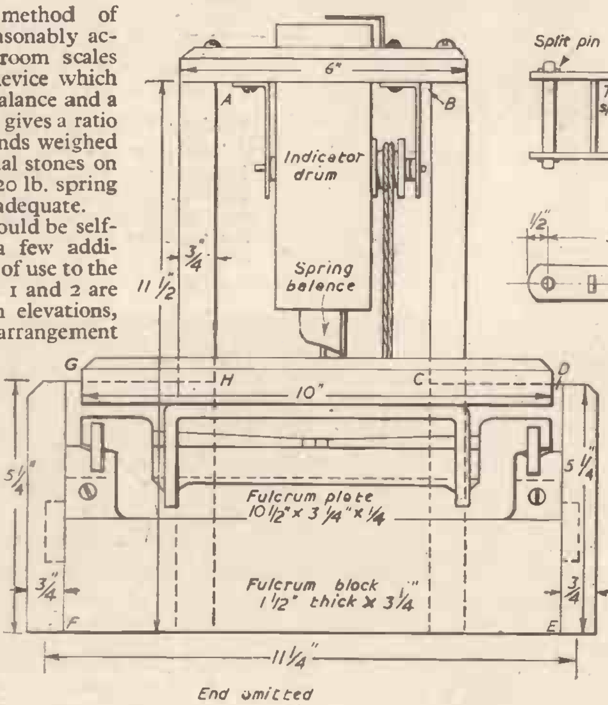


Fig. 2.—Front elevation, showing general arrangement details.

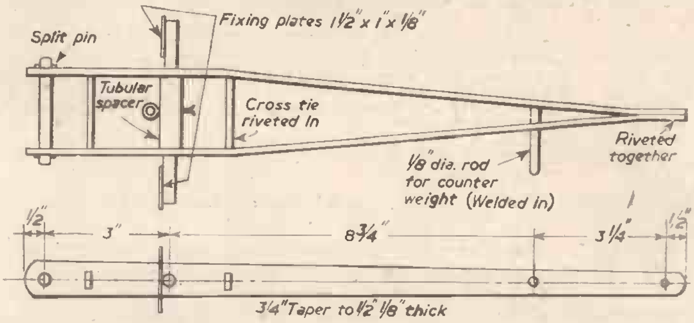


Fig. 5.—Details of the main lever.

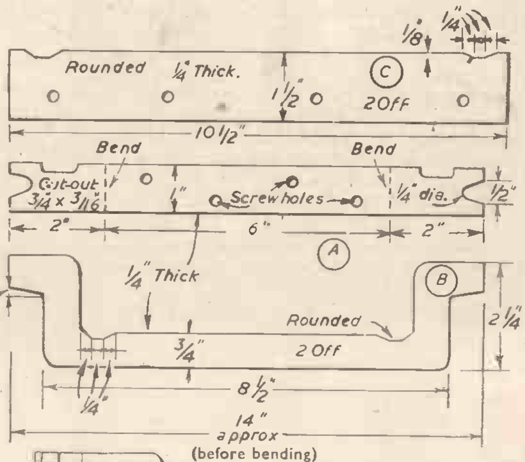
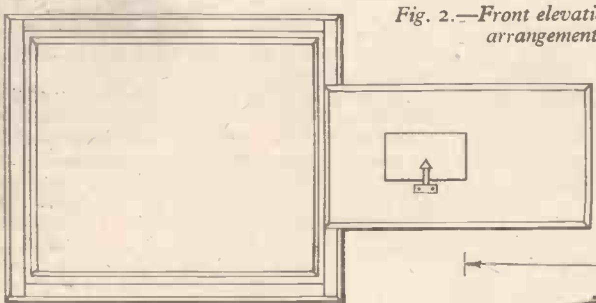


Fig. 3 (Right).—Details of fulcrum plates and connecting links.



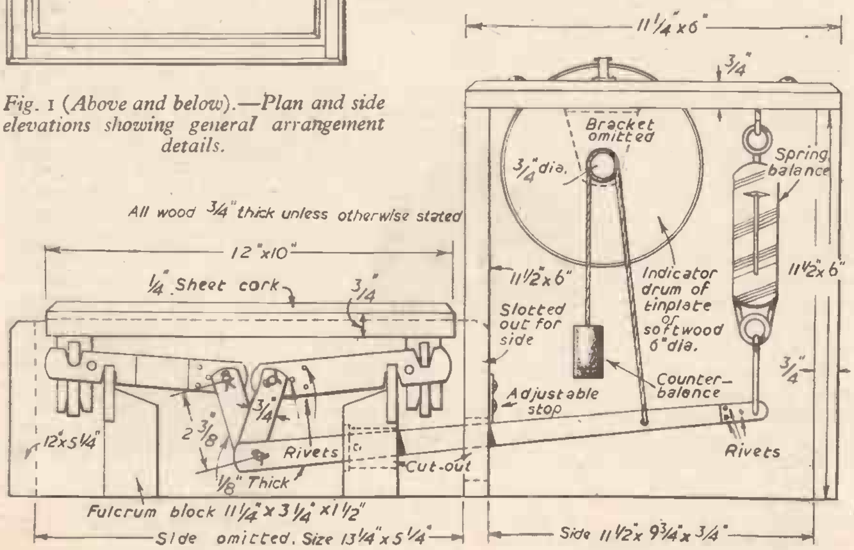


Fig. 1 (Above and below).—Plan and side elevations showing general arrangement details.

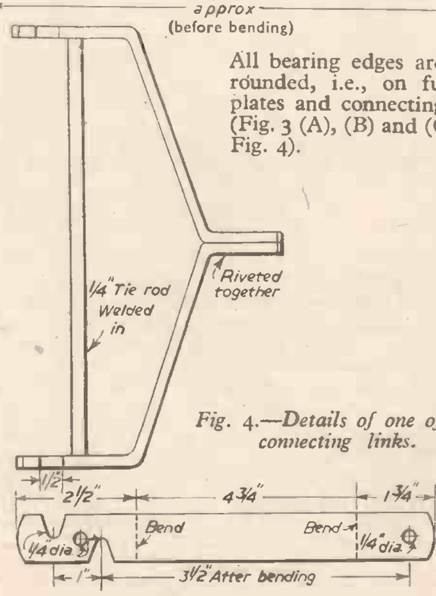


Fig. 4.—Details of one of the connecting links.

Assembly

Commence with the platform section by fixing lever constructed as in Fig. 5 to the fulcrum block (Fig. 6) and the fulcrum plates to the blocks. Glue and screw the two sides of the platform to the fulcrum blocks and the two ends to the sides.

Next assemble the indicator section, with the exception of the top and end pieces, which are only screwed in place. After the glue has set, assemble the platform lever linkage and fit the spring balance, the indicator and pointer.

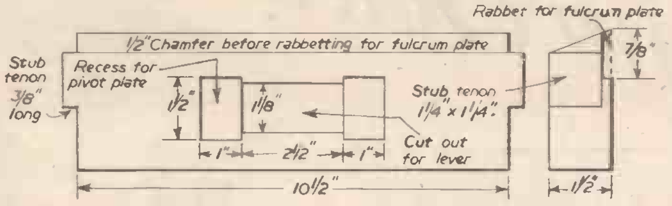


Fig. 6.—Details of the fulcrum block.

Fixed to the pulley of the drum by its centre is about 18in. of thin steel stranded wire, a small screw or brad being passed through the strands of wire to hold it. The top is replaced, the end removed, and to one end of the wire is suspended a weight which should be only sufficient to hold the lever up against the stop. With one complete turn round the pulley the length of wire should be adjusted so that with the lever against the stop the fixing pin will be on top of the pulley, the end is then fixed to the lever. The spring balance is connected to the lever by a link bent from stout wire.

Before replacing the end, the drum must be marked. To do this, use a screwed rod and wing nut attached to the lever and passing through a cross piece under the bottom edge so that the spring balance may be extended by tightening the wing nut, each pound on the balance being marked on the indicator drum as a stone; each stone may then be sub-divided into pounds and halves.

Copying Diagrams

Two Methods of Reproducing Drawings from Printed Matter

By H. A. ROBINSON

SOMETIMES it is very convenient to be able to take a copy of a diagram from a book that must be returned—or perhaps to be able to make several reproductions of one's own drawings—and here are two methods by which this can be done.

Using a Camera

Almost any instrument can be used that will focus fairly close, either by its own adjustments or by the use of a subsidiary lens. After the maximum in this direction a nearer range still can be secured by using a very small stop.

"Process" film should be used, as this gives the strongest black and white and the exposure, with one 100-watt bulb at about 1½ft. away, and an f16 stop, is about three to four minutes. A table lamp will do for the illuminant and it should be moved slowly over the camera during the time the lens is open. This evens out the light on the "copy."

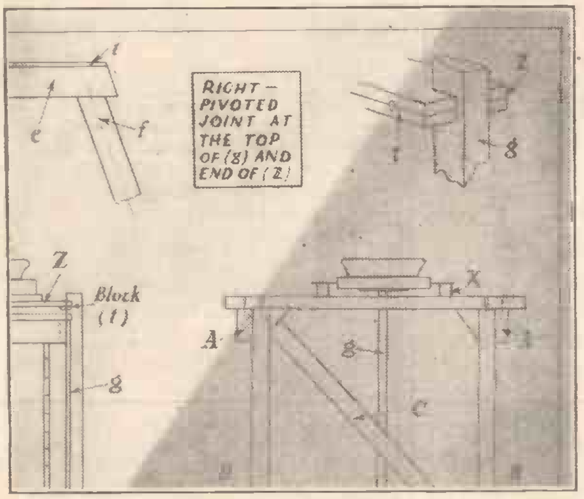


Fig. 1.—Section of a photograph taken with a hand camera from a magazine page. The left half has been treated with iodine-iodide.

The book from which a page is being copied must be held rigidly.

A plate camera with a ground-glass focusing screen is best for the job and one with a direct finder is also convenient. With ordinary finders allowance has to be made for the fact that it is a little to one side of the taking lens.

The negative, as it is, can be used as the record, being viewed, if necessary, through a magnifying glass for detail, but on the whole is better to make an enlargement.

Unfortunately, many post-war films seem to have lost the useful ability to give the absolutely opaque blacks which are so necessary for the best line work. This means that there is nearly always some "background" which quite spoils pleasing reproduction and if excessive may even cause loss of detail.

Using Iodine-Iodide Solution

This trouble can be overcome and a good firm line with a pure white background obtained by using an iodine-iodide solution as follows.

Printing to start with should be on vigorous paper, then—this being important—development must be carried to finality, irrespective of how muddy the background goes. This over-development, it is found, gives a strength to the lines which are left unaffected by the later reducing action of the iodine-iodide.

The print is *well* washed and is then plunged into a bath of combined iodine and iodide (as below) until the whites start to turn blue. The back of the paper immediately goes ultramarine but this can be ignored as it clears later.

When the bluish tinge in the whites becomes noticeable the print is taken out and transferred to a bath of ordinary hypo—when the clearing effect is at once seen. The deep colour on the back also disappears. An example is shown in Fig. 1.

If the clearing has not been sufficient the print must be again *well washed* when the process can be repeated. Indeed, with washes between it can be repeated as often as desired.

The iodine-iodide stock solution (which any chemist will prepare for a few coppers) is made up as follows:

Iodine, 30 grs. Iodide, 3 grs.
Water to 5 oz.

To use, it is diluted with three to four times the bulk of water.

Surface Printing Method

The principle here is that if a sheet of bromide paper is placed face down on a diagram and light is brought to bear on its back the diagram underneath will print on to the sensitive surface, it being made visible after the exposure by the usual development.

This kind of print-making seems to violate all the accepted methods where light, of course, shines *through* whatever is in front on to the emulsion. But the method works.

Fig. 2.—A negative obtained by the surface printing method.

The print thus taken comes up as a negative—an example is shown in Fig. 2—but a positive can be obtained by placing another sheet in contact with the print and making a second exposure.

In this method of copying the quality of the final print is greatly regulated by the structure of the base of the paper used. The finer this is, the clearer the print; the coarser it is, the "rougher" will be the texture of the print.

To reduce structure marks to a minimum one or two firms have produced "document paper." This is particularly thin and is of very uniform and fine structure.

To make a good surface copy the diagram is laid on a flat board with two sheets of thick blotting paper below. On top is placed the document paper face down, and over that goes a fairly weighty sheet of plain glass, this all being done in the usual yellow light in which bromide paper can be worked.

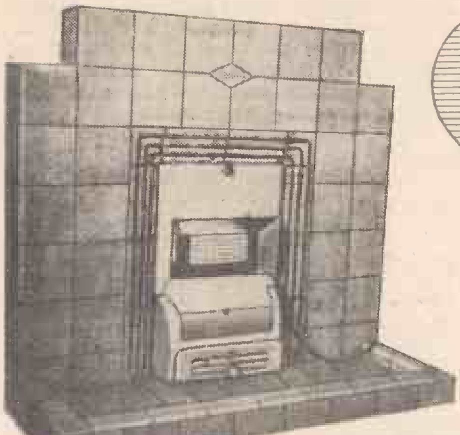
A light is now brought to bear on the "sandwich," or the board with its contents can be carried and held under the light which should be quite even. Hence a frosted bulb is best for the purpose, and the sandwich should not be held too near.

There will have to be a little trial and error to start with to get some idea of the exposure, this being done with strips, but 10 seconds 1½ft. from a 100-watt lamp is a good starting exposure.

An Electric Panel Fire

A Smart Unit for Occasional Heating in the Summer Months

By W. J. STANNAGE



The finished appearance of the fireplace.

WITH the approach of the summer months many people do without a coal fire and use an electric fire for a few hours in the morning or evening. By doing so quite a saving of coal is achieved but there are three disadvantages. In the first place an empty fireplace looks cold and unsightly; secondly, as the fireplace is open there is always a draught which lowers the temperature of the room and, lastly, an electric fire is very difficult to guard safely where there are children.

To overcome these difficulties the author designed the fire shown in the heading photograph. It fits snugly into the fireplace, thus cutting out the draught, its light colour adds a splash of brightness to the room and, most important of all, the ordinary fireguard fits over it making it completely safe. There are no complicated fittings to hold it in place and it can be removed in a few seconds by merely turning the knob and lifting it away. Although the fire shown was made to fit a continuous-burning grate it could easily be adapted to suit any type of fireplace.

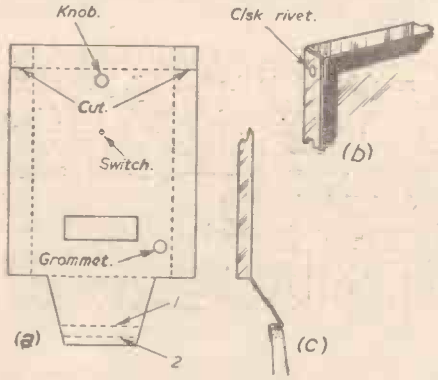


Fig. 1.—Cutting, folding and riveting details of the front panel.

Panel

Material required is 18 s.w.g. aluminium. Exact measurements cannot be given as these will depend on the fireplace in question. The panel is cut to the shape shown in Fig. 1a, and folded where shown dotted at both sides and top to form what can best be described as a three-sided tray. The depth of the sides is equal to the thickness of the tiles forming the sides of the fireplace and the two top corners are riveted as seen in Fig. 1b. The tapered section is bent forward to cover the front of the grate and the bottom part (marked 1 and 2 on the drawing) bent back and down to form a lip which fits over the front of the grate. Fig. 1c. The panel should now fit snugly into the fireplace and cover the open part of the grate.

Decide the exact position for the 1 kW. rectangular fire bar and cut out a section to accommodate it. This should be slightly oversize to allow for expansion and for the same reason the securing screws should not be tightened unduly. If a 2 kW. fire is required the panel will easily take two fire bars.

The switch shown is optional but if fitted should be well above the reflector. The hole for the ½in. rubber grommet is drilled where shown and should be on the side convenient to the power plug. Note that the grommet is near the edge of the panel so allowing the reflector to shield the cable from the direct heat.

Retaining Device

To hold the panel in place the retaining device shown in Fig. 2 is made. The knob is of the bakelite variety bored out and tapped 5/16in. B.S.F. The 5/16in. dia. B.M.S. is threaded B.S.F. at both ends as shown. The knob is screwed on to one end and the catch clamped between two nuts at the other. The plain portion of the bar turns in the bearing section which is simply a piece of ½in. dia. bar bored out 5/16in. and brazed to the 2¾in. length of ⅛in. × 1in. flat iron. Three holes are drilled in the plate, one 5/16in. in the centre to allow the bar to pass through and two 3/16in. clearance holes at each end to allow the assembly to be attached to the back of the panel. Again exact measurement cannot be given but the catch, when turned by the knob, locates behind the tiles forming the bridge of the fireplace, so holding the panel firmly in position. A little work with the rule and a few simple calculations will give the exact figures required. Incidentally, the knob is always turned clockwise to prevent it unscrewing. The catch which is made from ⅛in. × 1in. flat iron, is given a slight bend, as shown, to provide a " lead in."

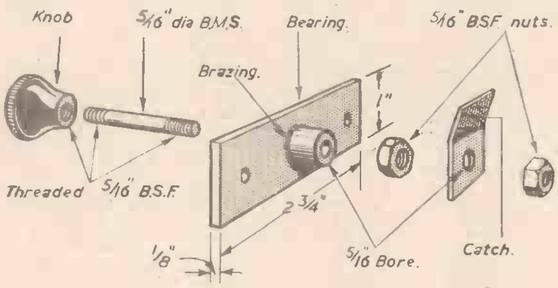


Fig. 2.—Details of the retaining device.

Cover

The cover is cut out as shown in Fig. 3. Make it as small as possible but large enough to cover all the electrical gear. The sides are 3in. deep and are folded where shown dotted on the drawing to form a tray, which is reversed and screwed to the back of the panel. The ½in. sections seen are folded back at right-angles to the sides and drilled at intervals to receive the fixing screws. These are 4 B.A. countersunk and as the countersinking is on the outside of the panel it must be done neatly. The grommet is at the top as this arrangement allows the cable to be brought up along the outside of the cover, protecting it from the heat, and only a very short length going to the terminal bar is actually inside.

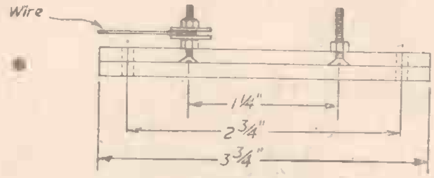


Fig. 4.—The terminal bar.

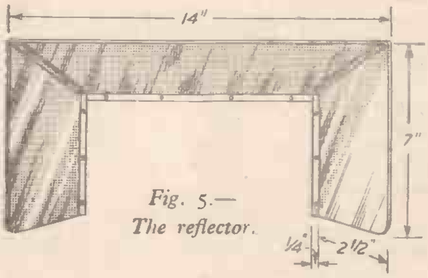


Fig. 5.—The reflector.

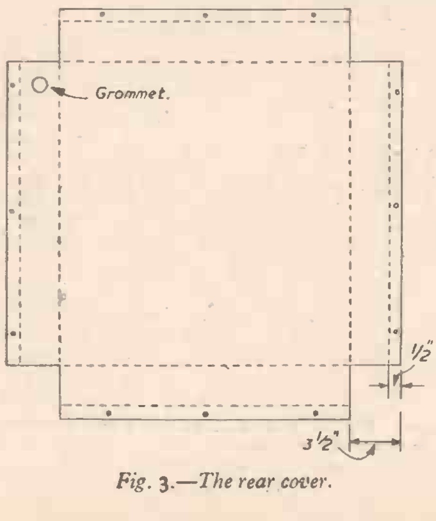


Fig. 3.—The rear cover.

Terminal Bar

This is made from asbestos or heat-resisting fibre. The proper material together with the three-core flex may be had from your local electrical dealer. Details of the bar are given in Fig. 4. It consists of a double thickness of material 3¾in. long × 1in. wide. The top half is drilled and countersunk on the centre-line for the two 3/16in. brass screws which are held in place by nuts. Also it is drilled at each end, as is the bottom half, for the two 3/16in. screws which secure it to the back of the panel. The bottom half insulates the screw heads from the metal. The flex and the connecting wire are clamped between two washers by a nut as shown.

Reflector

This is also made from aluminium. Fig. 5

gives the dimensions which may be varied to suit individual requirements. The sides and top of the reflector each form an angle of 45 deg. with the panel. The top section is riveted to the sides and the complete assembly is in turn riveted to the panel. Rivets used are 3/32in. countersunk.

Wiring

Slip the three-core flex through the grommet in the front of the panel, pass it up behind the panel and bring it through the grommet in the side of the cover. Strip the outside insulation from the end of the cable and connect the bared end of the red wire to one of the two screws of the terminal bar and the black wire to the other screw. The green wire, which is the earth, should be connected to one of the screws which hold the terminal bar to the panel. To protect the insulation of the cable from the heat the portion which will be inside the cover should be lapped with asbestos cord. If a switch is incorporated it should be of the double-pole variety. Connections from the terminal bar to the switch and from the switch to the fire bar are made in bare flexible wire covered with procelain interlocking insulating beads (sometimes known as fish-spine insulators). Connect a three-pin plug top to the other end of the cable, using the following connections:

Red.—Wire to terminal marked "L."
Black.—Wire to terminal marked "N."
Green.—Wire to terminal marked "E."

The fire must be connected to a power point and *not* to the lighting circuit.

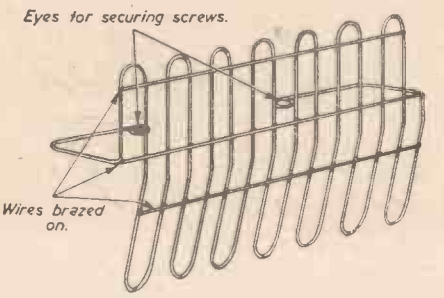


Fig. 6.—Details of the guard.

Guard

An efficient guard can be made from a length of stout wire twisted to the shape shown in Fig. 6. The loops are ½in. apart and it is held in place by the two screws which hold the fire bar. This guard, together with the ordinary fire-guard makes the fire safer than most electric fires, in the presence of children.

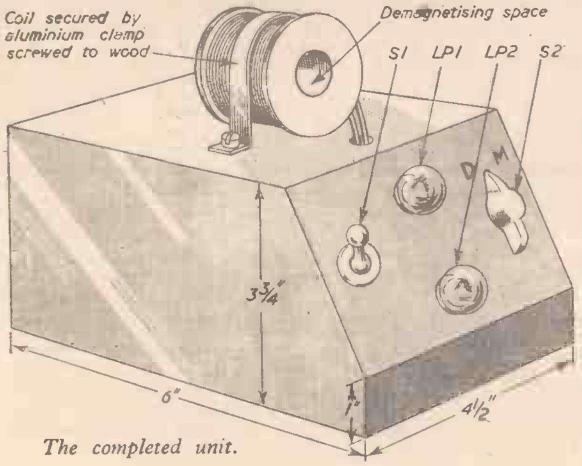
Finish

The reflector and a portion of the panel under the fire bar are polished with metal polish and the remainder of the metal-work painted with a heat-resisting paint of any desired colour.

A Magnetiser and Demagnetiser Unit

Make this Handy Gadget for Your Workshop

By J. BROWN



The completed unit.

THIS unit is not only useful to the radio enthusiast, but to amateur watch repairers, motorists and handymen as well. It could even be used in school for the introduction of the "magic" of magnetism to pupils. It is in itself a complete magnetiser and demagnetiser and has been found an asset in, for example, looking for a shakeproof lock washer which has disappeared into the "depths" of a radio or TV. set; by magnetising a screwdriver this can be easily retrieved. As a reverse example, magnetised tools, such as drills, pick up iron filings, etc., from the bench, and trying to find a centre punch mark on a chassis, with the cutting edge of the drill covered with iron filings is difficult.

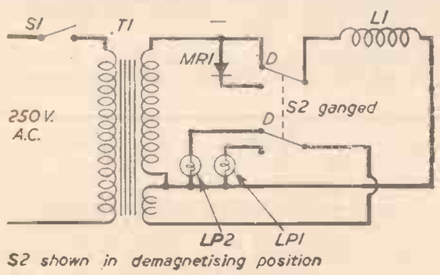


Fig. 1.—The circuit.

The Circuit

After many experiments, the circuit in Fig. 1 was evolved.

The two sections magnetised and demagnetised are controlled by S2. This is a DP/DT change switch, one section of which controls the input to L1, the other section controls LP1 and 2 which are indicator lamps to show which process is in operation, see Fig. 2. LP1 shows red during magnetising and LP2 which is white shows during demagnetising. T1 is a standard TV. pre-amp type transformer. MR1 is a RM4 metal rectifier and L1 is a coil from a scrap energised Rola speaker.

Using the Unit

Switch to demagnetising position of S2, white light on. L1 is now fed from A.C. and the article is slowly passed backwards and forwards a few times through the hole in the field coil. This hole was originally occupied by the pole piece.

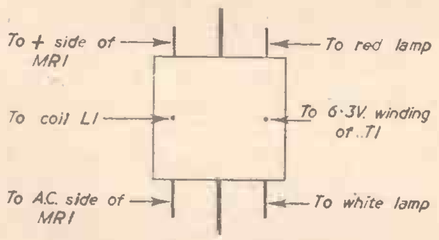


Fig. 2.—The connections to S2.

Switch to magnetising position of S2, red light on, and L1 is now fed with D.C. via rectifier. The article is slowly passed through the hole in coil.

Components Required

T1 transformer	250 v. primary 250 v. at 60-80 mA secondary 6.3 v. at 1a secondary
MR1	RM4 metal rectifier
L1	2,500 ohm field coil—1¼in. hole
S1	Single pole main switch (rotary)
S2	Double pole double throw switch
LP1	Red Perspex domed holder and lamp (6.3 v. 3 a)
LP2	White Perspex domed holder and lamp (6.3 v. 3 a)
Screws, flex, etc.	

The original was built from wood as per leading sketch and was found to work well.

For obvious reasons the device must be kept away from watches and meters.

Building a Home Workshop

5.—Making Milling Cutters

By "TUBAL CAINE"

(Continued from August issue)

THE milling of large and wide faces of the type found on articles similar to the surface plate which formed the subject of a previous article in these notes requires an equally large cutter in order to cover the area in the shortest time. This surface plate referred to is an excellent example for demonstration purposes and the width of 9in. makes two cuts necessary.

A cutter about 10in. in diameter is, of course, somewhat outside the scope of the lighter type of centre lathe—it will, of course, swing in the gap, but as there is no adjustment between the table face and the cutter spindle it would not cover a distance much greater than 7in. wide. Fig. 1 illustrates this point for the benefit of newcomers who may doubt the assertion. It becomes readily apparent that the small extra surface which the larger member produces is outweighed by the very real possibility of chatter occurring, and the time and material needed for such a tool does not in this case make it a sensible proposition. Coupled to all these items is the general awkwardness of assembling so massive a cutter on what after all is a comparatively small spindle; so I advise readers not to imagine that because a cutter is very large it will operate really efficiently. One can overdo such matters and the result is frequently a poor cutting tool.

Whereas this cutter is too heavy for the light lathe, the 6in. diameter member is a practical proposition, and I suggest that those contemplating the making of this equipment adopt this size as a standard diameter.

The Design

The chief factor with this class of milling operation is rigidity, and in addition to clamping and supporting the workpiece securely the cutter requires a solid body as well as a stiff spindle on which to assemble it. The latter is naturally governed by the size of lathe the reader possesses, but the design of cutter body is an item which can receive attention.

A fairly large and, therefore, heavy piece of steel or cast iron stores energy when it rotates—it becomes a miniature flywheel, and this condition has, I suggest, much to do with the dampening of vibration which would arise in a thin and flimsy disc.

This is obviously not a highly technical explanation, but many older and experienced readers will appreciate that this takes place. Endeavour, therefore, to secure a billet of material approximately to the dimensions given in Fig. 2.

A perusal of this drawing reveals that a series of small circular tools is inserted into holes bored in the face and held there by a substantial socket-head grubscrew. For a cutter of this size six tools are needed, and though very accurate spacing is not essential the holes should be bored within ±1/32in. across the chords. An evenly balanced cutter will avoid persistent chatter, and a large degree of error will introduce vibration especially if the lathe bearings are in need of repair.

Turning and Facing

The first operation on this billet is, of course, the turning and facing of all the diameters. As the fitting of this cutter on the headstock spindle is of prime importance this process requires special attention, and the only way to secure accuracy is to make up a series of simple gauges for the checking of each stage.

For the depth of the recess you can use a narrow steel rule, but a plug gauge carefully screwcut to represent the spindle thread will prevent you removing the part from the chuck before it properly fits on the thread. Next turn up a double-end plug gauge of the type so well known in the workshops—a diameter at one end being equal to the exact size of the spindle nose register and the other about .002in. smaller.

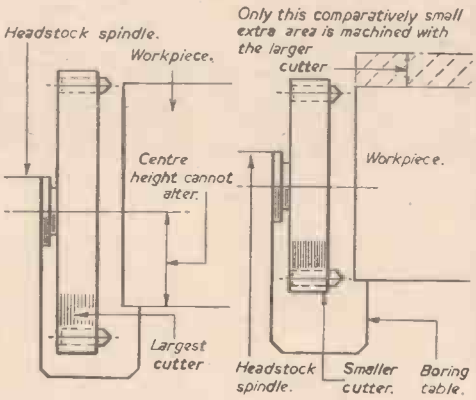


Fig. 1.—A comparison between the use of large and small cutters.

The Register and Thread

The boring of this register is nothing more than a series of light cuts until the final diameter is reached, and the provision of a secondary gauge very little smaller enables you to know how much to bore out for the last cut. To make sure the cutter fits the register correctly check and see that it first gauges to the small diameter and then advance the cross slide the required amount until the opposite end locates satisfactorily; but remember it must slide without being too tight, otherwise you will experience difficulty in removing the body from the spindle.

Internal calipers are useful in conjunction with a micrometer for determining the bore size until the small end of this gauge just enters, and with gentle manipulation quite a close accuracy is achieved. A skilled turner will, in fact, bore this recess without the above-mentioned gauge; he relies solely on his sense of feel when adjusting the micrometer to the caliper.

Once the register is finished the screw-cutting of the hole is an easy operation, and as this thread merely holds the cutter on the spindle and does not in any way locate it there is no need to make this a perfect fit to the screw plug gauge. A nice easy fit for the full depth is all that is needed.

Once the register and thread is completed the chuck is removed from the spindle and the cutter body substituted, but before doing so drill three equally spaced holes about ¼in. diameter round the periphery as I have indicated on the drawing. These will assist the removal of the body from the spindle and save hammering it where the tool holes appear—a practice that soon makes the body very unsightly.

Now run the body on the thread and register, finish turn it all over and face the front surface. A light skim only is needed, just enough to true them and so ensure perfect concentricity; when this is completed gently apply a file to the corners of the outside diameter to blunt the razor-sharp edges that will have appeared there. Once again take the body off the spindle and mark out the six tool holes on the front face.

Marking the Tool Holes

There no need to go to the trouble of making a special wooden plug to insert into the centre bore to provide a site for the compasses, an easy and effective way is as follows. Most of you have a pair of odd leg dividers similar to those shown in Fig. 3, so set these to apply from the outside diameter and mark six rather long scratches at intervals equal to the spacing of the tools. Centre pop one of the lines deeply, and then set the

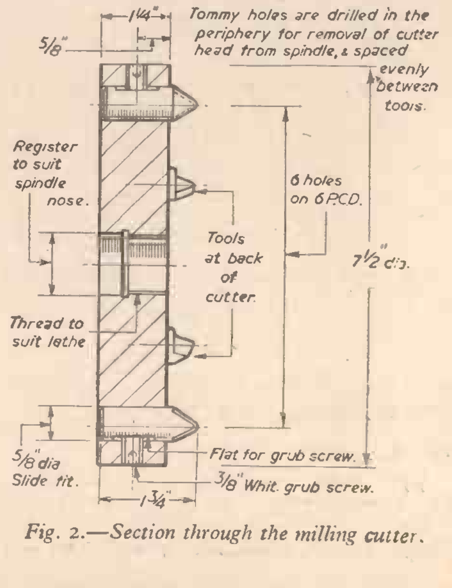


Fig. 2.—Section through the milling cutter.

orthodox dividers and step off the remaining five points. You will undoubtedly make three or four attempts before you arrive at a suitable spacing, but spend a little time on this operation and so secure the centres within the above specified $\pm 1/32$in.

Centre pop the five markings and transfer the blank to a drilling machine (if you possess one) which will take a 39/64th drill—one with a Morse taper is necessary—and open out each hole carefully. Next pass the $\frac{5}{8}$in. diameter reamer through these drilled holes, taking care not to rush the work and so secure a clean hole which is the correct size. Try a length of silver steel in each hole to see that tools made from that material fit without trace of shake, as this can completely ruin the effectiveness of such a large cutter.

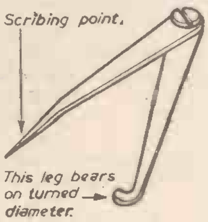


Fig. 3.—A pair of odd-leg dividers.

Drilling the Tool Holes

For those who do not possess a drilling machine capable of taking these large drills and reamers, set the body on the lathe boring table and with a drill in the Morse taper of the headstock spindle drill and then ream each hole before you disturb the setting for the next position. Any suitable block of metal will serve for a support while this work is being carried out, and as we have not yet machined up angles plates or cage blocks for such work this is a case for improvisation. Two square blocks of bright mild steel, attached by screws passing through the centre, will do very well. To these is attached the circular body. They need spacing out to allow some simple clamp of the type used by toolmakers to pass over both the flange of the body and the block of steel. Heavy clamping is not essential—a little over finger tightness will hold the disc securely against the pressure of this fairly large drill.

Scrape the sharp edges off the holes back and front, and then mark out, drill and tap the side holes for the grubscrew that holds the tool in place. The body is now ready to receive the tools.

The Tools

Silver steel is the best material for these items, and a foot or so of $\frac{5}{8}$in. diameter is required for either one or two sets. I advise two complete sets to make sure that, in the event of them being burnt or otherwise damaged no time is lost while they are reground. You can, of course, make do with perhaps two or three spares, but an extra set of six does not take much longer to grind ready for cutting.

There is no need for me to go very much into detail on the making of these tools, because they follow standard outlines, and anyone who can make and grind a lathe tool should be able to finish off these sets without difficulty.

The heat treatment also is an easy process. Heat the tool to a bright cherry red, taking care to heat it thoroughly and slowly. Quench in clean cold water by plunging it into a bucket and stirring the water with the tongs and tool until the latter is cold.

Tempering is the next stage, and the tool is again heated, this time by playing the gas flame on the shank and allowing the heat to travel toward the tip. Clean the tool with emery cloth before starting this work, and watch the colour as the flame gradually causes the article to become hotter. This will travel toward the tip, and when it reaches a straw colour plunge it once more into the water. The usual sharpening on a small emery wheel will make it ready for use in the cutter body.

I have shown a flat on the side of this tool adjacent to the grubscrew which holds it in place; this you can file before hardening the tool and about 1/32in. deep is sufficient. If you omit this item and harden the tool grind the flat, but make sure it appears on the correct side. The cutter is now finished.

A later article will deal with the setting of each tool prior to taking a cut over a casting or large piece of black bar material; so now it is proposed to deal with those tools which everyone can make and use to carry out innumerable milling operations on the lathe.

Small Tool Design

Fig. 4 illustrates a popular form of cutter which may be filed and ground in various diameters, but it is advisable not to make the cutting portion too long as there is a risk they may snap under pressure while operating.

Make the two flats behind the teeth approximately even with the aid of a coarse file and see that a generous radius is left in each corner. Next file the end teeth in the manner indicated in Fig. 4, but do take care when filing the angular clearance to see that they are running in the correct direction, otherwise the tool will not cut unless you reverse the direction of rotation of the lathe headstock spindle. A small "nick" cut with a hacksaw before you commence filing is a good guide where to stop filing for each tooth. If you face each end of the silver steel before attemping to produce the teeth, this gives a perfectly flat face, and when filing the angles just remove sufficient metal to leave only the smallest amount of flat face—a line about .005in. wide is enough. When both sides are identical this shows both of these face teeth are exactly the same height. A light touch on the grinding wheel after the hardening operation will then bring them to a sharp edge.

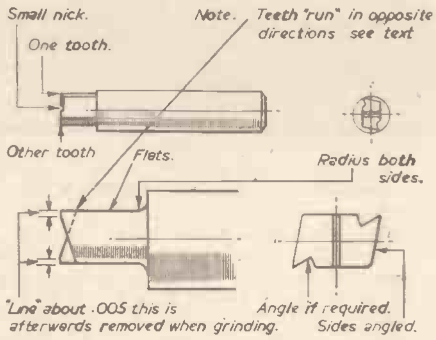


Fig. 4.—Design for a small milling cutter.

The heat treatment of these cutters is exactly the same as described for the tools in the large cutter head.

The side angles are not ground when resharpening becomes necessary—the cutter is pressed flat on the side of a wheel and the front face is ground together with the end teeth. Exercise care in the latter case and see that an equal amount is ground off each side. Fig. 4 is an enlarged sketch of these side and front teeth, mainly to show clearly the above explanation regarding the "line" mentioned above—remember these are ground to a sharp edge before the cutter is used.

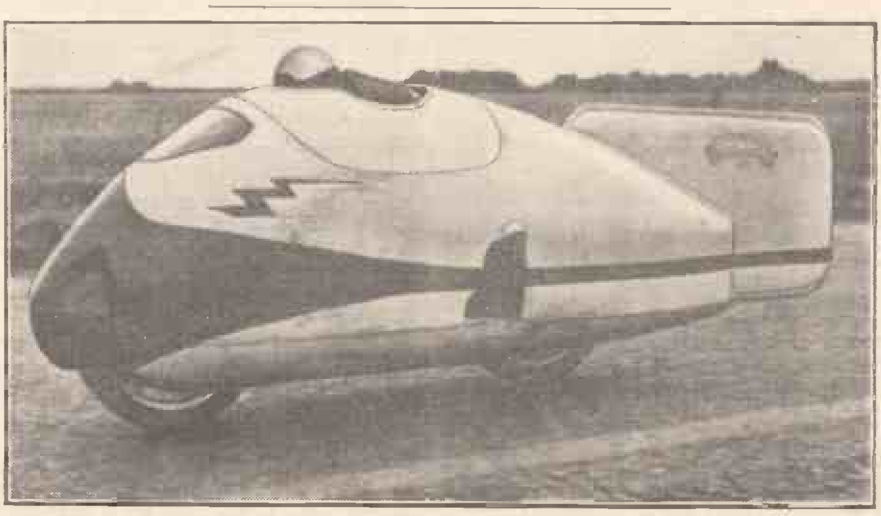
Driving the Cutter

As these smaller cutters are made with a straight shank some form of chuck is necessary in order that a satisfactory drive is secured, and though the orthodox drill chuck is often pressed into service a superior gripping device is the collet style of chuck. These tools are made from silver steel and of a standard size, consequently the reader should experience little difficulty over holding the tool securely—in fact, quite deep cuts are possible without the cutter pushing back into the collet. If this persists it may be due to the collet being worn on the front edges, or it may have worn oval. It may be preferred to turn a smaller diameter behind the teeth and use this for the purpose of clamping; the flange so formed then prevents this occurring.

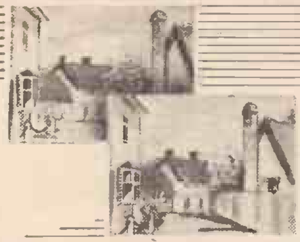
There are other types of milling cutters which will eventually find their way into the amateur's workshop, but the two examples given in this article will suffice for a host of different parts which call for milling. The cutting speeds at which to operate the tools will be dealt with in a future article. In the case of the end mill, never allow this to project too far from the collet.

A final piece of advice is to carry out the hardening and tempering processes very carefully as they can mar and ruin an otherwise good tool. Heat the tools slowly and do not let the flame concentrate on the actual cutting edges, but rather let it "run down to them." By using this method you will eliminate the risk of burning and so softening the particular point which does all the cutting.

(To be continued.)



Two world motor-cycling records were broken at Swannanoa, New Zealand, under ideal conditions. Russell H. Wright, aged 25, a builder, of Invercargill, New Zealand, became the fastest motor-cyclist in the world, when he thundered through the timed kilometre on his 1,000 c.c. Vincent Black Lightning to return an average speed of 5 m.p.h. better than the four-year-old German record of 180 m.p.h. held by Wilhelm Herz, on an N.S.U. His official time was 185.15 m.p.h. Half an hour later, the tuner of the machine, Robert Burns, of Christchurch, New Zealand, climbed into the machine, to which had been added a sidecar, and bettered his own world sidecar record by a little more than 6 m.p.h., bringing it to 163.06 m.p.h. The photo shows: Russell H. Wright in his machine at speed.



PHOTOGRAPHIC RANGEFINDING

Notes on the Construction of the Various Types of Rangefinder

By F. G. RAYER

A NUMBER of very interesting devices are employed in photography to determine the camera-to-subject distance, and rangefinders of this kind also have other applications. Several of the methods employed lend themselves very readily to home construction, and a good degree of accuracy is not difficult to achieve.

Most rangefinder methods employ some form of triangulation, whereby the distance of the object can be determined. Almost without exception the scales are marked in distances, so that the figures are read direct. Feet markings are most general, but if the rangefinder is to be used with a camera having a scale marked in metres, the finder is best based upon this unit of measurement. For this purpose, sufficient accuracy will be achieved by measuring or calculating with 3ft. 3in. to the metre.

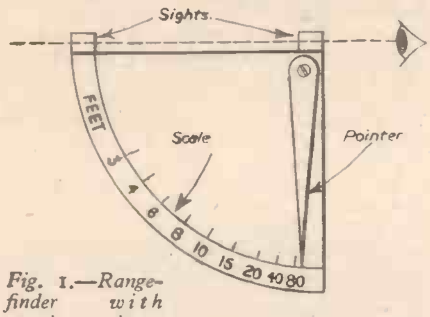


Fig. 1.—Rangefinder with gravity pointer.

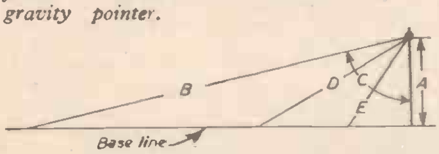


Fig. 2.—Calibrating the rangefinder in Fig. 1.

The Gravity Rangefinder

This simple type of finder is shown in Fig. 1, and may be constructed from card, wood, metal or stiff celluloid, etc. The sights may resemble those used on a rifle, or consist of two loops or tubes forming a peep-hole sight. The scale can have a radius of 2in. to 3in. and the pointer hangs freely.

The rangefinder is suitable for level ground, streets, etc., only, and measures the angle between the vertical afforded by the pointer, and the base of the subject. As the user's height to some extent governs the angle of sighting, the latter is best marked out by drawing a scale diagram, as shown in Fig. 2.

Here, " A " is the distance between ground and user's eye—usually about 5ft. 3in. to 5ft. 9in. A long base line is drawn on a large sheet of paper, and distance " A " marked off to some convenient scale, such as ¼in. to the foot. Line " B " is then drawn, to the farthest distance to be measured—say 80ft. The angle " C " is then transferred to the rangefinder scale by means of a protractor. This gives the 80ft. mark. Lines " D," " E," etc., are then drawn, and the angle for the respective distances marked upon the scale, until the latter is complete. All distances are measured, to scale, along the base line.

A Parallax Finder

This is another very simple method which employs the distance between the user's eyes as the rangefinder base, the apparent displacement of the object being measured by a scale, as shown in Figs. 3 and 4. It is extremely simple, accurate, and may be used anywhere, not being confined to level ground.

In use, the object is sighted with the left eye only, the left-eye sight-line being brought to coincide with it. The right eye is then opened. If the object is near, the eyes will be turned in slightly so that the scale lines towards the centre of the card appear to be aligned with the object. If the object is distant, the eyes will be turned outwards, approaching the parallel sighting position for infinity. By noting the coincidence of scale and object, the distance may thus be read, the left-eye sight-line being kept in line with the object at all times.

The user must stand facing the object squarely, and the scale must always be at the same distance from the eyes. This can be assured by always holding the scale at arm's length, or by having a cord loop attached to the scale, and passing round the neck. The exact position of the scale markings will also depend on the inter-pupilary distance, which varies with different persons. The scale is thus best drawn by trial, distances being measured off to some convenient subject, and the right-hand sighting line drawn. A transparent scale with thinly scribed lines is best, but by no means essential.

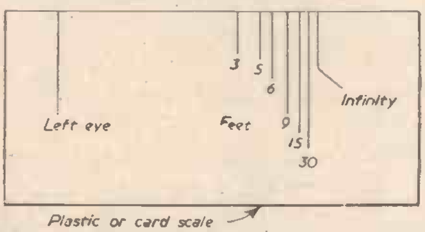


Fig. 3.—An apparent displacement or parallax rangefinder.

As with the rangefinder in Fig. 1, the scale can be calculated or arrived at trigonometrically, if this method is preferred, the inter-pupilary distance and distance between scale and eyes being measured, it not being overlooked that the former decreases as the eyes are turned inwards.

Split Image Rangefinding

This method is largely employed and can have great accuracy. The general manner of working will become clear from Fig. 5. The user views two images of the subject, one seen directly through the half-silvered mirror, and the other reflected from the pivoted mirror. For an object at infinity, the lines of sighting will be almost parallel. When sighting nearer objects, the pivoted mirror is slightly turned to make the sighting lines cross at the required distance. To determine the distance to the object, the wheel is therefore turned until the two images coincide, and the figure read from the scale.

The half-silvered mirror may be lightly sprayed only, so that direct vision is still possible through it. In other cases the silvering may be scraped away over a small area, and this lends itself most readily to home construction. One half of the mirror may be cleaned (e.g., the top half) so that the subject viewed through the rangefinder is seen in two halves, displaced until the wheel is turned to make the images coincide. Or a narrow strip of silvering may be left horizontally on the mirror, allowing direct observation of top and bottom of the subject, with a narrow centre strip to be brought into coincidence. It is also feasible to use a mirror with a centre spot scraped clear; or with all the silvering scraped away except that on a small central area. All these methods are employed by different manufacturers, and that chosen is largely a matter of personal preference. The mirror is permanently fixed in the rangefinder body at 45 deg.

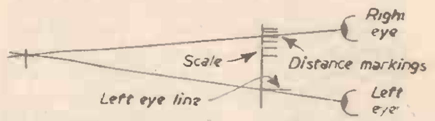


Fig. 4.—Operation of the parallax rangefinder.

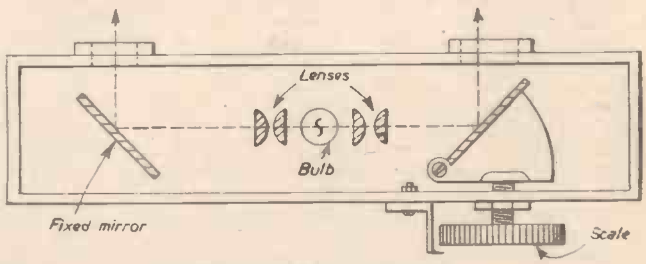


Fig. 6.—Split image rangefinder.

The second mirror is silvered all over. As its movement is very small, the simplest method is to have a screw bear upon the bracket upon which it is mounted, as shown. A full rotation of the wheel will then cause only a slight movement of the mirror. A light tension spring bears the bracket back against the point of the screw, which should be of steel and fairly blunt.

Photographic rangefinders of this type are frequently very small, as little as 1½in. being allowed between mirrors. Higher accuracy, especially for greater distances, will be obtained with greater separation between the mirrors, though 2in. will be ample for most purposes. When the rangefinder is made, it can be calibrated by sighting objects at measured distances, the figures being scribed on the wheel or scale. Small celluloid or glass windows are usually fitted to exclude dust.

For photographic purposes it becomes less necessary to measure the distance correctly as the subject becomes more remote. For this reason, a suitable feet scale would be: 2, 2½, 3, 4, 5, 6, 7, 8, 10, 15, 20, 30, 40 and infinity. A suitable metre scale would be: 1, 1.2, 1.5, 2, 2.5, 3, 4, 6, 12, 20, infinity. This also applies to the other types of rangefinder described. But if the camera has different figures, these may be used on the scale.

Night Finder

The method of operation for a finder produced for use with flash equipment, or in situations of very poor light, is shown in Fig. 5. Two narrow beams of light are projected, the angle between them being adjustable by means of a pivoted mirror exactly as in Fig. 6. The wheel is turned until the two spots of light thrown on the subject coincide, and the distance is then read off the scale. In some circumstances it may be preferable to set camera lens and rangefinder scale to the same figure, and approach or withdraw until the spots coincide, when the flash can be fired.

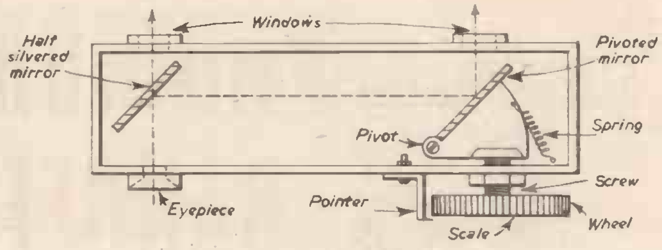


Fig. 5.—Night rangefinder.

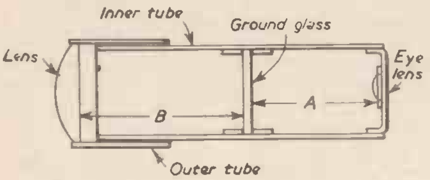


Fig. 7.—Image focusing rangefinder.

Rangefinders of this type are relatively large—about 6in. long by 1in. square. A torch bulb and dry battery can be used. The lens system is almost essential, so that narrow, parallel beams of light are thrown. To achieve this, the lenses must be of such a focal length that when situated near the bulb the light rays are gathered into parallel beams. Small condenser type lenses of about 1in. focal length will achieve this.

Such a finder is intended for use only when light is so poor that an ordinary type cannot be used, or in complete darkness. It is not effective in daylight as the spots thrown will be invisible.

Optical Finders

A focusing type of rangefinder may be constructed as shown in Fig. 7, and operates in exactly the same way as does focusing a camera with a ground glass screen. Here, however, a high-grade anastigmatic lens is not required, since the image is only to be observed with the eye, and marginal resolution is of no importance. In addition, the actual field of view taken in by the lens is of no importance, since the finder is used to determine distance only.

To permit of critical examination of the image on the ground glass, an eyepiece lens is situated at the back of the tube. This may be a simple small magnifying glass of about 1½in. to 2½in. focal length. The distance "A" is fixed, being such that when the eyepiece is held to the eye, the ground glass is in sharp focus. This can be found by trial. If required, the glass screen may be prepared by rubbing two small pieces of glass together, fine abrasive being placed between them. The ground side of the glass should face the large lens, when fitted in position.

An outer tube, a smooth sliding fit on the inner tube, is required, and carries the large lens. This requires to have a focal length of about 1½in. to 3in. A magnifying type of glass will be suitable, the expense of a multiple element being unnecessary. A position will be found in which the lens casts sharp images of distant objects on the screen. This is the infinity setting for the outer tube. As the subject viewed grows progressively nearer, the distance between lens and screen must be increased, to obtain sharp focus. The position of the outer tube can thus be marked, for measured distances. These markings will then show the distance of any object brought into sharp focus on the screen. Adjustment will be simplified if both tubes are of metal, a smooth fit, and if a helical slot is cut in one tube, engaging with a pin fixed to the other. Rotation of the outer tube will then cause it to move backwards and forwards. The scale may then be marked round the circumference of the tube, which will allow additional space for figures.

Making an Extendible Ladder

A Useful Article for the Handyman to Make for His Own Use

By T. H. E. MARSH

THIS extendible ladder is simple to make; it is not handsome, but it is very efficient and quite cheap. Each single ladder is 11ft. 0in. long, and bolted together the two give a maximum length of 19ft. 0in.

The rails are 2½in. × 1¼in. × 11ft. 0in. long, and four will be required. The treads are 1¾in. × ⅞in. × 15in. long, and 20 are required. To make lay all four rails on edge with the bottom ends level with one another. Mark off the position of treads with ten equal pitches of 12in., starting from the bottom. Make sure that all the rails are marked off square to one another. Then make one saw cut ⅛in. deep right across the rails and cut away a wedge-shaped piece 1¾in. long just to clear the cardboard template, Fig. 2.

Drill two holes ⅛in. diameter at a slight angle through each side of the treads. Then nail all together making sure that all the treads are at the same angle to the rails. Use 2½in. long wire nails and drive well home.

Four small blocks 4in. × 1¼in. × ⅞in. are required, two nailed to the bottom of the top ladder at the back and the other two at the top of the bottom ladder at the front of the rails.

Two ⅜in. diameter hook bolts 7in. long, each with a wing nut and one strap of mild steel about 2in. × ¼in. × 15in. long, with two 7/16in. diameter holes 12in. apart are required to bolt the two sections together, see Fig. 1. If the ladder is to be used by a heavy person four hook bolts and two straps are required.

The ladder is assembled as shown, but it must not be extended beyond 19ft. 0in. A platform for supporting a paint pot, etc., may be made from two pieces of wood 2in. × ⅝in. x 12in. long, and three pieces 2in. × ⅝in. × 12¼in. long nailed together as shown. Two ⅜in. diameter bolts × 2½in. long are required to fix the platform to the top of the top portion of the ladder. This platform makes an excellent "stand off" when working close to a wall. A good coat of red lead and two coats of a suitable colour of outside paint will preserve the ladder for many years.

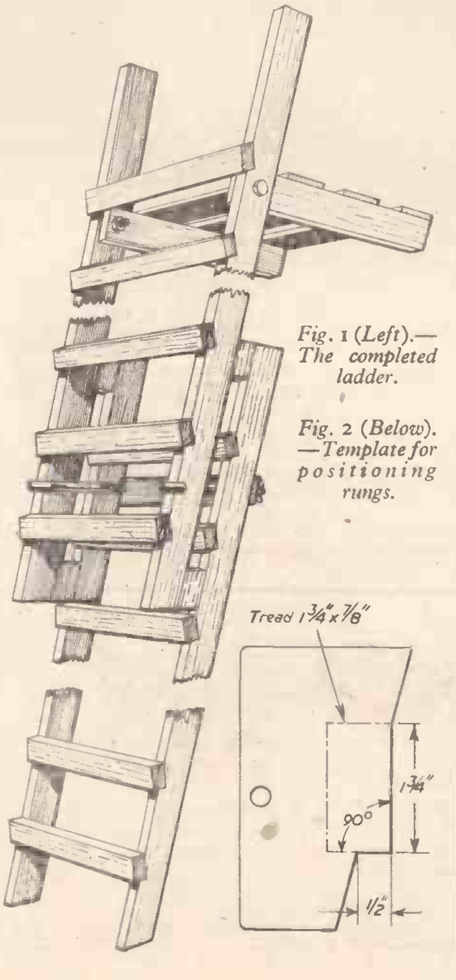
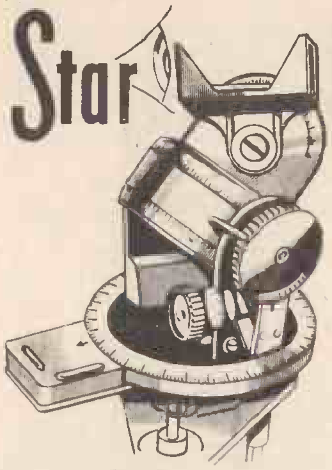


Fig. 1 (Left).—The completed ladder.

Fig. 2 (Below).—Template for positioning rungs.

Star Identification with the Astro Compass



An Inexpensive Way of Studying the Stars

By JAMES VOSE

READERS interested in star identification need not be deterred from their study by lack of an astronomical telescope. An ex-Air Ministry Astro Compass, obtainable for 10s. or so from advertisers in this journal, is an accurate instrument which enables positive identification to be made of the hundreds of stars which are visible to the naked eye. The finest telescope can do no more, in this respect, as a star is still only a point of light when seen through the most powerful telescope. The Astro Compass was originally made for the purpose of determining true north in a moving aircraft, by taking a sight from a known fixed star. It can be equally well used in reverse, so to speak, by sighting from a fixed observing position on to an unknown star, or planet, which can then be identified by reference to an almanac such as the Nautical Almanac or to a star catalogue, such as Backhouse's catalogue. In addition, a "wanted" star can be found. Suppose, for instance, we want to find the star Regulus. From the almanac we find that Regulus is declination 12.13 and its right ascension is 10 hr. 5 min. equal to 151 degrees. By setting the Astro Compass to these figures and looking through the sights, Regulus will be seen framed in the "horns" of the sights.

Star Movement

It is first necessary to understand how the stars move (apparently) around the sky. As the earth turns on its axis once a day (sidereal), the stars appear to make one complete revolution round the celestial pole (approximately at the star Polaris) in 24 hours (sidereal). Sidereal day is slightly shorter than our Solar day, so that the stars also appear to move, a little under one degree per day, so that in a year the stars appear to have rotated 360 degrees and are back in the same position again. Both these movements are in a counter-clockwise direction.

The Charting of Stars

The position of a star is charted in the same way as is a position on the earth's surface—by latitude and longitude. The celestial equivalent of latitude is the *declination* and is measured in degrees from the celestial equator. Thus Polaris is approximately 90 degrees declination. Stars below the celestial equator have their declination prefixed by a minus sign. Thus Sirius is −16.39 declination. The celestial equivalent of longitude is the *right ascension*, usually measured in hours and minutes (sidereal), which must be converted for our purpose into degrees. One hour equals 15 degrees. One minute is a quarter of a degree.

On the polar projection map Fig. 2, the concentric circles are declinations at 10 degree intervals, with the pole as centre 90 degrees declination, and the celestial equator 0 degrees declination. A few of the brighter stars have been added below the equator as they are useful for reference. The straight lines radiating from the pole are the meridians, starting with 0 degrees (the first point of Aries), the other meridians are numbered in hours (right ascension) and also in degrees. The several meridians are south at midnight on the dates set against them. This enables the map to be held overhead, and "set" so that the stars on the map are in the same relative positions as the stars in the sky. For intermediate dates, and for times other than midnight, the map must be revolved accordingly

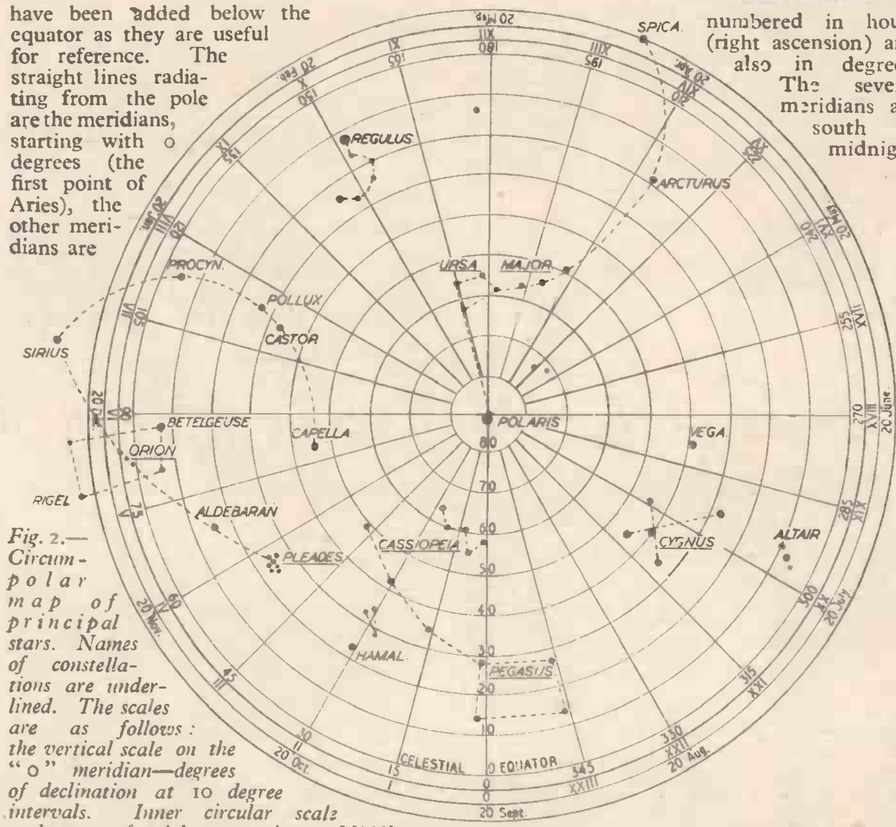


Fig. 2.—Circum-polar map of principal stars. Names of constellations are underlined. The scales are as follows: the vertical scale on the "0" meridian—degrees of declination at 10 degree intervals. Inner circular scale—degrees of right ascension. Middle circular scale—hours of right ascension. Outer scale—the several meridians are south at midnight on the dates set against them. The "first point of Aries" is on "0" meridian.

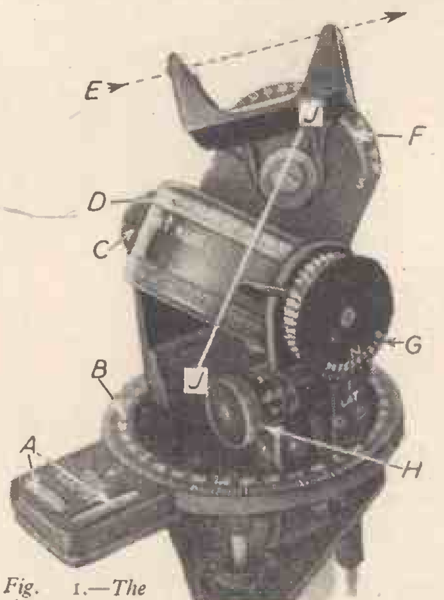


Fig. 1.—The Astro Compass set up for star identification. A—Spirit levels; B—Divided scale of vertical axis; C—Knob for turning polar axis; D—Divided scale of polar axis; E—Line of sight to star; F—Divided scale for declination; G—Divided scale for inclination to polar axis; H—Knob and vernier for setting "G"; J-J—Line of polar axis to celestial north.

Using the Astro Compass

The compass must be set up on a tripod—one was described in the December, 1954, edition of PRACTICAL MECHANICS—and levelled up. The lower divided circle must be turned until the "N" and "S" divisions face *true* north and south respectively. The top head must be tilted by means of the small milled knob until the *LAT* reading (the white figures) corresponds with the latitude of the observer's locality. The polar axis of the instrument is now in line with the earth's polar axis, and the instrument is ready for use.

Finding a Star

To find a particular star, first look up its declination and right ascension in the almanac, and convert the hours of right ascension into degrees. Setting the Astro Compass for declination is simply a matter of adjusting the peep sight on its friction pivot until the pointer is against the required degree on the scale. Setting for right ascension is, however, more involved, and there are various ways of arriving at it. The most straightforward, and perhaps the simplest method, is first to set the Astro Compass to 0 degrees R.A. (the First Point of Aries), take a note of the degree reading, and then revolve the Polar Axis the necessary number of degrees to bring the compass in line with the required star. The first point of Aries is on a line from Polaris, through a point approximately $1\frac{1}{2}$ degrees west of the great "W" of Cassiopeia and on through the Square of Pegasus, about $1\frac{1}{2}$ degrees west of the two stars forming the eastern side of the square. See map, Fig. 2.

If Cassiopeia is not visible, the R.A. can be established by first setting the compass on to a known star, and then revolving the Polar Axis, either east or west, the amount of the difference between the R.A.s of the known star and the "wanted" star. The small constellation—the Pleiades, sometimes known as the seven sisters—is a useful group for reference in this manner as it is instantly recognisable.

Still another method of finding the R.A. of a star is to use the hour and date circles of the map given here. For example, suppose we want to find Hamal at midnight on October 20th. From the map we see that Hamal is practically dead south at that time, so if we turn the Polar Axis to south -180 degrees on the "True Bearing" scale, and set the declination to 23.15, Hamal will be seen in the sights. The same method can be used for other stars, and for other times, by calculating the orientation of the required star at the required time. These calculations are a little confusing at first, so it is as well to calculate for a time about quarter of an hour ahead, so that the compass can be set ready in plenty of time. Note that the times given are for observations on the Greenwich meridian. For places east of Greenwich, the stars appear 4 minutes earlier for each degree of longitude east of the Greenwich meridian, and for places west of Greenwich, 4 minutes later for each degree.

The Planets

The almanac also gives the positions of the various planets as they move around the heavens and, if these are found by the compass and noted, it will avoid the confusion which nearly always arises with the student of astronomy between the planets and the stars.

A list of the brightest stars, with their declinations and right ascensions to the nearest degree, is appended. This will enable the compass to be used for practice purposes, but for serious study a proper star list is essential.

LIST OF BRIGHTEST STARS
With degrees of declination and right ascension

SIRIUS ...	$-16°$ 3″	100°
VEGA	$+38°$ 4″	279°
CAPELLA ...	$+45°$ 5″	78°
ARCTURUS ...	$+19°$ 3″	213°
RIGEL ...	$-$ 8° 2″	78°
PROCYN ...	$+$ 5° 2″	114°
ALTAIR ...	$+$ 8° 4″	297°
BETELGEUSE	$+$ 7° 3″	88°
ALDEBARAN	$+16°$ 3″	68°
POLLUX ...	$+29°$ 0″	115°
SPICA ...	$-10°$ 5″	200°
REGULUS ...	$+12°$ 0″	151°
CASTOR ...	$+32°$ 0″	113°
PLEADES ...	$+24°$ 0″	56°

A Self-recording Rain Gauge

Was Last Month Wetter than This? Make this Ingenious Model and You Will Know

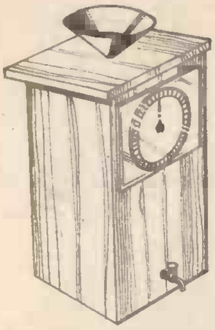


Fig. 1.—A view of the completed rain gauge.

ONE of the most satisfying models to build is an instrument which records some measurement itself, and this rain gauge can be built by anybody with a little patience and ingenuity. If you refer to Figs. 1 and 2 you will see that it consists essentially of a metal cylinder, A, to hold the water collected by a funnel, J. A tube, H, conducts the water from the funnel into the cylinder. As the water rises in the cylinder it carries with it a float, B. A cord, with the float at one end and a weight at the other, passes over the pulley, C, which revolves as the float rises and causes an indicator, E, to move round a graduated circle, F, thus recording the amount of rain falling.

Making the Wooden Box

This is 7in. square, 1ft. 2in. high in front, and 1ft. 1in. high at the back. The wood should be ½in. thick. In the front piece cut a circular hole 4in. in diameter, with its centre 10in. from the bottom. The dial consists of a piece of cardboard 5in. in diameter, divided into 40 equal divisions, as shown in Fig. 1. The hole through which the spindle passes is ¼in. in diameter. Glue this centrally inside the front piece.

The cylinder is made from stout sheet tin or copper, and has a diameter of exactly 2in. It is 9in. deep. A piece of metal, 9in. by 7.28in., is needed for this. Bend ¼in. at either end, as shown in Fig. 3. Hammer this join up tightly and run solder down it. Make a narrow flange round the bottom and solder in a circular piece of metal as in Fig. 3. See that it is perfectly watertight. The two bearings D D, for the spindle, project 2in. above the rim. They are 4in. long, ¼in. wide, and 1/10in. thick. Rivet them exactly opposite each other, as shown.

The Funnel

Obtain a funnel with a diameter of exactly 5in. across the top and cut off all but 1in. of the spout. Fix this firmly in the top of the casing. The tube, H, is $\frac{3}{16}$in. internal diameter. Bend it, as shown, and solder the bottom end carefully into the cylinder as near the bottom as possible. The top is joined to the funnel spout by a piece of rubber tubing, M. The tube, K, is about 1in. long, and is soldered carefully into the position shown. Obtain a piece of tubing with a tap, L, bend as shown, and fix firmly in a hole in the front, exactly opposite K. Join the two by a piece of rubber tubing.

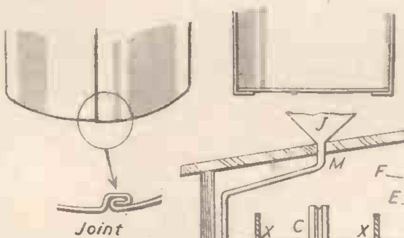


Fig. 3.—Details of the cylinder.

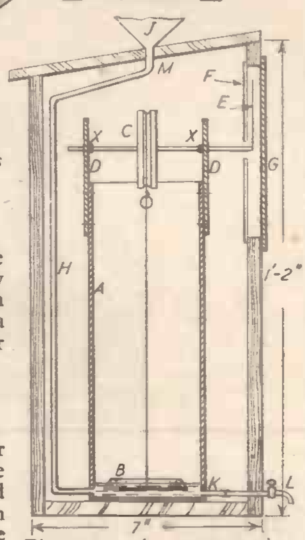


Fig. 2.—A cross-section showing the various parts in position.

The Spindle

The holes for the spindle should be bored in such a position that they are exactly opposite the hole in the centre of the dial. The spindle—a 5in. length of rod—should turn in them freely. The pulley is made by cutting three exactly circular discs of wood ⅛in. thick, and glueing them carefully together. The smaller central disc must be exactly 6in. in circumference—1.9in. diameter. Fix this firmly on the spindle, which is kept in position by two clips, X X. The arm, E, cut from thin sheet metal, is ¾in. long. Solder carefully to the end of the spindle.

The float, B, is 1⅞in. diameter and ⅜in. thick, cut from a piece of hardwood, and well painted. Use strong, black thread for the cord. The counterpoise weight should be a little lighter than the float. Use a small ball of lead.

Screw the wooden case together, leaving one side out. Insert the cylinder and join the tubes at M and K. Insert the spindle through the hole in the dial and first bearing. Push on the pulley and insert spindle into second bearing. Adjust the pulley until it is central and the arm just clears the dial. Fix with the clips X X. Pass the cord once completely round the pulley. Screw in the remaining side and make the case firm.

Setting the Dial

Pour in the funnel enough water to make B float freely, and adjust the spindle until the arm points to zero. A sheet of glass, G, is fixed to the front to prevent rain getting at the dial and arm.

Fix the instrument in an open space. When rain falls, it is collected by the funnel, delivered into the cylinder, and the float rises, making the arm move round the dial. With the dimensions given, 1in. of rain rises exactly 6in. in the cylinder and, since the pulley is exactly 6in. circumference, this gives one complete turn of the pointer to an inch. Whenever the instrument is read, open the tap, L, and allow water to run out until the pointer is again at zero, when it will again be ready to record.

By CECIL JASPER

A Useful Spare-time and Profitable Hobby

SIGNWRITING can be a profitable undertaking provided one is enthusiastic and willing to practise in order to master the brush and acquire speed.

The Tools

The tools required need not be elaborate or too expensive, their quality, however, should be good if competitive work is to be achieved. The most important items

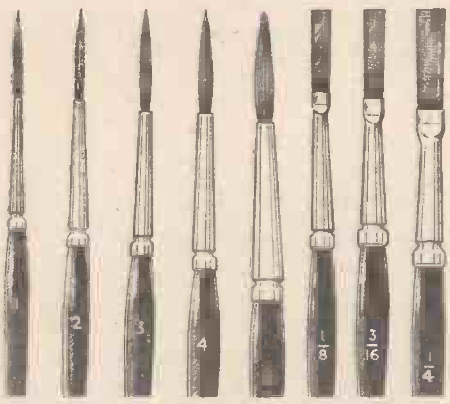


Fig. 1.—Examples of pointed and chisel-edged writing pencils.

are the brushes and these are known in the trade as writing pencils. They are of different sizes, named according to the quills they are set in: such as Lark (small); Crow, Duck and Small Goose (Medium); Large Goose, Small Swan and Large Swan (large). Writing pencils are also set in tinplate, when they are sold by numbers: 00, 1 and 2 (small); 3, 4, 5, 6 and 7 (medium); 8, 9 and 10 (large). Some numbered pencils may be seen in Fig. 1.

The best type of writing pencil is made of pure red sable hair, which retains its shape and holds the paint well, sable hair also possesses natural flexibility and spring, necessary for executing good writing. Other cheaper types of pencils are brown sable and ox hair. Writing pencils may be pointed or chisel edged (see Fig. 1), the latter being called "one stroke." These pencils have become popular, yet many signwriters prefer the pointed writing pencils. If disappointment is to be avoided, it is recommended that all intending signwriters should possess a good set of pure red sable pencils to ensure satisfactory results. Good pencils cost money but last a long time if properly looked after. They should be washed out in turpentine or white spirit two or three times after use, then when the paint is rinsed out of them, a little grease or Vaseline worked into the hairs to keep them soft. Always keep writing pencils in a suitable box to protect them from dirt and dust; care should be taken to see that the points do not contact the ends or sides of box, so as to damage the ends or points.

Mahl Stick or Rest

This is an essential tool yet it is easy to make. Take a piece of cane, and some cotton wool; place the cotton wool in a piece of new chamois leather, draw ends together then

Fig. 4.—Using the mahl stick.

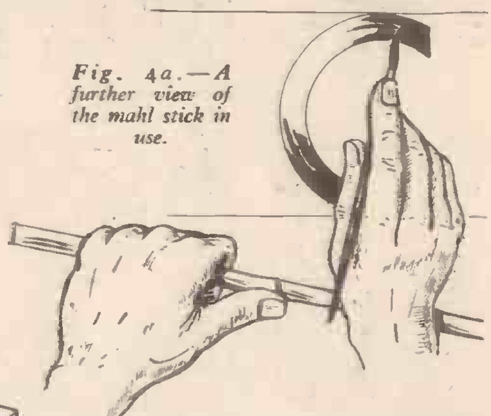


Fig. 4a.—A further view of the mahl stick in use.

place on end of cane and bind up with strong twine. Other suitable tools are a thumb palette, palette knife for cleaning, and a number of dippers for colours. As a matter of convenience, the latter can be clipped to the palette board when writing. A straight edge, a pair of compasses, some chalk and strong cotton for snapping lines are also essential.

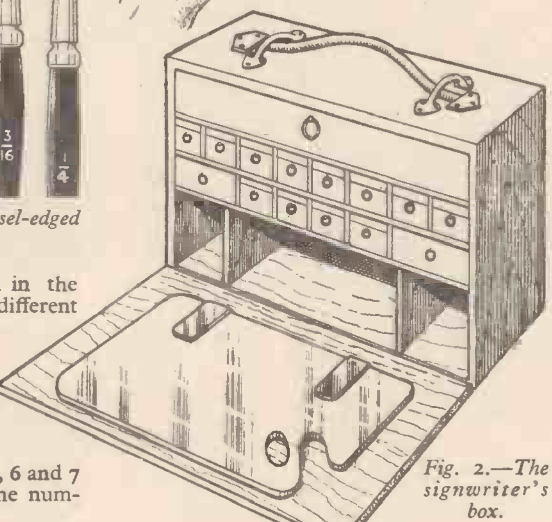


Fig. 2.—The signwriter's box.

Fig. 3.—The block alphabet, showing sequence and direction of strokes.

Signwriter's Box

This box is very useful, especially when moving around; it acts as a kind of store for tools and paints and is, in addition, handy for standing on or for using as a seat. The most convenient size for the box is 15in. long by 6in. deep by 12in. high, as seen in Fig. 2. It should have a top drawer suitable for carrying writing pencils, a jointed mahl stick and compasses. Beneath this should be two sets of small box drawers these can be reserved for colours in small pots, tins, or tubes. Turpentine, oil, varnish or goldsize can be kept in four small cans with screw tops to keep out dirt, dust or air. About two drawers could be reserved for transfer gold leaf, cotton wool or clean rags, and a palette can be secured to the lid by means of a clip. A leather handle would be best for a wooden box, and a small metal handle could be soldered to a steel box.

Paints

Paints used for signwriting should be durable, able to withstand dampness and heat, and be fast to light. The materials should dry in a reasonably quick time so as to avoid spoiling by dirt and rain. For good work a careful selection of paints is advised from a firm specialising in materials for signwriters. (Remember lettering work done with cheap materials is very exposed, more perhaps than in any other trade.)

Preparing the Ground Work

The signwriter does not always prepare the groundwork upon which he writes, so

Fig. 6.—All letters can be drawn in or about a square, oblong or circle.

cannot be blamed for the deterioration of this. When working on his own account, however, it is a sound plan always, if possible, to prepare the groundwork himself to ensure good work.

Groundwork for signs should be prepared as for ordinary house painting, care being taken to observe the rule of coat sequence—priming, stopping, undercoating and finishing, allowing ample time for each successive coat of paint to dry. The finishing material should be a high grade enamel, and this can be employed for the lettering as well. Paint used for actual writing, however, must lend itself to easy application under the writing pencil. It is difficult to produce good writing with paint that fails to flow out correctly. Colours ground in turpentine and bound with mixing varnish or goldsize are extensively employed to-day by signwriters. Goldsize is a useful material which assists in the drying off, but should be used with discretion as too much means a brittle surface. A little goldsize mixed in flat oil paint, or gloss speeds up the drying.

The signwriter uses practically all pigments from drop black to white lead and the pigments should have good body to ensure good covering power. Tube colours are extensively used as they are of good quality, economical and convenient. Waste is negligible, for only just the amount needed for the job is squeezed out of the tube; the tint or shade can be mixed on the palette.

Choice of Colour

This often depends on personal taste, dark colours are less likely to develop defects than light colours, and the latter show up the dust. Light shades also absorb and retain more heat from the suns rays than dark colours. Black lettering on a white ground is often favoured as regards legibility, more than white lettering on a black ground. In using this, there is a tendency on the part of signwriters to-day to use over-pigmented and under-bound materials in an attempt to cover in one coat; the outcome of this is a cracking up of the paint on the letters. For white writing on a black background, *Titanium Zinc White* will be found to be the best mixture for pure white lettering. Yellow letters on a black ground also give good legibility at a distance.

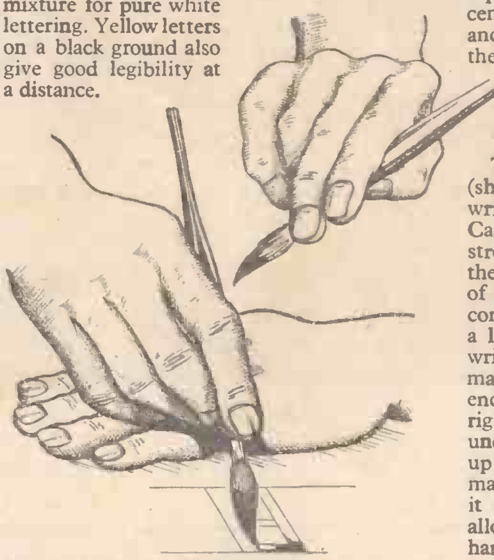


Fig. 5.—How the brush is held when the mahl stick is not in use.

Mastering the Writing Pencil

Mastery of the writing pencil is necessary in order to gain confidence and to achieve good work. The method of practice and working should be "free and easy." This may not come at once, but with some perseverance, confidence and skill will be achieved. Try to avoid a cramped manner of working at the start; this is generally the result of being too fussy. At the commencement one cannot hope to letter with the same legibility as the signwriter with years of experience. Do not be discouraged, however. You will be surprised what can be achieved with patience and practice.

All lettering must be written between two chalk lines, top and bottom. These should be "snapped" across the board you are going to practise upon as follows: Take a piece of strong cotton and tie a loop in the centre of it, next hold the thread by the loop and rub chalk a few times along it. Stretch the thread across the board, take hold of it in the centre with the teeth, raise it about 1 in., and then release it to snap back on to the surface to leave a chalk line.

The next job is to try out the block alphabet (shown in Fig. 3). Remember, a good signwriter always makes a good block letter. Carefully study the outline and direction of stroke of each letter. Begin by dotting out the outlines of the letters with a pointed piece of chalk, and when satisfied that the shape is correct, outline the letters with colour. Put a little paint on the palette, and charge the writing pencil. Having done this, take the mahl stick in the left hand, placing the knob end on the board in a position suitable to the right hand. The mahl stick should cross under the part to be written on. Next take up the writing pencil and hold it in the same manner as you would a pen; avoid holding it too close to the hairs of the pencil, but allow the forefinger to rest on top of the handle. This is shown in Fig. 4.

As the right hand lightly rests on the mahl stick lay the pencil on the top of the letter,

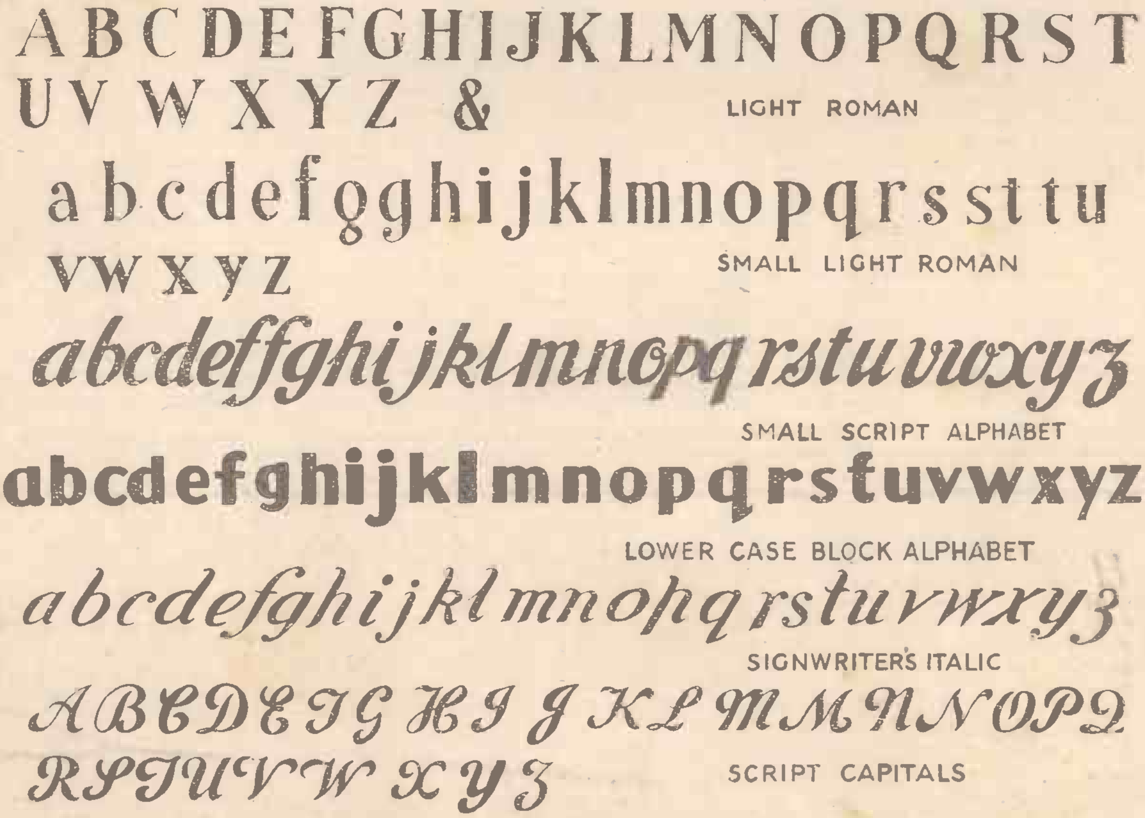


Fig. 8.—Several of the more popular alphabets in use by signwriters.

then make a firm, downward stroke, using the point and trying to maintain even pressure, repeating this till the letter is outlined. Recharge pencil with colour and fill in the letter. The corners of letters can be squared each time by a little flick of the pencil. The down strokes of all block letters should be a little thicker than the up strokes.

To ensure that all letters are vertical, use a set square and draw a light chalk line through each letter to act as a guide until the eye gets accustomed to straight lines.

Master vertical lines first and curves afterwards, and when necessary use the mahl stick as a straight edge. Place it on the work in a horizontal or a vertical position. Take the pencil between the thumb and forefinger close up to the hairs, now use the little finger as a guide to draw the pencil along to run a line.

It is essential that the forefinger should rest on the pencil, as this enables the operator to roll the handle slightly when turning a curve, an action which keeps the point of the pencil down on the surface and enables the writer to complete the curve in one movement. It is essential to practise this rolling motion as it helps to avoid ragged edges when making curves. The beginner may become adept in wiping off ragged edges, but practice and interest will soon dispense with this.

The block alphabet should be thoroughly mastered, then it will be found that other styles will come to hand easily. At times the mahl stick may be dispensed with; this may be convenient when writing small letters. Fig. 5 shows how the brush is held when the mahl stick is not in use.

Spacing

All letters of the alphabet can be drawn in or about a square, oblong, or circle. Fig. 6 shows this. All letters, however, do not require the same amount of space, so the following points should be carefully borne in mind:

Careful spacing is needed with W and I. The W must encroach on the I space. Allow a little more space when I comes next to N or any other straight, vertical letter. This also applies when I comes next to curved letters like O, C, G and Q. See that the bottom of A and the top of V and W are spaced more closely on account of receding from the vertical. Spacing should appear even when observed from an average distance. The signwriter realises that correct spacing depends on the eye alone; it does not consist of leaving equal widths between letters, but what appears to be equal widths. Spacing means a careful adjustment of letters until by the eye they appear correct. This is illustracted in Fig. 7.

Always leave a space of one letter between words to ensure legibility. Remember a well-proportioned letter should be height 4, breadth 3, thickness of verticals and horizontals ⅞ths approx.

All horizontal lines appear thicker and should be written slightly thinner, while the downward strokes of curves should be slightly thicker than vertical strokes.

Curved letters occupy more space than straight ones. The letter M requires about the thickness of N or H plus the letter I. W is a double letter, being wider at the top but receding at the bottom. This forms a large space so any letter following a W should be spaced nearer to make space appear equal. Letters L, J and F have self-contained spaces; they may be placed a little nearer to other letters.

It should be noted that a number of letters appear to the eye to be equal in size, top and bottom, but this is not so. Examine a piece of letterpress upside down and note the capitals B, E and S. They appear top heavy and they would appear like this if written exactly the same size top and bottom. Note the spacing of the word "WATER" in Fig. 7; A and T can upset the balance.

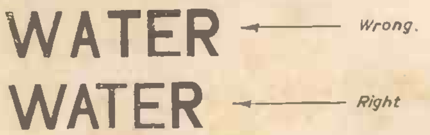


Fig. 7.—The right and wrong ways of spacing.

Spacing between letters calls for practice and judgment, and is not possible by pure measurement alone. Although all letters of the alphabet can be constructed in a square, oblong or circle they would look unsatisfactory if spaced like this on an actual sign. The vertical letters coming together would look correct, but the others would look odd. A signwriter gets to know by practice the peculiarities of the alphabet; this makes it necessary for the beginner to experiment so as to acquire the art of setting out.

The main groups of lettering in use to-day are Block, Roman, Italics and Script. Block Letters are known as "Sanserifs," and Roman as "Serifs." Roman is written with thick down strokes and thin up strokes. The Roman alphabet is suitable for high-class work, for advertisement and trade vans. Roman style letters have feet called "Serifs," thus the letters require more care in the spacing out. The serifs may be light or heavy, pointed, square or round. When Roman letters are written on the slope they go well with "Signwriter's Italics," and small script lettering, as it can be adapted to cramped space. Several of the more popular alphabets are shown in Fig. 8.

Writing a Sign

Suppose the lettering, A. THOPER & SON, is to be painted on a signboard. After consideration we find that the lettering is best written in two lines. There are seven letters in the name, including the initial; this means seven spaces. Mark out the centre of the board and chalk O in this space then place the letters P-E-R on the right side of the O and the letters A-T-H on the left side of the O. Allow more space between the A and T as it is an initial. Place the letters & SON, on the second line in four spaces in a similar manner, and allow equal space at each end of the sign to give balance. Place a little well-mixed paint on the palette, charge the writing pencil, and use the point well when outlining the letters, afterwards fill in in the usual way. Allow more space when writing Roman letters to make room for the serifs.

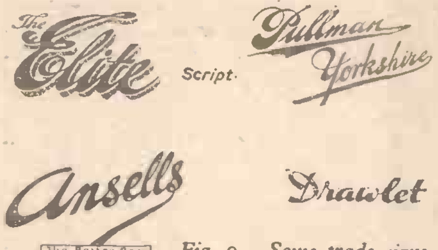


Fig. 9.—Some trade signs.

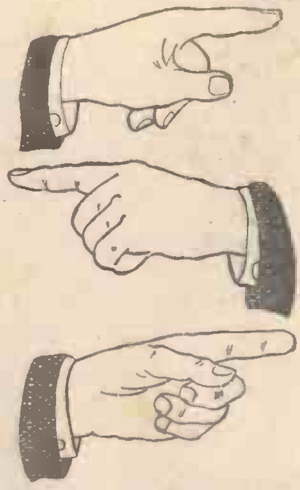


Fig. 10.—How pointers are formed.

Many firms to-day adopt distinctive and individual lettering for their businesses; a good deal of this lettering on trade signs is not a true style. This can be seen by the word "ANSELLS" in Fig. 9, the capital letter A is a small script letter. The prospective signwriter should devote his main attention to mastering the principal alphabets, Block, Roman, Italics and Script. Having accomplished this he can turn his hand to these other forms of writing which he will find easy to execute when he is a master of the correct styles. The pointers in Fig. 10 also provide a useful field for practice. The signwriter who can write the true styles correctly and neatly will always be in demand, providing he is in the right place for the work.

Royal Naval Gunboat Fitted with Gas Turbines

H.M.S. **GREY GOOSE,** *a war-time steam turbine gunboat is now a floating test-bed for the Royal Navy. She has recently been fitted with two of the latest Rolls-Royce R.M.60 gas-turbine engines of advanced design for experimental purposes and has been showing her paces in the Channel off Portsmouth during sea tests. These engines are expected to give 35 per cent. more power than that of the two steam turbines which* Grey Goose *originally had. This increase is combined with a 50 per cent. reduction in weight and a saving of 25 per cent. in machinery space. The photograph shows H.M.S.* Grey Goose *moving at speed in the Channel off Portsmouth.*

THE PLANETARIUM

By FRANK W. COUSINS, A.M.I.E.E., A.C.I.P.A.,

THE planetarium in its modern form is the development of an idea expounded by Dr. Bauerfeld. It comprises an optical projector of great complexity situated on the floor of a room provided with a hemispherical ceiling. The projector—electrically-controlled by a skilled operator—is able to project moving images of the star fields, the Sun, Moon and planets on to the hemispherical ceiling to simulate the night sky.

The realism produced is truly breathtaking. Dr. Fox, of the Adler Planetarium, Chicago, has said, "*visitors come to see a stirring spectacle, the heavens brought within the confines of museum walls. Not a trivial plaything, a mimic aping of the firmament, but the heavens portrayed in great dignity and splendour, dynamic, inspiring in a way that dispels the mystery but retains the majesty*."

The effect is one of great beauty, giving an impression of standing under a cloudless, starlit sky, with the advantage that the projector operator can show to an audience the sky exactly as it would appear to an observer at any latitude, on any specific night of the remote past, the present or remote future. Complex astronomical happenings which in nature may require thousands of years to run their course may be presented to an audience

Fig. 1.—A fine example of an Indo-Persian celestial globe made in bronze and inlaid with silver.

in a matter of minutes. It will be readily appreciated that a planetarium may provide an educational and cultural centre at which large masses of persons may be introduced to the queen of the sciences. Indeed, many thousands may be made fully aware of the wonders of the macrocosm and each one may —"*hold infinity in the palm of his hand and eternity in an hour.*"

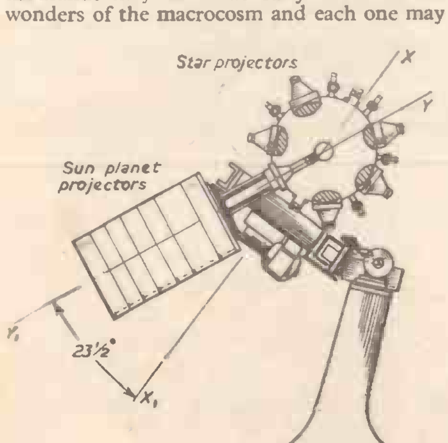


Fig. 4.—The fixed latitude instrument of Dr. Bauerfeld.

History of the Planetarium

The history of the planetarium is not without interest.

From the earliest times the inhabitants of Asia had some cognisance of astronomical phenomena and this passed by Egyptian and Babylonian civilisations into Greece. The astronomers of these great civilisations were familiar with the movements of the stars, the phases of the Moon and the wanderings of the planets—in fact they used the heliacal rising of Sirius to determine the length of their year and other astronomical events to position *inter alia* feast days and the times for the sowing of seeds.

This pre-occupation with the sky caused celestial globes to be produced much earlier than terrestial globes, the star fields being more accurately understood than the terra aqueous surface of man's home, the Earth. A fine example of an

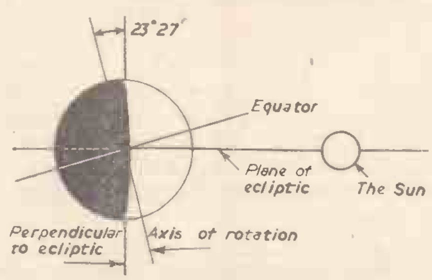


Fig. 5.—The inclination of the Earth's axis of rotation to the plane of its orbit.

Indo-Persian celestial globe made in bronze and inlaid with silver is shown in Fig. 1. The oldest celestial globe extant is preserved in the museum of Florence being made at Valentia before the year 1200. Much skill was lavished on the celestial globe, some artists producing a terrestrial globe surrounded by a glass celestial globe, the whole apparatus being provided with a mechanism for showing the relative positions of the Sun, Moon and planets. A 12ft. diameter globe of this kind was made for Louis XIV, at Venice, by Coronelli, at the close of the seventeenth century. Evidence is available, however, to suggest that the *original* celestial globes were made by the Arabs *circa* 300 B.C.[1].

Armillary Spheres

The next step forward in the manufacture of a model of the heavens, designed to show the complex movements of the Earth-Moon system and the apparent movements of the Sun and stars, was the armillary sphere. It is in essence a skeleton celestial globe, the series of rings (armillae) representing the great circles of the heavens and revolving on an axis within a horizon circle. The armillary spheres which have the Earth as centre to represent the geocentric astronomy of the ancients are known as Ptolemaic, and those with the Sun as centre to represent the true heliocentric astronomy are termed Copernican.

Eratosthenes, Hipparchus and Ptolemy all made use of the armillary sphere (276 B.C. to A.D. 161). Ptolemy gives a very full description in its famous work the Syntaxis, Book V, Chapter I. Tycho Brahe, the celebrated Danish astronomer, made elaborate equatorial and zodiacal armillary instruments and these have been fully described and illustrated[2]. The elegant armillary sphere shown in Fig. 2 was made by Phillipe Danfrie the elder *circa* 1570.

Early Planetaria and the Orrery

Models of the solar system, showing the Sun with its retinue of planets visible to the naked eye (Mercury, Venus, Earth, Mars, Jupiter, Saturn), adapted to move by clockwork, were commenced in the early 17th century. Johannes van Ceulen de la Haye is credited with the first of the wheelwork planetaria after a design by the astronomer Christian Huygens (1682). This remarkable model is preserved at

It has been widely reported that Madame Tussauds are having built at the Zeiss works, in Oberkochen (West Germany), a planetarium projector to be housed in a planetarium building on the site of their cinema, next to the Wax Works, bombed in 1940. The planetarium will be open to the public in 1957.

No planetarium has ever been built in Great Britain. The Science Museum has considered such a project but after much procrastination it is still not known whether they are to proceed with the idea or not.

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Fig. 2.—An armillary sphere made by Phillipe Danfrie the elder circa *1570.*

1 "Terrestrial and Celestial Globes." E. Luther Stevenson. Two vols. Yale University Press, 1921.

2 Tycho Brahe's description of his Instruments and Scientific Work. As given in "Astronomiae Instauratae Mechanica" (1598) Copenhagen, 1946.

M its History, Design & Use

(*Left.*)—*The planetarium brings the vast spectacle of the heavens within the walls of a museum.*

F.R.A.S.

Lyden. The design is such that the relative speeds of the planets are correctly interrelated to agree with the relations which exist in the actual solar system. The problem of providing suitable gear trains is no mean one. Practical solutions were available, however, by Huygens' continued fractions and the subject was treated very excellently by Camus in his Cours de Mathematique, 1752. The problem of the gear trains is of particular interest to our subject for a not dissimilar problem occurs in the modern plane-

rly 1700s George Graham, a ument maker, designed and n instrument which included the nd Moon ; this is now in the History of Science at Oxford. Rowley improved Graham's design and presented to his patron, the Earl of Orrery, a working planetarium in 1712. Later the essayist Sir Richard Steele coined the name "an orrery" which has ever since been used to denote mechanical models of the solar system. Many fine wheel-work orreries are on view at the Science Museum, South Kensington, and one of these by the Rev. Wm. Pearson (1813) showing the mean motions is presented in Fig. 3. Noted artists and constructors of the orrery include Eise Eisinga, of Franeker, Holland (*circa* 1775), P. M. Hahn and A. de Myluis (*circa* 1790) and David Rittenhouse, of Philadelphia (*circa* 1767). A fine Rittenhouse orrery showing the elliptical Keplerian orbits of the planets is now preserved at the University of Pennsylvania.

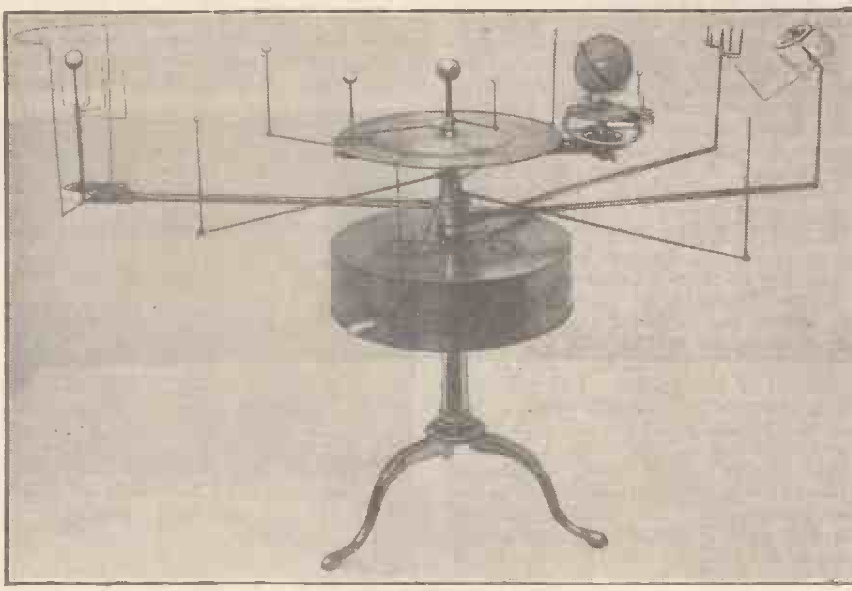


Fig. 3.—A wheelwork orrery at the Science Museum, South Kensington, made by the Rev. Wm. Pearson (1813).

All orreries of the form discussed above have *one* major objection which is shared with the armillary sphere and the celestial globe : the observer views the model from an extra mundane position which places him in the position of a cosmic traveller outside the universe—a position which while mentally refreshing is alien to man's natural view of the universe from his home on the Earth.

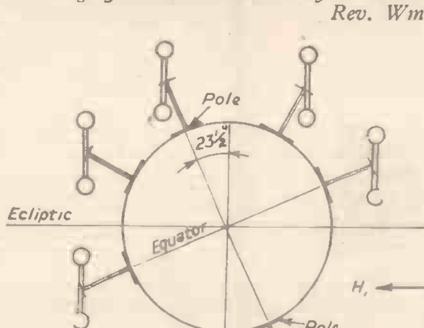


Fig. 7.—Orientation of the projector for various latitudes.

Celestial Spheres and Orreries in which the Oberver is at the Centre

In 1655 Andreas Busch, of Limberg, under the direction of Adam Olearius made a sphere of 11ft. diameter ; at its centre was a platform on which 12 persons could be accommodated. The stars were painted on the inside of the sphere and illuminated by a lamp. The sphere was rotated by water power to simulate the rising and setting motion of the stars. The platform was so constructed as to remain stationary and act as a horizon circle and ground plane.

A similar device, called a Uranium, of 18ft. diameter, was constructed by Prof. Long, the first Lowndes' Professor of Astronomy at Cambridge in 1758. Thirty persons could be accommodated inside the Uranium. The stars were small holes pierced through the metal wall of the spherical shell of the Uranium and an external source of light gave the watchers inside a realistic view of the heavens.

A modern mechanical orrery of large dimensions, in which the planets are arranged on rails and moved by electrical carriages,

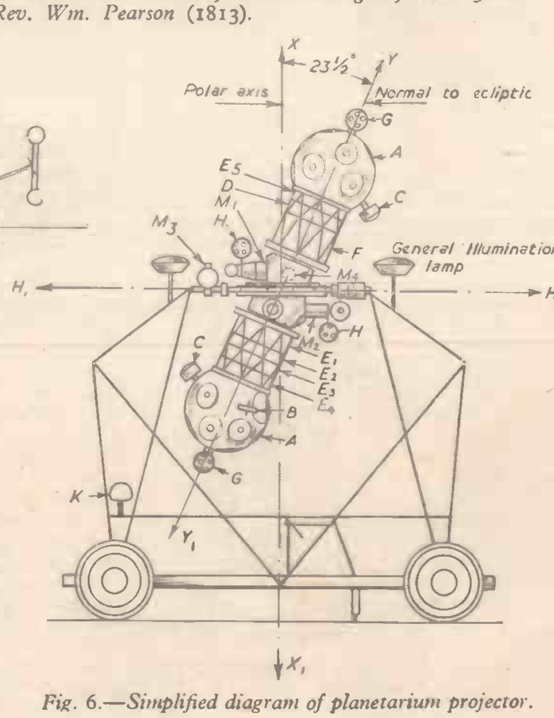


Fig. 6.—Simplified diagram of planetarium projector.

Fig 8.—Three of the sixteen aspherical condenser lenses as they appear inside a star globe.

was constructed at the Munich Museum in 1913. The designer was Franz Meyer, chief engineer of Carl Zeiss. This orrery is housed in a circular room of twelve metres diameter. A 22 cm. illuminated opal ball at the centre of the room represents the Sun. An earth carriage for an observer is provided and this is power driven to make one revolution about the sun in 12 minutes, the observer riding on the carriage. It is generally agreed that the next logical step from the Munich construction was taken by the Museum's curator Dr. Oskar Miller, who proposed a refined model in which the heavens would appear exactly as they do to an observer on the Earth. Dr. Walter Bauerfeld, as previously mentioned, solved the problem with his bold idea of a stationary sphere with a *projector* at the centre able to project images on to the inner surface of the sphere. The projector was to incorporate the principle of the orrery so that the images could be made to move with such relative speeds that they represented the true relative speeds found in nature. This idea of Dr. Bauerfeld is the genesis of the modern planetarium. It enables an observer within the sphere (usually a hemisphere) to share in the complex motion of the Earth and see the true panorama of the skies from the anthropocentric viewpoint.

Projection Planetaria of the Bauerfeld System

Much detail design work was necessary to translate Dr. Bauerfeld's basic idea into a practical working system. The credit for the final piece of optical equipment is due to the repository of brains and engineering skill centred on the Carl Zeiss works at Jena and Oberkochen. On the roof of a factory building at Jena an 83 ft. diameter dome was constructed to hold 700 spectators. At the centre of the dome was placed a fixed latitude projector designed by Bauerfeld. The general appearance of this instrument is shown in Fig. 4. The star globe was capable of projecting 4,500 fixed stars of the 1st to 6th magnitude of brightness on the inner surface of the dome. Thirty-one separate projectors were mounted on a spherical shell of gunmetal with a nitrogen lamp of 200 c.p. at its centre, and they were so divided up that the 31 lantern slides derived from large-scale star maps would form a continuous picture of the stellar sky on the inside of the dome. The required spherical shell took the geometric form of an icosahedron having each of its twelve corners cut off by planes in such a manner that the resulting 20 hexagons and 12 pentagons have identical circumscribing circles.

The Milky Way was projected by lantern attachments and separate projection heads marked in Fig. 4 were used for projecting images of the Sun, Moon and planets.

The star globes and the special projectors were rotatable about the axes. XX, YY, which represent the polar axis and the perpendicular to the plane of the Earth's orbit respectively. The disposition of the axes is more readily appreciated from the geometry of Fig. 5.

It was found, however, that this projector, while satisfactory for the fixed latitude at Munich and Jena (for which it was designed) was not able to project the whole fixed star-sky for positions of small latitude. An improved projector to overcome this objection and able to simulate the whole star-sky for any latitude was the subject of a British Patent Specification No. 244448 of 1924 in the name of Carl Zeiss. It is in substance the superior model projector now produced by Zeiss, and hereinafter described in detail. The improved model, often termed a "dumb-bell" model, from the characteristic shape of the twin star globes on a cylindrical framework, is shown in Fig. 6. This model projects stars for the Northern and Southern hemispheres. Rotation of the dumb-bell on axis HH, enables the projector to operate for any latitude as shown in Fig. 7.

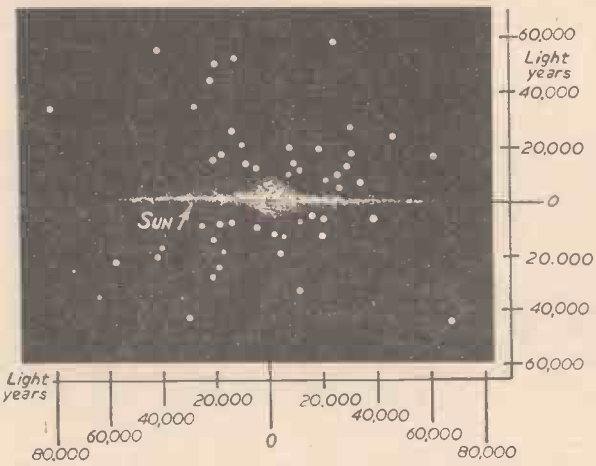


Fig. 9.—The Milky Way or Galaxy and globular clusters.

The general layout of the projector (Fig. 6) will be more fully appreciated from a careful study of the parts denoted by capital letters which are taken in alphabetical order.

A. Star globes each containing 16 star field projectors fed with a 1,000-watt lamp, to provide, in all, 9,000 stars of the Northern and Southern hemispheres.
B. Projectors for the Dog Star—Sirius.
Algol in Perseus
Mira Ceti in Cetus } variable stars.
Delta Cephei in Cephus
Megallanic clouds.
Globular clusters.
Nebulae.
C. Projector for the Milky Way.
D. Projectors for the Sun.
Aureole.
Zodiacal Light.
Gegenschein.
E. Projectors for the naked eye planets
Mercury E1.
Venus E2.
Mars E3.
Jupiter E4.
Saturn E5.
F. Projector for the Moon.
G. Projector for the names of the Constellations.
H. Projectors for the Equator.
Ecliptic.
Hour Circles.
Parallels, etc.
K. Projector for the Meridian.

Electric driving motors are denoted by the capital letter M.

Motor M_1 provides power for the annual motion about axis YY_1, normal to the ecliptic.

Motor 2_2 provides power for the daily (diurnal) motion about axis XX_1, the polar axis.

Motor M_3 provides power for change of latitude about axis H_1H_{11}.

Motor M_3 provides power for precession.

To understand the mechanical and optical features, it is desirable to relate the operation of the projector with details of the astronomical phenomena it is able to represent.

(A) Star Globes

Each star globe contains 16 star field projectors consisting of an aspherical condenser and *f*/4.5 Tessar-type projector lens system fed by a 1,000-watt lamp, the filament of which is shielded to give uniform illumination. In all, 9,000 stars are projected and this includes stars down to stellar magnitude 6.5. It is helpful to know that a star of magnitude 1 is 2.512 times as bright as a star of magnitude 2; and a star of magnitude 2 is 2.512 times as bright as one of magnitude 3, and so on. Hence, a star of magnitude 1 is $(2.512)^5$ times as bright as one of magnitude 6 $(6-1=5)$ or 100 times as bright.

The star magnitudes are represented by different sized spots of light on the dome surface, the images being produced by accurately hand-punched holes in very thin copper foil. The accurate holes are so made that a range of 65 punches from 0.0009in. diameter to 0.03in. diameter give the various star magnitudes sufficiently to produce a realistic star-filled sky.

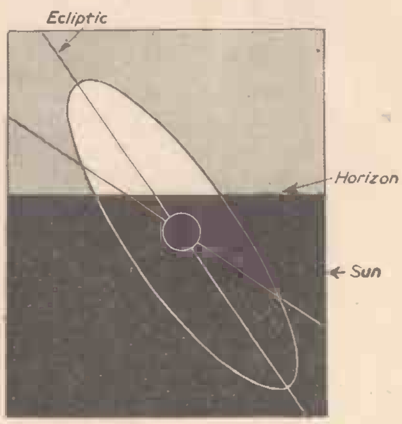


Fig. 10.—The Zodiacal light.

To simulate the fading of the stars as they approach the horizon, a gravity-controlled occulting device is mounted in front of each star projector; this gradually restricts the light through the lens as the lens comes into line with the horizon of the planetarium. The horizon of the planetarium is usually hand-painted by a scenic artist to represent the

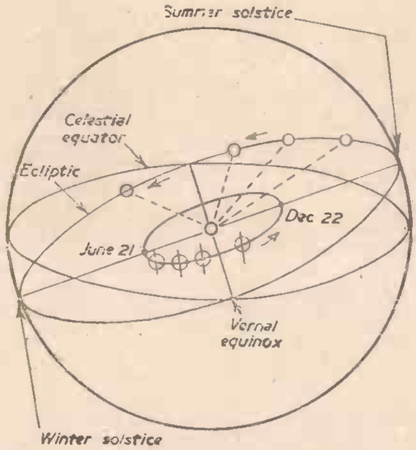


Fig. 11.—Apparent path of Sun amongst the stars (about 1° per day west to east).

well-known skyline of the city or town in which it is situated. Further occulting devices prevent star images being projected on to the audience.

(B) Special Star Projectors

The famous stars Sirius, Algol, Mira Ceti and Delta Cephi are represented by special projectors to reproduce the characteristics of the star in question. These characteristics are as follows:

Sirius. This star is the brightest in the whole heavens with a *negative* magnitude of 1.58. It requires a projector of its own.

Algol. "The Demon Star" is a dark, eclipsing, variable star; its magnitude for about two-and-a-half days is constant at 2.3 magnitudes. It then decreases rapidly in brightness to magnitude 3.5, taking about five hours. Finally, in a further five hours its original brightness is regained[3].

Mira Ceti ("The Wonderful") is invisible for six months at about 9.6 magnitude. It then becomes visible to the naked eye for about six months. Its magnitude changes from 9.6 to 3rd.

Delta Cephi is the type star for the famous cepheid variable stars[4]. Its magnitude varies from about 3.6 to 4.3 in 5.37 days. It is believed to be a pulsating star. To provide such changes in magnitude the variable star projectors have a rheostat control for reduction and increase of the light intensity.

Megellanic clouds. These appear in the night sky of the Southern Hemisphere as small patches of light. They were named after Magellan, the circumnavigator. From detailed investigations it is known that these "clouds" are island universes outside our own star system, the Milky Way. Specially stippled negatives used with a projector lens system provide a realistic effect on the planetarium sky. The same technique is used for the globular clusters and other nebulous objects.

(C) Milky Way or Galaxy[5] is the spiral star system of 100,000 light years across in which our Sun is an average-sized star. Some idea of the system is given in Fig. 9.

If one looks out at the heavens on a clear, moonless night, about 3,000 stars are visible above the horizon to the naked eye. A faint, broad band of light encircles the sky in an irregular manner: this is the Milky Way. It is, in fact, the edge of the great star system in which our Sun is approximately 30,000* light years from the central region in Sagittarius.

Two drum-like projectors, one for each star globe, produce the Milky Way by projecting light through negative films made of the northern and southern half of the Milky Way. These films are made in their turn by photographing a drawing carefully prepared with stipling of the correct intensity.

The tenuous appearance of the Milky Way is produced in nature by millions of stars at great distances from the Earth and Sun. On the planetarium sky a similar effect is produced by a multiplicity of spots of light.

(D) The Sun Cage and Projectors

The Sun Cage contains a projector for the Sun *per se* and five other projectors: two for the aureole round the Sun's image; one

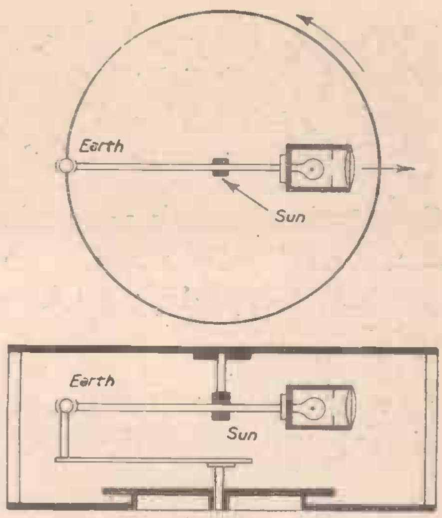


Fig. 12.—The Sun cage.

for the Zodiacal Light and two for the Gegenschein.

The aurole round the Sun is produced by the strong scattering of light which is seen in nature close to the limb of the Sun.

The Zodiacal Light appears as a faint hazy conical beam along the ecliptic (Fig. 10) a little south (in the northern hemisphere) of where the Sun is below the horizon. It is attributed to sunlight reflected from great numbers of meteoric bodies.

The Gegenschein or Counterglow is a very faint round patch of light about the size of the Great Square of Pegasus. It is situated on the ecliptic at the point diametrically opposite to where the Sun is at a given time.

It is to be appreciated that while the Sun moves across the sky each day from east to west owing to the diurnal motion, the Sun also has another motion across the sky from west to east owing to the Earth's motion in its orbit. (See Fig. 11.)

The mechanism of the Sun cage is easily understood from the simplified drawing at Fig. 12.

(To be continued)

3 "Some Famous Stars." Prof. Smart.

* A light year is 5.88×10^{12} miles.

4 "The Size of the Universe" F. J. Hargreaves, F.R.A.S. Penguin Books.

5 "The Milky Way." By Bok and Bok (Harvard Series).

32 Colour Transparencies with a 16/20 Camera

A Method of Masking Which Doubles the Number of Exposures

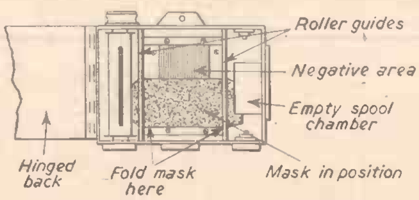
By R. J. FREEMAN

THERE are, no doubt, many photographers like myself who have not attempted colour photography because of the high cost of materials and processing. It may be of interest to users of 16/20 cameras, therefore, to know that at no expense, a simple mask can be made which will give 32 exposures instead of the normal 16, thus halving the cost of colour film. I adopted this method last summer and the resulting transparencies were of excellent quality.

The mask consists of a strip of backing paper 5in. × 1 3/16in., the ends of which, after opening the back of the camera, are threaded between the roller guides and the camera body. The paper is then pressed flat and a note made of the two places where it meets the outer edge of the frame opening. The paper is then removed and folded at these points and when replaced should fit snugly within the countersunk frame opening. Slide the mask until it is flush with one edge, thus masking just over half the frame opening (see sketch).

The colour film is now inserted and 16 exposures taken. Owing to the mask the film is only exposed for half its width. Remove the film from the camera and rewind in the dark. Slide the mask to the other side of the frame opening, re-insert the film and 16 more exposures can be made down the unexposed half of the film. There are now 32 exposed frames, size 42 mm. × 27 mm.

It is essential to mask half the viewfinder



Showing the Mask and position.

—a piece of masking tape can be used for this purpose—and it must be remembered when doing this that the image on the film is reversed, therefore the mask is placed on the side opposite to the mask inside the camera. This must also be reversed for the second run through. When using the finder for horizontal pictures the masked portion should always be at the bottom to avoid tilting the camera. This also gives the effect of a rising front and unnecessary foreground can be eliminated.

Masking the film in this way has the same effect as the use of a long focus lens in a 35-mm. camera and can be very useful.

The resulting transparencies were mounted in the usual way and if the normal 35-mm. masks are used, the larger size transparencies obtained by this method allow room to correct sloping horizons and eliminate unwanted intrusions at the edges of the transparencies.

A Gauge 'O' Steam Locomotive

The B.R. locomotive "Britannia." Photograph: British Railways.

Constructional Details and Scale Drawings of a Loco to Run on the "O" Gauge Layout Given in Our May and June Issues

By E. W. TWINING

(Concluded from the August issue)

FIGS. 5 and 6 show respectively one of the cylinders and one of the valve gears. The left hand is drawn in both cases, but both the right and the left hand are alike except for the fact that they are handed.

There are two methods of making these cylinders; they may be of cast brass or gunmetal or they may be built up of little bits and pieces of tubing, in part silver soldered and, in the case of small parts, soft soldered together. I have shown in Fig. 5 a built-up job, because I feel sure it will be neater, much less massive and will not have to be mounted in the lathe for boring and machining as if castings were used.

The stroke of the pistons is ⅝in. and thickness is 7/32in., whilst the bore is 7/16in. Of the valve, the travel, in full gear, is ⅛in., the diameter of the valves is ¼in. and the admission edges are 25/32in. apart All the necessary measurements are given on the drawing. The parts to be silver soldered are the cylinders to the flanges, the port pieces at each end and the cylindrical valve chests. In addition hard solder the boss to which the port face is screwed. It is advisable to silver solder the half tubes which form the exhaust manifolds though this is not important and the heat may injure or distort the valve chest. It will be safe to soft solder it and all the other parts as well. The steamports are drilled into the cylinder through the valve chest barrel and then have little brass plates soldered over the outer openings to seal them.

The blocks in the centres of the valve chests and manifolds will have to be carefully fitted and can be soft soldered, though those taking the steam pipes can be silver soldered. All silver soldering must be done first and then the soft soldering after the borax is cleaned away. The parts which can be soft soldered are the little plates over the drilled ports through the valve chest, the little half-round plates to fill the ends of the manifolds, the main exhaust connections at the manifold centres and the bosses on the cylinders which take the studs to hold the cylinders on the frames. It is recommended that all steam and other pipe joints be silver soldered.

The cylinder covers are to be separately fitted by circles of about five screws at each of the ends. Both of the pistons and the valves will have to be carefully lapped in, particularly the valves. The pistons will each have a single deep groove turned in it at its centre, and this will be filled with soft cotton wick wound in to form a soft packing. This should be well greased. The valves have no packing—they slide metal to metal and depend upon perfect fit, with a film of oil for their steam tightness.

The best way in which to fit up the cylinders, having assembled the frames and their stretchers together, will be to fix them by the studs and nuts firmly to the frames; then, with the four pipe flanges screwed to the valve chests, insert the ends of the pipes into the flanges and solder them. To remove the boiler again, simply unscrew the flanges. Of course, it must be checked that the boiler is in its right position, that it is level and at the correct height before the soldered joints are made. See also that the blast pipe points directly upward through the chimney before soldering the exhaust pipe into the two flanges. I have not indicated the length of the exhaust manifolds. This does not matter much so long as they extend to beyond the final exhaust ports. These are each composed of two circular holes which are indicated by fine dotted lines in the longitudinal section. The end plates of the manifold should come just beyond these circles: in other words, they should be in line with the outer faces of the cylinder covers.

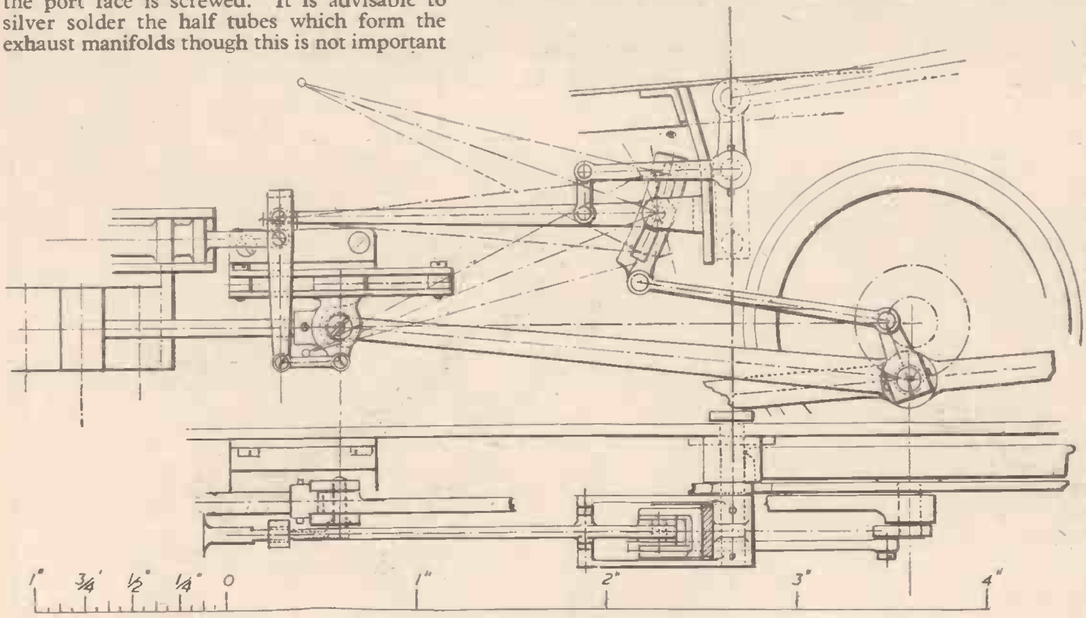


Fig. 6.—Elevation and plan of valve gear.

The Valve Gears

The gears, with which I include the connecting rods and crossheads, control the steam which is admitted to the cylinders and this gear is itself driven by the cylinders. In this model, although it is so small, full Walschaerts gear is fitted, so it is reversed by moving the radius rod to the opposite end of the curved expansion link as in the full-sized engine. It will call for very fine and accurate workmanship, and some of the links are very small; it will, however, be a job well worth doing. It should be made of steel throughout for strength, including the coupling rods but excluding the piston rods, the pistons and the slide valves. The rods will be of German silver and the valves and pistons of brass. All the links and rods can be cut and shaped from sheet metal. Observe that the radii of the expansion links, 2in., is equal to the length of the radius rods between their end centres. These expansion links are double, with the radius rods between them. So cut four links all together. In the full-size engines there are die blocks working in the slots of the expansion links but these are not necessary in the model. They would be too small to make and pass a pin or screw through them. So make the pins through the ends of the radius rods of large enough diameter to fit the whole width of the slots in the links.

The eccentric rods have their centres

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2007C **VEE BELT** (endless). A33 ½" x 33". 3/- each.

2007H **VEE BELT** (endless). A26 ½" x 26". 2/6 each.

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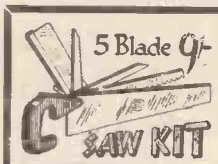

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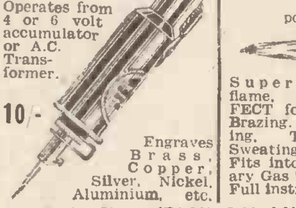

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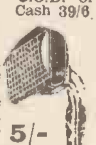

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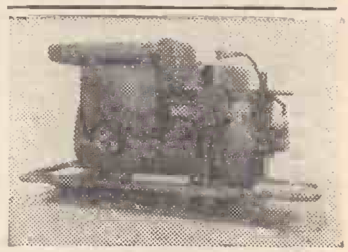

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1 5/16in. apart. They are driven by return cranks from the main crank pin on to which they are to be pinned ; but when fitting these they should be made a fairly tight fit on the crank pin, sufficiently so to make them hold for moving the gear without pinning, until you are sure that the valves have the correct amount of travel. When this is known drill the return crank and the crankpin together and knock in a pin.

In the prototype engines the reversing is by screw gear and the screw is down on the reversing shaft. This is unusual, but it saves space in the cab ; however, we cannot copy it in this model as it would be too small. I have therefore shown an ordinary reversing rod which will, at the rear, be pinned to a simple push-and-pull lever in the cab. Such lever can have a sector plate alongside of it, which sector can have two notches, one at the forward position and one at the rear, into which the lever will spring. The rod will make the same angle upward to the cab as the round screw shaft makes in the full-size gear and, in fact, the rod in the model can very well be made of round rod or tubing if desired.

The Reversing Shaft

This will call for some comment because it cannot run straight across the engine as it would foul the water tubes, as may be seen from Figs. 3 and 4. Therefore we shall have to crank the shaft downward to miss the tubes. The amount of the cranking is shown in Fig. 6. The whole shaft must be silver soldered and the shouldered ends of the round rod riveted over in flat steel plates as indicated. Since the shaft is cranked it will need to have bearings on each frame plate made up, each of two parts. These should be of brass and will be screwed in place.

The crossheads are each made of three pieces, silver soldered together, the central piece being the only one having any complication in its form. It is filed out to clear the connecting rod little end and then the side cheeks are attached. The gudgeon pin passes through these side cheeks and through the cover-rod eye. The outermost of the cheeks in each crosshead has a lug extending downward to which the union links are attached. There are two links, one on each valve gear, which rise upward from the union links to receive the valve spindle and the radius rod, the latter being the uppermost. This link is called the " combination lever." It gives the provision for the lap and lead of the valve and it is turned over at its top in order to give a double bearing for the two pins.

The Radius of the Track

The reader will remember that the minimum radius of the curves of our " O " gauge railway in the outdoor line described in our May and June issues was 5ft. That was measured to the inner rail and the engine has been designed to take this curve. In order to make it do so the wheelbase of the bogie has been slightly increased. The front axle has been put forward 3in. by the scale of 7mm. to the foot, which is actually only 1¾mm. This will never be noticed and was done to prevent the leading bogie wheel from fouling the front cylinder cover when the engine took the 5ft. radius curves. All other wheelbase measurements are correct and bogie wheels are of correct scale diameter. The rear radius truck has its pivot forward under the front edge of the fire box and here a block is silver soldered to a cross stretcher. A pivot pin is carried up through a tapered hole in the block and is held in place by a tiny pin through the pivot pin. Note that the main frames are strengthened by additional pieces soldered to them, where they are shallow, over the trailing wheels.

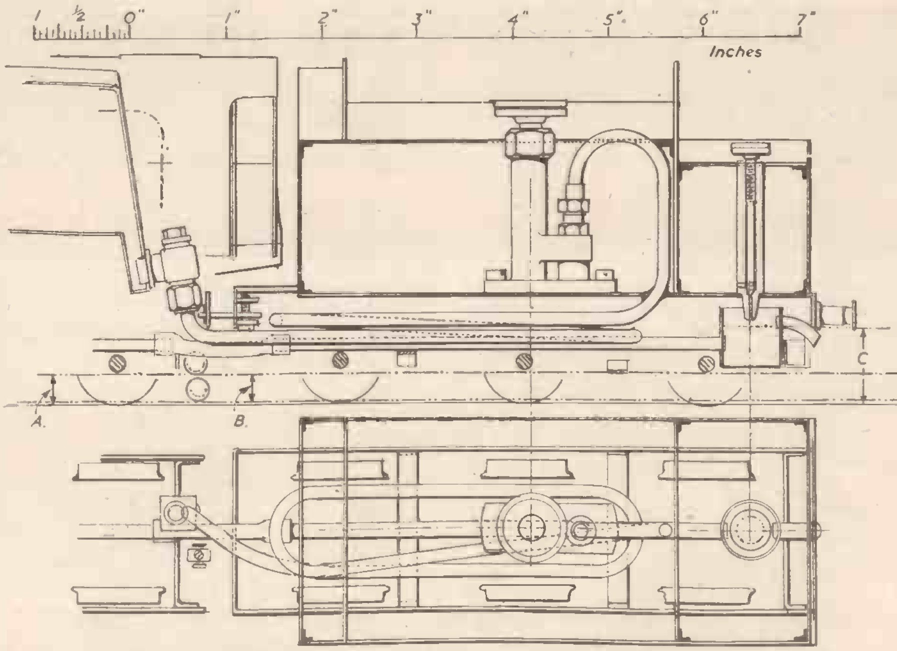


Fig. 7.—Longitudinal section of tender with spirit drip feed and water pump.

The Spirit Burners

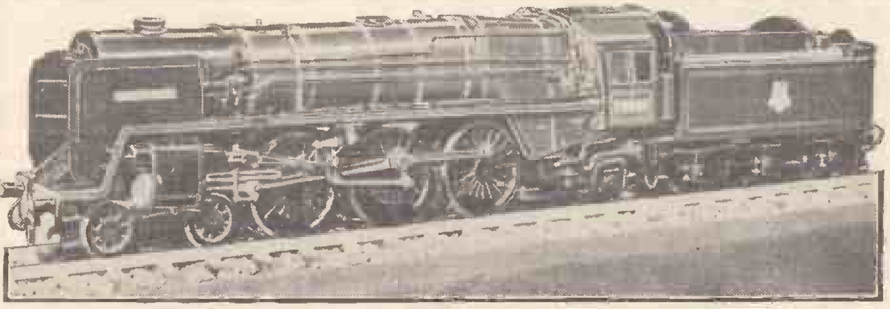
There are five of these filled with asbestos string to serve as wicks. The spirit pipe passes through all of them and this is drilled for the egress of the spirit in each burner tube which is made of slightly flattened brass tubing. The heights of all the burner tubes must be exactly equal and must be of the same height above the rails as the receptacle into which the flow of spirit is regulated on the tender. At the back end the spirit pipe is supported by a bent-plate stretcher between the main frames under the middle of the fire box. It is shown in the fire box cross-section, Fig. 4. At the front end the pipe is flattened, soldered and a screw passes up through it into the bogie pivot stretcher. The spirit drip feed and the tubular box into which the spirit falls, drop by drop, is shown in Fig. 7, together with the pipe which, running along under the tender, is flexibly connected to the burner tube by a short piece of pure rubber tubing. The tubular box is open at the top and the dotted line across it represents the correct level of spirit. The bent pipe at the back of the box is to carry off any overflow. The drip feed adjustment is provided by a screw-down valve which is shown as one of the items in the group of parts which is the subject of Fig. 8. As may be seen it is really a needle valve. The angle of the valve and its seat is fine and gives a very accurate adjustment, especially if a fine thread be put upon the screw, say a No. 4 B.A.

In the rear of the fire box a back-pressure valve is screwed. This is a Bassett-Lowke fitting ; its catalogue No. is 115/1 and it is connected to a hand pump. This also is by Bassett-Lowke Ltd., its number is 723/2. The connection is by a long pipe of ⅛in. diameter, which is coiled elliptically once around in order to provide, by its elasticity, sufficient flexibility to allow the engine and tender to pass around a curve. It will be obvious that in order that the pump shall send water to the boiler, when it is in steam, the pipe must take pressure in excess of that in the boiler, which will be about 30 or 40 lb. per sq. in., so the delivery must be made through a metallic pipe connection, not a rubber or composition one. It will be necessary to see that the union nut on the check valve is screwed up tightly. It will be found that Bassett-Lowke Ltd. supply an internally screwed collar with the check valve ; this can be soft soldered into the back of the boiler.

Springs

It will be necessary, or advisable, to fit springs to all the axle boxes on the engine and on the tender. These can be of the simplest possible kind and the reader can form them how he likes, but the methods shown in Fig. 8 will be found quite good. The tender and the trailing axle boxes all have the cast spring buckles drilled up nearly to their tops and tiny spiral coils of fine steel spring wire inserted to press down on to the axle boxes. Where there are axle box guides these will form part of the axle boxes and will slide up and down with them ; the edges of the slots in the frames being the actual guides. The six coupled wheels can be sprung as indicated, as may also be the bogie axles. Pieces of clock spring can be used. Small and thin, of course.

There is an enlarged sectional view of the safety valve given in Fig. 8. This is not a Bassett-Lowke production, they do not list a



A model of the Class 7, mixed traffic, 4-6-2 locomotive " Britannia." This model was on show at a recent exhibition at Euston Station but is not the actual model described in this article.

suitable one and this valve must be specially made for the model. The collar which is soldered to the boiler and into which the valve itself screws will probably have to be made of two pieces of brass, one for the spigot and the other for the saddle portion. They should be silver soldered together, then drilled and tapped.

The valve itself is given a comparatively flat tapering seat and is then ground down with one or two grades of carborundum and finally with a fine abrasive. The boss on the top of the valve can have a saw cut across it for turning it with a semi-rotary motion. This boss is really provided for lifting the valve with pliers or some suitable tool in the event of its sticking. The length of the stem must be watched to see that the longitudinal boiler stay does not prevent the valve from seating when its case is screwed right down.

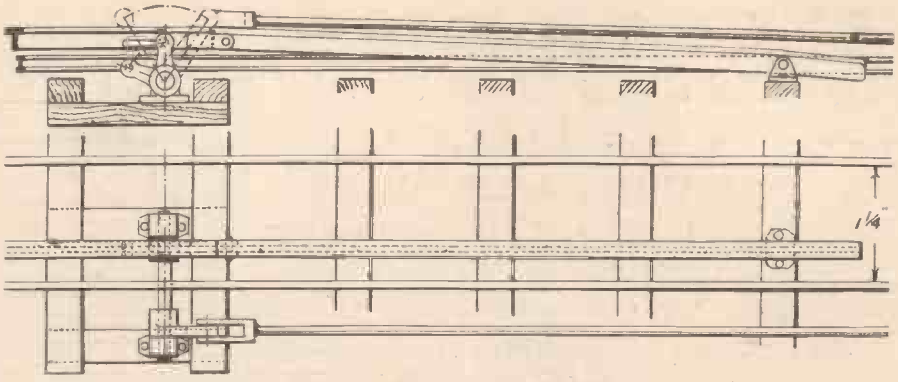


Fig. 9.—Device for stopping train.

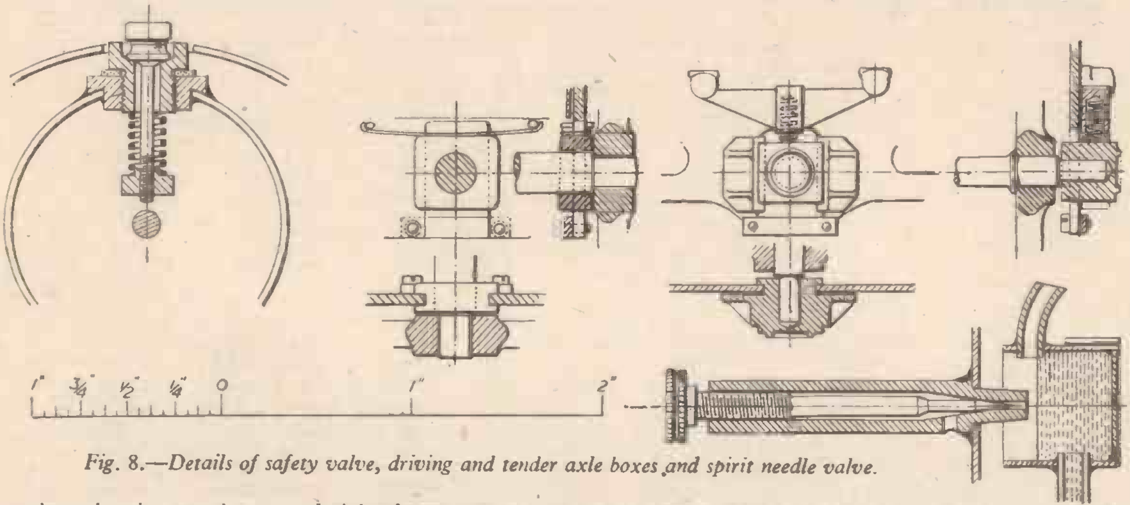


Fig. 8.—Details of safety valve, driving and tender axle boxes and spirit needle valve.

Remote Control, Stopping and Restarting

The regulator on this locomotive (the model) is an ordinary plug cock and the plug is drilled so that the lever makes an angle of 90 deg. to the plug's open and closed positions, each of which are at 45 deg. to the horizontal. The lever has a length between centres of 3/16in. so that its outer end travels almost exactly ¼in. in opening and closing the cock. From a pin, or a screw, in the end of the lever, a rod is pivoted and this has, at its lower end, a fork in which is mounted a little wheel or roller ¼in. in diameter. When the roller is in the down position the regulator is open and when it is up steam is shut off. With steam " On " the roller is exactly 1/16in. above the level of the track, or should be. In the drawing of the tender, Fig. 7, I have shown chain dotted lines parallel with the rail surfaces. These lines represent the heights of the roller. The first measurement A equals 5/16in. and the second, B, the rise and fall of the roller, ¼in. Incidentally there is " C," which is the level of the spirit in the sump, which level is 13/16in. above the rails.

Fig. 9 shows the movable ramp which, operated from the signal box or other point which may be preferred, moves a rod running longitudinally with the rails and looks like a point rod. This rod engages, by means of a forked end, with a crank arm which is fixed on one end of a short shaft. At the opposite end there is a forked lever having a pin through the fork, which pin passes through a slot in a length of 3/16in. by 3/16in. Tee brass. The length of the levers and the movement of the rod are such that the ramp is lifted exactly the required ¼in. to close the regulator and the length of the " T " brass ramp must be sufficient to prevent the train from over-running it. On the approach side there is pivoted to the end of the ramp an inclined plane made of the same " T " brass. The upper end of this rises and falls with the ramp and at its lower end it is pivoted in a bracket fixed to a sleeper of the track. There are two other brackets, or bearings; these are to carry the short shaft and must be screwed to two ties fixed to a pair of other sleepers.

Whether the whole arrangement on the engine and the track is the best to install I am not sure. It will, of course, work positively and it seems desirable to shut off steam at any necessary point on the railway and to be able to start up again without going to the engine but whilst you can stop at any station you cannot stop at a home signal unless you fit a ramp there. You can, however, arrange for the ramp to operate the signal. Of course, you can hold a train on a distant part of the line, as long as you wish, and then restart it. The ideal arrangement would be to have a ramp made of angle brass and on the engine two rollers one below the other, one roller passing along above the angle and the other below it; there would be no spring on the regulator and the ramp bar would either push up the regulator or pull it down. This might lead to accidents to the engine, however, because you could have no inclined portion of the ramp and the locomotive would have to approach the ramp very accurately and only after it had become engaged with the angle could the ramp be operated. So it would seem to be that the arrangement drawn will be the best.

In fitting the spiral springs (they are shown in Fig. 2) be careful to see that the regulator opens and closes easily and that the springs do open for steam every time. Watch also that when you raise a ramp it does not raise or overturn an engine.

It may interest the reader to know that full particulars of the prototype engines, with drawings, were given in these pages in the issue for April, 1951, and that in October of the same year, the B.R. standard tank locomotives were given. These engines are of the 2-6-4T type so there is the same number of axles as in the class 7 tender locos, only the wheels have a diameter of 5ft. 8in. The cylinders are 18in. by 28in. stroke and the fire boxes are between the frames. As the model railway owner will need a second engine on his line I would suggest that it should be a B.R. tank. They can largely be built the same size, as regards cylinders and valve gear, from the drawings here given, but the boiler will be a little lower pitched so as to yield a longer chimney and a taller dome.

A Loudspeaker Telephone

A Useful Device for Domestic Use

By S. SIMPSON

THE equipment forms a loudspeaker telephone with control of conversation from one point. It is for domestic use only and finds a most useful application in dealing with tradesmen where the tradesmen's door is remote from the kitchen, for instance down a flight of stairs which have frequently to be climbed for quite trivial matters.

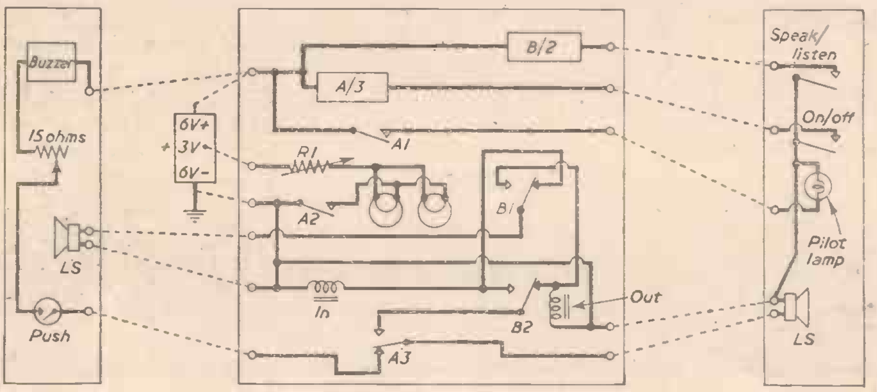


Fig. 1.—The theoretical circuit.

The telephone is quite easily built and the materials listed below are readily obtainable from most radio dealers. The two relays are ex Government stock.

List of Materials

Kitchen Control: Loudspeaker, less cabinet, 5in. diam., low impedance; key switch, Kellogg on-off; key switch, Kellogg, non-locking; lamp-holder, miniature Edison screw (MES); lamp, MES 6 v. 0.3 ampere; "break-off" bakelite connector strip, five-way; suitable cabinet to hold all of above.

Door Speaker: 5in. speaker, as kitchen; buzzer, high-pitched, 4.5/6 v. working; variable resistor, 15 ohms, to carry 0.3 ampere, intermittently; electric bell push, as used in normal bell systems; four-way "break-off" bakelite connector strip; suitable panel to hold above, less push.

Amplifier Panel: One relay, 4.5/6 v. operating with two "make" and one "change-over" contact sets; one relay, 4.5/6 v. operating, with two "changeover" sets; one 5 ohm variable resistor to carry 0.5 amp. intermittently; two five-pin valveholders; two output transformers, battery-pentode operation; resistor, 50,000 ohms; resistor, 75,000 ohms; resistor, variable, 250,000 ohms; capacitor, 0.01 mfd., 300 v. working; capacitor, 0.1 mfd., 300 v. working; one HL2 valve; one KT2 valve; capacitor, electrolytic, 4 mfd., 150 v. working; "break-off" connector strips, four-way, five-way, six-way, one each; H.T. battery, 90/120 v.; four dry cells, heavy duty, 1.5 v.; quantity insulated wire, 24 s.w.g., for panel wiring; quantity twin bell-wire, for interconnections between panels; staples, screws, clips as necessary.

The Sequence of Operation

The circuit arrangement is shown in Fig. 1 and comprises three distinct units: (1) kitchen control; (2) amplifier; (3) door speaker. The system functions as follows: the caller presses an electric push-button mounted on the door in the usual manner. He thus completes a circuit from 6 v. +, through the buzzer, 15 ohm resistor, contact A3, and kitchen speaker, back to 6 v. −.

The buzzer operates and causes the kitchen speaker to sound. The housewife hears the call and puts down the "on/off" key, so operating the circuit 6 v. +, relay A/3, on-off key, back to 6 v. − via one terminal of the kitchen speaker.

Relay A/3 closes and performs three functions: (a) at A2 it completes the circuit from 6 v. −, through both valves and R1 back to 3 v. − (the resistor presets the supply voltage to the 2 v. level necessary for the valves); (b) at A1 it closes a circuit from 6 v. + to the pilot lamp and back to 6 v. − via the kitchen speaker terminal; (c) at A3 it changes over the kitchen speaker from the buzzer circuit to the output of the amplifier.

The conditions now existing are: (1) pilot lamp is alight; (2) the amplifier is alive; and (3) the door speaker is acting as a microphone while the kitchen speaker functions as the loudspeaker.

Normally, the caller waits for an answer and this is supplied by the housewife, who now presses down the "speak/listen" key to "speak." Relay B/2 operates over the circuit 6 v. +, relay B/2, "speak-listen" key, back to 6 v. − via the kitchen speaker terminal. Relay contacts B2 change over the kitchen speaker to the input of the amplifier (it will be remembered that contacts A3 have changed over and will remain so for as long as the "on/off" key is at "on"). At B1 the door speaker is transferred to the output end of the amplifier. The kitchen speaker is thus connected as a microphone and any speech can be heard at the door speaker.

The "S/L" key is spring-loaded, returning to "listen" when pressure on the key is released and breaking the holding circuit for relay B/2. On releasing, the original condition is restored and the door speaker reverts to its function as a microphone.

At the end of the call the "S/L" key will automatically return to "listen" and the glowing pilot lamp will remind the user to set the "on/off" switch to "off." This action releases relay A/3, which then breaks the battery supply to the amplifier valves, extinguishes the pilot lamp and returns the kitchen speaker to the buzzer circuit in readiness for the next caller.

Summing up these actions:

(1) The caller presses the button;

(2) The housewife hears the kitchen speaker sounding;

(3) She switches "on" and presses to "speak";

(4) She replies verbally to the caller;

(5) She releases the "speak" key to hear the caller's reply;

(6) At the end of the conversation she switches "off"; the "speak" key automatically returns to the correct position.

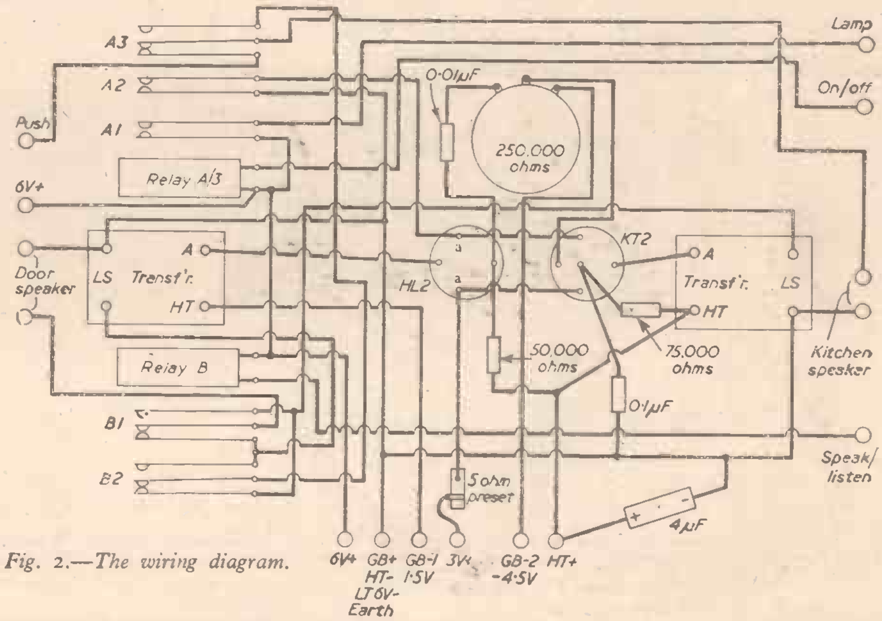


Fig. 2.—The wiring diagram.

Wiring and Construction

The layout can be set to suit the constructor's own choice of panel dimensions. The relays can be mounted in any position which permits of free operation of the movable part (armature) and the springsets; they are, for all practical purposes, independent of gravity. The cover of the amplifier unit should be drilled to enable a screwdriver to be inserted for adjustment of the volume control. The battery for valve heating and relay operation consists of four dry cells (each of 1.5 v. rating); these are connected in "series," i.e., the side terminal of one is connected to the centre terminal of the next. Regard the free side terminal as 6 v. −. The second centre terminal is then 3 v. +, and the fourth centre terminal is 6 v. +. These cells should be mounted somewhere near to the amplifier and the H.T. and G.B. batteries may be mounted along with them. The earth connection is made to the nearest water pipe as in radio practice.

Wiring between the units is made in twin bell-wire of good insulation properties. It will be noted that only five wires are required between the kitchen control and the amplifier; since six wires will be available, a pair should be used as one wire between the pilot lamp terminals on the kitchen unit and the amplifier. Do not fit the valves into the amplifier until the method of adjusting the L.T. supply is clearly understood (see paragraph headed "L.T. Compensation").

Adjustments

The pitch of the buzzer can be raised by inserting one or two strips of soft blotting paper between the vibrating part (armature) and the polefaces. Readjust the contact screw until reliable operation is obtained.

To control the volume of the calling *signal* increase the amount of resistance in the buzzer circuit; the limit is determined by the current necessary to operate the buzzer. This test should be checked from the push, as the resistance of the lines to and from the push is also in circuit when the system is used normally.

Volume control of the *speech* out of the kitchen speaker is set by adjustment of the 250,000 ohms volume control. Since it also controls the volume heard at the door speaker it should be adjusted with that fact in mind; a speaker working in the open requires more power than one which is in a small room.

Little more need be said as regards maintenance. An occasional check of the relay action is advisable; clean the inside face of the armature and the poleface, then draw a soft lead pencil along the inside of the armature angle to provide lubrication. Never apply oil—even of the finest—to a relay.

Failing batteries will be indicated by intermittent operation of the buzzer and by falling volume of speech. H.T. failure generally shows up as falling volume and roughness of reproduction. Over a long period of time the 4 mfd. capacitor may begin to deteriorate; this will probably show up as the H.T. battery ages and will cause either a "plopping" sound or perhaps a "howl."

Battery life should prove very economical, as the equipment consumes only a small current and is not in use for lengthy periods.

L.T. Compensation

The initial adjustment of the L.T. supply for the valves is made by setting the resistance of the 5 ohm preset to include all of the resistor. Now close relay A/3 from the "on/off" key and connect a voltmeter across the pins marked "a" on Fig. 2. Reduce the amount of resistance until the meter shows 2 volts (both valves must be in their holders during this test and it is advisable to disconnect H.T.+). It will be seen that this adjustment leaves a little leeway for subsequent readjustment as the battery ages; as stated above the "discard" point is likely to be determined by faulty operation of the buzzer.

A Photographic Print Washing Bath

A Useful Device for the Darkroom Enthusiast

By H. HUCKSTEP

THE process of washing photographs is at least as important as any other stage in their production, for upon the thoroughness of the removal of the last traces of undeveloped silver depends their eventual permanance.

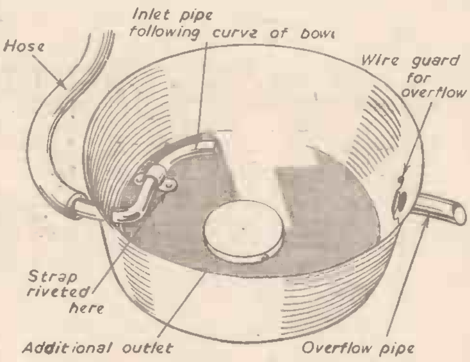
The washing bath described here has had many years' use, and has been copied by others, in each case with complete satisfaction.

It fulfils the purpose of producing a strongly circular rotation of the water and contents, thus ensuring that the prints do not stagnate, or stick together. An overflow is provided at the upper portion of the bowl, and since the water entry is at the bottom, a continuous flow of fresh water is maintained. Hypo being a heavy salt, where a circular motion exists, it tends to form a sort of vortex of strong concentration in the centre of the bowl. In order to drain this away, a shielded secondary outlet is also allowed for.

The basis of the apparatus consists of an upright-sided cylindrical bowl of the type used for standing preserving jars in while they are being heated. It is known as a Maslin Pan, and is of aluminium, with small loop handles near the top. The prototype was 14in. diameter by about 6in. deep, and just takes 10in. x 8in. prints. Larger sizes are also available. Three holes of approximately ⅜in. diameter are drilled in the bottom, and a larger hole to take a short length of copper pipe (3/16in. internal diameter) is also made in the lower edge, as shown. A final hole of sufficient size to take a 1in. length of aluminium tube (approximately ⅜in. internal diameter), is also provided, and this is made at about 1in. from the top edge, to act as overflow.

As aluminium was in use, it was decided to employ a heatless solder, and the result was far better than anticipated. It is essential, however, to very thoroughly rough up both adjacent surfaces. Each surface is then given a thin coat, allowed to dry thoroughly, and then united with a generous application of the compound. The joint is temporarily "splinted" in position by means of cellulose tap and allowed 24 hours to harden before use.

In this way, the three small outlet holes are covered by the aluminium lid of a dentrifice tin. Four small notches are first made in the lower margin of the lid to allow the water to escape, and it will also be necessary to make a tiny hole in the top of the lid to prevent unpleasant gurgling noises which will otherwise be caused by an air-lock.



Details of the bath.

The entry pipe, bent as shown is next "soldered" in, and it is recommended that, if possible, a strap is riveted in position to provide extra support, since this pipe gets the pull of the rubber hose. Lastly, the overflow spout is fitted, and the aluminium guard-wire is also placed to prevent prints blocking the overflow.

The rubber hose is simply gas tubing, and the free end is fitted to a tap connection or a plastic "anti-splash."

The washing bath is now complete, and can be used as soon as the "solder" is hard. It is placed in a sink or bath, and the hose connected to a cold tap, which is turned on fairly fast. The water will swirl round quite forcibly at first, but as the level rises, it slows down. The tap should be so adjusted that the prints rotate fast enough to prevent them clinging together, but they should not turn over or stick to the sides by centrifugal force, if so, it should be turned off slowly until it is sufficient only to maintain the level of the water and to keep the prints gently on the move.

Generally speaking, half an hour in this bath will provide ample washing, since it is automatically removing the contaminated water and replacing it by fresh all the time. An additional safeguard is to soak the prints, immediately after fixing, in a solution of one per cent. anhydrous sodium carbonate, which converts the hypo into a less harmful and more soluble compound.

List of Parts Required

- One aluminium Maslin Pan (or similar aluminium bowl) of sufficient size.
- 8in. copper pipe, 3/16in. in diameter, for inlet.
- 6in. aluminium wire for outlet guard.
- Small piece (approximately 1in.) aluminium pipe ⅜in. in diameter for outlet.
- One aluminium lid of dentifrice tin.
- 6ft. gas tubing with tap adapter.
- Heatless solder.

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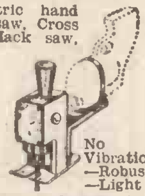

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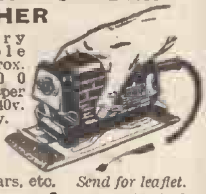

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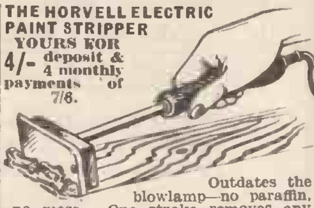

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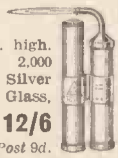

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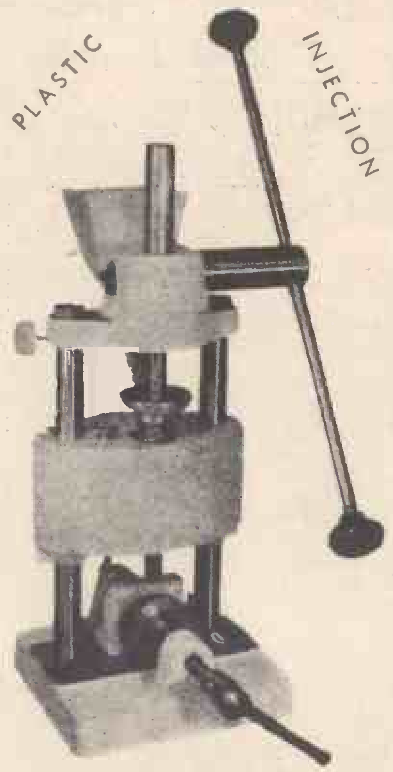

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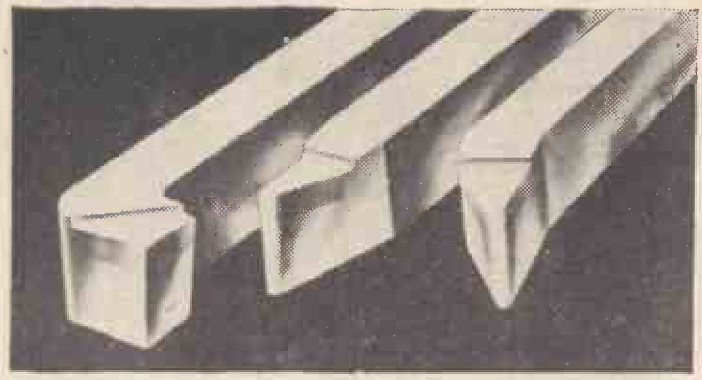

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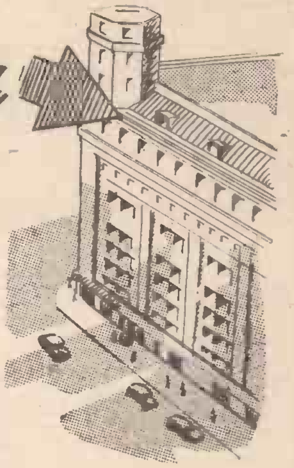
Letters to the Editor



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

The Railway of the Future

SIR,—I should like to comment on Mr. Zalewski's "Railway of the Future," described in the June issue, from the point of view of an engineer intending to build such a line.

The abandonment of wheels in favour of sliding bearings, travelling on rails the recessed tops of which are to be filled with a light lubricating oil, of course, completely rules out the possibility of gradients in the completed railway, as the oil would simply flow down to the bottoms of the grades, leaving the tops unlubricated. Obviously, no practical railway could be constructed without gradients. Even supposing such a line were to be constructed, however, it could not be in the open air, as the action of wind, rain, frost, etc., would rapidly remove the lubricant. Even underground, there is one other factor which would still remove the lubricant from the rails, and that is the unavoidable presence in the latter of expansion gaps, down which the lubricant would drain into the roadbed. Unless one were prepared to construct the railway in a perfectly level tunnel, hermetically sealed, vacuum-pumped and thermostatically controlled, or alternatively to fabricate the entire permanent way from "Invar" steel, the lubricated-slider system would be completely impracticable.

Not very widely known, however, is the fact that by constructing bearing surfaces from a hard metal, such as steel, plated with a thin film of a very soft metal such as lead, or, better, indium, coefficients of friction comparable to that of ice may be obtained.

Having now abandoned the wheel, we must perforce also abandon the driving-wheel and look round for some other method of obtaining reaction and motion.

It would be neither practicable nor economical to festoon miles of full-sized railway with thousands of closely-spaced electromagnets, solenoids or coils, to say nothing of the hair-raising losses which would be introduced by voltage drop at the extremely heavy currents which would be required. It must be remembered that we are now considering, not a demonstration model, but a solid, full-sized, everyday line carrying thousands of passengers and tons of goods daily from, say, London to Manchester; and what works perfectly in model form frequently flatly refuses to work when scaled up to full-size, as many early would-be aviators found to their cost.

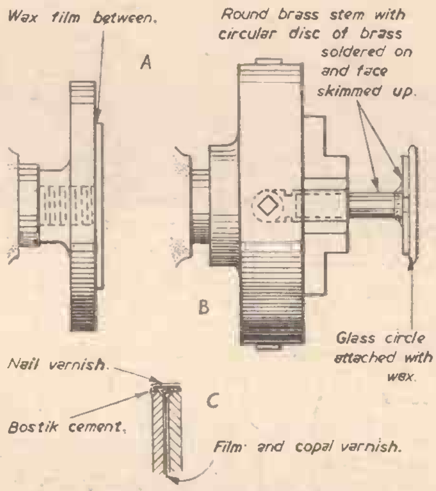
The only possible method of obtaining thrust for our skating railway would be by the use of either airscrews or jet engines. No doubt a jet-propelled skating train would be capable of extremely high speeds across country, but this would be of little use if it were unable to start comfortably from a station after picking up its passengers. Imagine the effect on passengers of a red-hot, hundred-mile-an-hour gale screaming through the station from the gently starting jet locomotive! Or are we to imagine that in 1984 the train departure will resemble the take-off for the moon of the space-ship in the conventional American second feature film.—B. L. KERSHAW (Leeds, 16).

Gelatine Photographic Filters

SIR,—In your information sought column of PRACTICAL MECHANICS, R. G. Sanders requires information on how to make gelatine photographic filters and maybe the following will be of interest to him.

If he is an enthusiastic photographer as well as a practical mechanic he may have the necessary materials to hand, if not, they are easily obtainable.

I used 3½in. × 2½ in. glass negatives which had served their purpose, and were of no further use. Select those without scratches or flaws on the emulsion or glass. First, these are bleached in a solution of permanganate of potash and acid, then in an acid hypo bath to



Gelatine photographic filters.

A—Glass squares attached to catch plate.

B—Grinding edges of glass circles, using brass stem and disc.

C—Enlarged section of glass circles, showing V-shaped edge.

clear, finally wash in running water to eliminate all traces of hypo and set to dry.

Cut the cleared plates into squares 3/16in. to ¼in. larger than finished circle required, two glasses are required for each filter. To colour the clear emulsion I used a Velox photo tinting outfit which consists of paper leaves impregnated with dye. Using a minimum amount of water in a small vessel the water is tinted the required colour by the paper leaf (small tin lids are suitable for this job), the glass squares are placed emulsion side down, and floated on the surface of the liquid to absorb the dye. To dry, place them flat, emulsion side up on a *perfectly level* surface.

When dry, the next operation is to cut out the circles and grind the edges V-shape, the cutting and grinding can be done on a lathe catch plate with the glass attached to catch plate by melted candle wax or beeswax and the glass cutter fixed in the tool post of the slide rest. The edge can be ground to size by using a coarse carborundum oil stone using turps substitute sparingly as a lubricant. After grinding, clean all glasses by washing in turps sub., no water to be used, taking care not to scratch the film or glass.

The next job is to cement the cover glass to filter glass, remove the emulsion from the cover glass using hot water and a stiff nail brush, and dry. For cement I used a mastic varnish which photographers use for doping the face of bromide prints. If this is not to hand use ordinary clear copal varnish. Coat the film face of the filter and one face of a cover glass, allow them to dry until the varnish is tacky and stiff like treacle, and then place them face to face, gently working them together to exclude any trapped air bubbles, but do not use too much pressure as a thin film of varnish must remain in between the glasses. Clean the edge and face of the glass with turps to remove surplus and leave for a day or two before sealing the edges which is the final operation.

Before sealing the edges examine for air bubbles, if none present seal edges with Bostik C cement and allow to dry for a day or so, and pare off any surplus. Coat the edge over the Bostik C cement with nail varnish to give a hard gloss finish which is better for handling.

The idea of cementing the two glasses together is that the cover glass protects the film which is easily scratched. The varnish in between must be kept in a viscous state and sealing the edge prevents air getting in to dry out the varnish; also to hold the two glasses together and in position.

Although these filters cannot be compared with those dyed in the mass and optically ground flat, they are quite good when used in landscape photography; also any shade of colour desired can be obtained by mixing the dying solutions.—THOMAS M. ROBERTS (Liverpool, 13).

Arrowmaking

SIR,—I see that Mr. L. F. Moss (New Zealand) enquires in the June issue for details on the construction of arrows.

May I therefore draw your attention to "Bowmans Handbook of Practical Archery," edited and published by P. Glover, 27, The Dale, Widley, Portsmouth.

The book is in two parts—Technical Notes on Archery and Hints, Tips and Gadgets—and it describes how to make all types of archery gear. It is the only comprehensive handbook on archery gear to be published anywhere in the world and it is certainly the only one in print to deal with the dynamics of the bow and arrow.—P. G. (Portsmouth).

SIR,—You may be interested to know with regard to your recent enquiry on the subject of fletching arrows that all archery equipment, including bows, arrow shafts, heads, flights, targets, etc., is available from Messrs. John Jacques and Son, Ltd., Thornton Heath, Surrey.—L. V. WOOD (London, W.4).

SIR,—*Re* Mr. Moss's query on feathering arrows (fletching is the proper word!) I think he can find all information on making equipment in a small book, costing 4s. 9d., called "English Archery," by Frank L. Bilson, and published by "The Covenanter Union," 326, St. John Street, London, E.C.1. —"ARCHER" (Wales).

Space Travel

SIR,—On the subject of space travel, I read recently that research by high flying rockets in America show that the temperature falls the higher the rocket flies and then starts mounting again until the temperature of the heaviside layer is estimated to be between 200 and 650 deg.

Surely common sense must tell us it is not a barrier of heat to be passed through, but the fact that the projectile is flying in a partial vacuum and there is little or no loss of heat by conduction or convection and very little by radiation while the surface is exposed to the burning untempered rays of the sun.

Moreover, conventional methods of cooling by refrigeration as suggested by your correspondents in the past cannot be used, as they depend on conduction and convection in free air.

It seems, then, that until some practical method of cooling in a vacuum is evolved, no space travel is possible.

I also read recently that it is now known that an electric current of many thousands of amperes is known to be flowing from pole to pole at an altitude of 50 or 60 miles. Study, research and experiments on those lines and on the effects of untempered cosmic and ultra-violet radiation might yield interesting results.—W. J. LAW (W.5).

Device for Measuring Current in a Cable

SIR,—I was very interested in your Editorial in this month's PRACTICAL MECHANICS, particularly the centre column, which states that "there is *now* a device which can be clipped to the outside of a live cable, for measuring the current passing within."

These have been in production for over 40 years. They are shown in the 1912 catalogue of Drake & Gorham, Ltd., under the name of The Frisby Current Gauge.

The illustration shows a gentleman, wearing a "straw boater" hat, in the act of clipping the instrument round a live cable in a street feeder box.

The price was about 55s. These were the days when we used to sell 100 watt lamps at 5s. 6d. each, and 60 watt at 2s. 8d.—now they are 2s. 2d. and 1s. 7½d. respectively.

I have read most of your small electrical "text books" and have a number still in my possession, kept for reference by our small staff.

I would like to close by wishing you as long and as successful a life as Mr. Robertson-Scott, who in his 90th year still goes out lecturing.—P. A. LOWNE (Norwich).

Underground Water Pipe Tracer

SIR,—*Re* Mr. E. Ball's enquiry, page 416, June, 1955, I did considerable experimental work on his problem some ten years ago. The following notes will, I think, be enough to give Mr. Ball a start on the work.

The simplest "vibrator" may be a relaxation oscillator employing a standard small neon 240 volt lamp. Alternatively a valve oscillator of a simple type may be used.

In place of the triangular frame, a coil of wire with or without an iron core can be used. Examples of this would be an unscreened intervalve transformer (the secondary should be used), or a single headphone with diaphragm removed.

The "coil" should be coupled to a one- or two-valve amplifier, of quite small gain, feeding headphones.

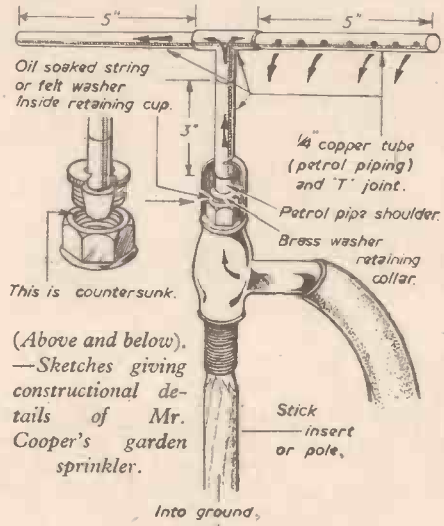
It is not always necessary to connect the "vibrator" output to *both* ends of pipe-run. Often one end, say the tap, can be connected to one output lead while the other lead may be "earthed" to some other object, or even to the pipe itself!!

A vibrator frequency of around 1,000 cycles is good, but is not critical. Higher is better than lower.

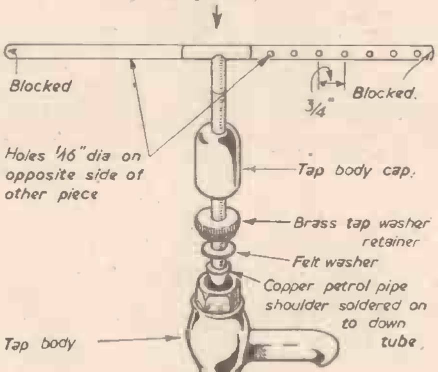
It might be as well to add that quite a number of snags arise if one continues to develop this type of apparatus, and it is highly inadvisable to make conclusions without actual experiment.—P. I. KEITH-MURRAY (Perthshire).

A Garden Sprinkler

SIR,—As a regular reader of PRACTICAL MECHANICS, I would like to take this opportunity of congratulating you on a fine magazine and would like to say that it has,



(*Above and below*).—*Sketches giving constructional details of Mr. Cooper's garden sprinkler.*



indeed, been "worth its weight in gold" during the past year or so.

I thought I might be of assistance to many readers who may require a cheap and easily made lawn or garden sprinkler. I have used the design shown in the sketch in making the one that has served me well for two years.—R. COOPER (Stockport).

Installing a Ford Engine in a Boat

SIR,—With regard to Mr. Levett's article on installing a car engine in an inshore fishing boat (June issue), I would like to make the following comments.

The rear bearing as illustrated is made in two halves to enable it to be fitted around the prop shaft. If this method is employed it has to be fitted outside the hull to give support to the prop shaft, just in front of the propeller. This in turn means some form of support for the split bearing which is subjected to corrosion by seawater.

If this split bearing is fitted inside the hull then a second bearing must be added to give support as near as possible to the propeller.

When two bearings are fitted, they must be in line with each other to prevent binding of the shaft.

The sketch shows a method which in my opinion is better than the one suggested. This consists of a steel tube accurately threaded at both ends. On the end projecting out of the hull an ordinary phosphor bronze bearing is fitted with a suitable running clearance on the shaft.

On the other end is fitted a bearing with a recess for some graphite cord packing, this being compressed by the normal type gland with studs. This will prevent water entering the boat. One grease cup is fitted on the gland so that grease can be fed to the running surfaces and the grease cup on the prop shaft tube.

Before launching this tube is pumped full of grease if desired to lubricate the rear bearing.

A short distance in front of the gland is placed a plummer block on each side of which is fitted a standard ball thrust race, held in place by two collars to take the thrust of the propeller.

This method prevents turning grooves in the shaft and thereby weakening it. Under normal circumstances, using a moderately powered engine, a 1in. diameter shaft from bright, drawn mild steel bar is ample, but turning 3/16in. deep grooves reduces the effective thickness to ⅝in. diameter.

I also suggest that the propeller be fitted with a taper and locked in place by a bronze or brass nut to stop corrosion, as after a few months of immersion a steel nut would be rusted solid.

I do not claim any originality for this method, but it has been used for many years in dozens of small craft built by my father, without any signs of trouble. One ran for four months without packing and the amount of water that entered was negligible.

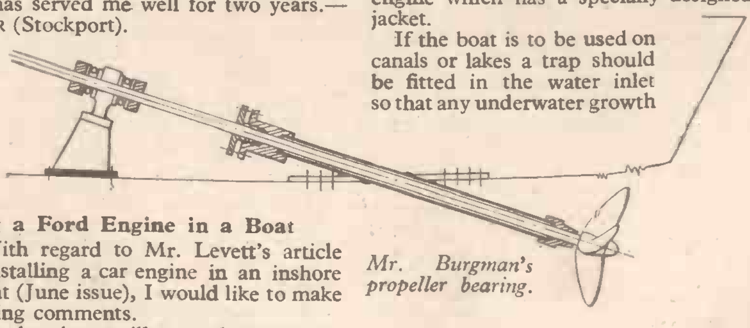
Also shown on the sketch is a method of fixing the prop tube to a metal hull, a rectangular or oblong shaped plate being welded to the tube and held with bolts to the hull.

The prop tube should be passed through a slot in the hull, lined up and then tacked in a few places, withdraw assembly and weld off. It has been noted on several craft coming in for shaft replacement that water seems to lubricate the rear bearing quite well, but watch must be kept on the shaft between rear bearing and propeller as quite a bit of corrosion takes place at that point.

On the point of cooling, I should advise fitting a pump that will give plenty of water, as over-heating of car engines in boats is a common occurrence. This is caused by the fact that little air flows past the engine and also because the water-jacket round the cylinders is smaller on a car engine than on a marine engine which has a specially designed water jacket.

If the boat is to be used on canals or lakes a trap should be fitted in the water inlet so that any underwater growth which is drifting cannot block the pump.

Finally, I would point out that the angle of the prop tube on the sketch is out of proportion and the whole sketch is diagrammatic.—H. BURGMAN (Coventry).



Mr. Burgman's propeller bearing.

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

A.M.I.Mech.E., A.M.Brit.I.R.E., City and Guilds, etc., on "No Pass—No Fee" terms. Over 95% successes. For details of Exams. and courses in all branches of Engineering, Building, etc., write for 144-page Handbook—Free. B.I.E.T. (Dept. 967B), 29, Wright's Lane, London, W.8.

SPRAY PLANTS

SACRIFICE PRICE, 4 cu. ft. portable Sprayplant, £39/10/-; "Smith" airline Filters, £1 each. Fraction manufacturing cost. Fans, Dust Extractors, etc., cheap. Bellangers, 306, Holloway Road, London, N.7. (North 4117.)

SPRAY PLANTS, £10; Air Bottles, 25/-; Compressors, piston type, 35/-; s.a.e. list. L. Unwin, Bousley Rise, Ottershaw.

WOODWORKING

ARE YOU LOOKING FOR A RELIABLE FIRM for Timber Plywood, Wallboards, Veneered Plywood; call at our warehouse or send s.a.e. for price lists. N. Gerver, 2/10, Mare Street, London, E.8 (near Cambridge Heath (E.R.) station). (AMHerst 5887.)

WOODWORKING MACHINES, all cast-iron constructed. Complete Saw Benches, 7in., £4/15/-; 8in., £5/10/-; 10in., complete, motorised, £30. Planers, 5in., £12; Bowl Turning Heads, £4; with 8in. Saw Tables, £7/10/-. Lathes, £7/10/-; Combination Lathes, £10/10/-. Motors, Pulleys, Belts, etc. 12 months' written and money refund guarantee. 4d. stamp for illustrated booklet. James Inns (Engineers), Marshall St., Nottingham.

SAWBENCHES, all sizes from £10; motorised, £20; petrol portable, £32. Spindle Assemblies, from 27/6 for saws up to 36in. Motors, Engines, Bearings, Pulleys, Belts. Deferred terms. Send 1/4 for handbook-catalogue. Price list free. Beverley Products, Sturton-le-Steeple, 17, Notts.

PLYWOOD, 36 x 12 x 3/16, 13/- doz.; 24 x 12 x 3/16, 9/6 doz.; c.p.; s.a.e. for list. Parmount (Dept. P.M.), Burnley Road, Rawtenstall.

WOOD LATHES, Attachments, Motors and Control Gear, Circular Saw Blades, Spindles or Benches, Turning Tools, etc.; interested? Then send 6d. for illustrated literature, price list and H.P. terms. D. Arundel & Co., Mills Drive, Farndon Road, Newark, Notts.

BOOKS

10,000 FORMULAS, Processes, Recipes, Trade Secrets. This is the 1,000-page money making and money saving book of the century. Limited number again available. Full approval against payment, 27/6, p.pd. Below:—

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

AMERICAN BOAT BUILDERS Annual; 28 boat plans, 8-22ft., and other helpful articles, 7/6, p.pd. Below:—

TELESCOPES—DESIGN AND CONSTRUCTION, only 3/-, p.pd. Really outstanding American designs at lowest cost to make. Below:—

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

LATHE HANDBOOK, 3 books in one, 5/-, p.pd.; wood-turning, metal turning, metal spinning, jigs attachments, special operations; 200 illustrations; outstanding, practical "how-to-do-it" material throughout. Below:—

ARC AND SPOT WELDERS For The small Shop. Easily, cheaply made. Full plans, 3/-, p.pd. Below:—

SOLDERING AND BRAZING Simplified. Outstanding American book, 3/-. Below:—

MIDGET CAR AND SCOOTER Construction, 3/-, p.pd. Below:—

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

WATCHMAKERS

WE REALISE THAT YOUR WATCH is an essential part of your life to-day. We have therefore organised our repair service for reliability and speed. You will also find that our charges are more reasonable than most. Hereford Watch Company, 13, Castle Street, Hereford.

EDUCATIONAL

I.P.R.E. TECHNICAL PUBLICATIONS. 5,500 Alignment Peaks for superheterodynes, 5/9. Data for constructing TV aerial Strength Meter, 7/6; sample copy "The Practical Radio Engineer," quarterly publication of the Institute, 2/-; membership and examination data, 1/-. Syllabus of 7 postal courses free and post free. Sec., I.P.R.E., 20, Fairfield Road, London, N.8.

MERCHANT NAVY Radio Officer Cadet Training School. World travel and adventure overseas. Brook's Bar, Manchester.

LEARN IT AS YOU DO IT. We provide practical equipment combined with instruction in Radio, Television, Electricity, Mechanics, Chemistry, Photography, etc. Write for full details to E.M.I. Institutes, Dept. PM 47, London, W.4.

BUILD YOUR OWN T/V and learn about its operation, maintenance and servicing. Qualified engineer-tutor available whilst you are learning and building. Free brochure from E.M.I. Institutes, Dept. PM.58, London, W.4. (Associated with H.M.V.)

WANTED

LATHE SADDLE 4½in., plain base, sturdy. Particulars, sketch to Box 127.

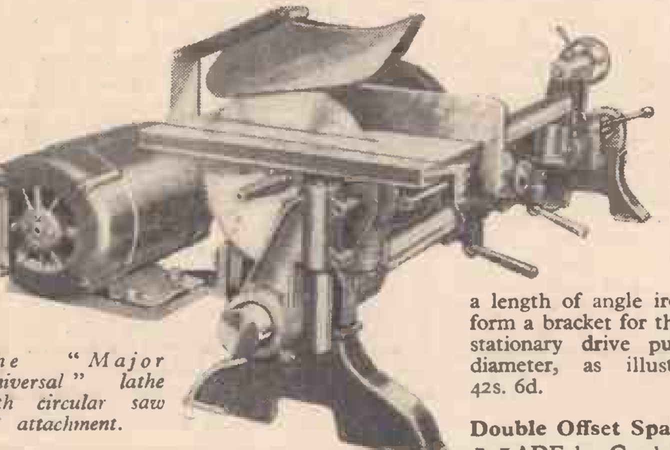
(Continued on next page)

(Continued from previous page)

Trade Notes

The Coronet Tool Co.

THE above firm has sent us leaflets describing their "Home Cabinetmaker" and "Major Universal" lathes and woodworking machines, together with a list of tools and accessories. The home cabinetmaker is described as a universal $3\frac{1}{2}$in. centre lathe and combination woodworking machine. It is available with 19in., 24in. or 30in. between centres and costs £8 17s. 0d. The versatility of this machine is increased by the availability of a long list of accessories which enable many additional operations to be carried out.



The "Major Universal" lathe with circular saw attachment.

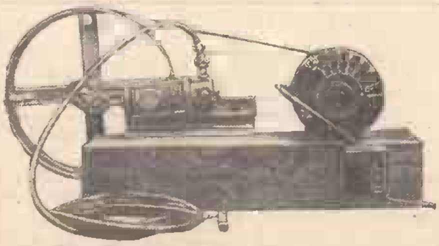
The well-known "Major Universal" combination woodworking machine and lathe is also fully described and all the range of attachments comprehensively dealt with. This lathe, complete with back and prong centres, large face-plate and long and short rests, costs £29. A large selection of standard cutters and blocks is also available. Full details of all these products may be had on request from The Coronet Tool Co., 8, Mansfield Road, Derby.

New Dial Caliper

AYLESBURY TURNED PARTS (TRUE SCREWS), LTD., Britannia Works, Britannia Street, Aylesbury, Buckinghamshire, announce the addition of a dial caliper to the "Helios" measuring instrument range. This incorporates a dial indicator in place of the conventional vernier scales, accurate readings being obtained instantaneously. The caliper is available in 6in. and 5in. sizes with English or metric readings.

The "Komag" Air Pump

MARKETED by Lawrence Edwards and Co., Commercial Buildings, Oxford Street, Kidderminster, the "Komag" air pump is a new portable compressor unit with a capacity of 150lb. per sq. in., output approximately 3 cu. ft. per minute at 500 r.p.m. It is claimed to be ideal for rapid tyre inflation, and for operating spray and grease guns. The pump unit is of sturdy construction and has double ball-bearings on the crankshaft to ensure quiet, easy running. The outfit weighs about 14lb. and is complete with coupling suitable for a variety of drives, mounting plate, and 18ft. of airline complete with adjustable lever plug tyre connector, at a cost of £120 1s. 0d. complete (including delivery).

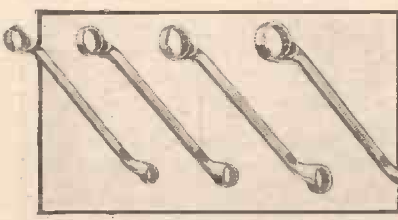


The "Komag" Air Pump.

As will be seen from the photograph, the "Komag" pump is also suitable for mounting alongside an electric motor or petrol engine to form an independent compressor unit, additional parts required for this being a length of angle iron suitably drilled to form a bracket for the pump and a special stationary drive pulley of about 13in. diameter, as illustrated, which costs 42s. 6d.

Double Offset Spanners

MADE by Gordon Tools, Ltd., Rockingham Street, Sheffield, these spanners have double hexagon openings and are made throughout from chrome-vanadium steel, heavily chrome-plated, with highly polished rings. They are supplied in boxed sets of four and six, and are obtainable in the following sizes:



A Set of Double Offset Ring Spanners.

No. 801 Whitworth: $\frac{1}{8}$in. × $\frac{3}{16}$in., $\frac{3}{16}$in. × $\frac{1}{4}$in., $\frac{1}{4}$in. × $\frac{5}{16}$in., $\frac{5}{16}$in. × $\frac{3}{8}$in.

No. 802 American A/F: $\frac{3}{8}$in. × $\frac{7}{16}$in., $\frac{7}{16}$in. × $\frac{1}{2}$in., $\frac{1}{2}$in. × $\frac{9}{16}$in., $\frac{5}{8}$in. × $\frac{11}{16}$in.

Sizes each set of 6. Boxed weight 1lb. 4oz.:

No. 803 Whitworth: $\frac{1}{8}$in. × $\frac{3}{16}$in., $\frac{3}{16}$in. × $\frac{1}{4}$in., $\frac{1}{4}$in. × $\frac{5}{16}$in., $\frac{5}{16}$in. × $\frac{3}{8}$in., $\frac{3}{8}$in. × $\frac{7}{16}$in., $\frac{7}{16}$in. × $\frac{1}{2}$in.

No. 804 American A/F: $\frac{3}{8}$in. × $\frac{7}{16}$in., $\frac{7}{16}$in. × $\frac{1}{2}$in., $\frac{1}{2}$in. × $\frac{9}{16}$in., $\frac{5}{8}$in. × $\frac{11}{16}$in., $\frac{3}{4}$in. × $\frac{25}{32}$in., $\frac{11}{16}$in. × $\frac{7}{8}$in.

"Nubrex" Grease Gun

A DOUBLE-ACTION, high-pressure, pocket-size grease gun, the "Nubrex," manufactured by C. J. Neuman, Ltd., 445, Brighton Road, South Croydon, Surrey, is now available from all garages and motor agents. With a push-on nozzle GH501/0 for use with tight-grip and push-on nipples, its lubricant capacity is approximately 1oz. It is spring-loaded, and thus provides the ideal grease-gun for the motor cyclist, retailing at 9s. 6d.

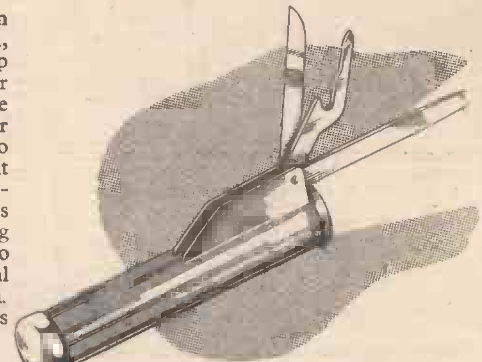
The "Nubrex" Grease Gun.

It is also available in sizes of 3oz. capacity at 19s. 6d., and $4\frac{3}{4}$oz. capacity at 21s. 6d.

The "Toolite"

DETAILS are released of a new pocket tool which the makers (Mitwood Engineering Co., Ltd., Coleshill, Birmingham) consider will find a ready market with mechanics and handymen.

It is a multi-purpose tool, to be called the "Toolite," and consists of a pocket torch with spotlight beam, knife, screwdriver, bradawl, bottle opener. It has been designed so that the torch beam is focused on the work, eliminating the necessity of holding a light with one hand whilst the work is being done by the other hand. The three hinged blades are spring-loaded to fold flat against the torch barrel when not in use and the torch is operated simply by screwing down the reflector cap.



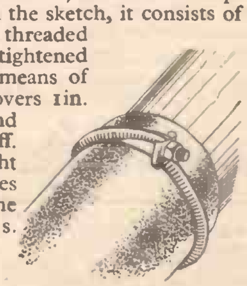
The "Toolite" Pocket Tool.

The barrel of the tool is of high-quality steel sprayed and stoved at 600-650 deg. F. A wide range of colour finishes is available including: black, bottle green, pillar-box red and deep bronze blue. The reflector and base cap are chromium-plated and the snap action blades are ground, hardened, tempered, polished and nickel plated. Nickel plated rivets are used throughout. Standard 3v. pencil batteries and 2.2v. or 3v. 0.25 a. bulbs, which retailers can supply ex-stock, are required for the torch.

The tool, less battery and bulb, will retail at 9s. 11d.

A New Hose Clip

FROM the Lightning Tools Dept., Elms Garage, Birmingham, 31, we have received details of a new adjustable hose clip. As may be seen from the sketch, it consists of a specially annealed threaded band which may be tightened round the hose by means of a nut. Each clip covers 1in. to $2\frac{1}{4}$in. diameter and the surplus is cut off. It is claimed that a light finger pressure ensures a leak-proof joint. The price of the clips is 1s. each.



The hose clip in position.

Your Queries Answered

RULES

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

Sand-blasting Materials

I WISH to make up a fairly small sand-blast cabinet. I have an air supply of 80lb. per sq. in. Would this be enough pressure?

The articles I wish to clean are mainly the bodies of ordinary car type dynamos, and none of these is larger than 10in. × 7in. I am able to get the cabinet made up and also any turning or machining required. Any information on the type of sand and where obtainable would be appreciated.—G. J. Drayton (Hounslow).

THE pressure needed for sand-blasting is from 60 to 100lb. per sq. in., according to the article and the amount of cleaning required. It appears that your air supply is sufficient.

Sand for industrial purposes is obtainable from the Standard Brick and Sand Co., Holmethorpe Works, Frenches Road, Redhill.

You will find a considerable amount of information on blasting and other cleaning methods in Newnes' "Engineer's Reference Book," and we suggest you study this.

Caulking a Boat

I AM repairing an 18ft. flat-bottomed motor-launch, which has been lying neglected for about 12 years. It has been under cover and out of the water, but between some of the boards there are gaps up to about ¼in.

Can you advise me of the best method of rendering the craft water tight, and the type of paint you would recommend for protection against fresh water. It is proposed to finish in white.—A. F. Bagshaw (Uttoxeter).

THE easiest way of making such a craft watertight is with "Bostik" or "Seal-astik," both of which can be obtained from the ironmonger. If there are many ¼in. gaps this may prove expensive in an 18ft. boat, and it may be cheaper to use caulking cotton and putty mixed with red lead.

The gaps should be filled first and when this filling has dried on the surface the boat should be painted with red lead primer and finished off with white paint.

After the paint is dry, the boat should be filled with water to the gunwales and left for several days.

Electrically-"fired" Camera

I HAVE a Rolleiflex "Old Standard" camera. I want to effect shutter release by electrical means from a distance, using, if possible, low-voltage battery supply. Could you advise me of an efficient method, and where I may obtain the necessary parts? The mechanism must not interfere with the manual "charging" of the shutter spring.—M. Gurney (S.W.5).

IT would appear that the movement of an ordinary electric bell or buzzer could be utilised for your purpose; the electro-magnet could be clipped on to the camera with the make-and-break contacts short-circuited by means of a wire. The armature, or a short extension of the armature, could then be used to trip the trigger when the coils are energised, or alternatively when de-energised. The coils could be supplied from a dry battery, such as a three-cell flashlamp battery.

Removing Distemper

I UNDERSTAND that absolutely *all* old distemper must be removed from walls and ceilings before either re-distempering or painting. Can you tell me a sure, quick and comparatively easy way of doing this? I have tried all the old methods, but find it extremely hard work. On re-distempering such surfaces, I find the surface soon flakes badly.—F. J. Glynn (East Grinstead).

IT is not necessary to remove well-adherent areas of distemper from a wall previous to re-distempering it, although, to make a really good job, it is always advisable to do so. The method of wetting, scrubbing and scraping the old distemper, although tedious in the extreme, is the most reliable one to use. You can, if you wish, soften the distemper by scrubbing over it a solution of one part of caustic soda in six parts of water, used, for preference, warm or even hot. The caustic solution will have to be applied by means of an old brush or with a piece of rag tied round the end of a wooden pole so that the solution does not make contact with the skin. After the distemper has been removed in this manner, the wall should be washed with water thoroughly in order to remove every trace of the caustic, which, if left behind, would affect the new distemper or paint. After such caustic treatment, followed by washing, the wall should be rubbed down with vinegar and again with water and finally allowed to dry out thoroughly.

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

Air-purifying Chemicals

COULD you please tell me the chemicals used in the various air-purifiers now on the market?

The type I am most interested in consists of a perforated metal receptacle in which crystals which slowly volatilize are placed.—G. G. Milne (Aberdeen).

CHEMICALS used in the air-purifiers to which you refer are usually mixtures of naphthalene and ortho-dichlorbenzene. Equal quantities of these are melted together gently. The mixture is then cast into block form or into the shape of pellets or marbles. Sometimes, too, the cast mixture is merely broken up into irregular shapes.

The mixture is sometimes perfumed by the addition of terpineol and, sometimes, with carbolic or cresylic acids.

For your purpose, however, the straight 50-50 mixture of naphthalene and ortho-dichlorbenzene, with, perhaps, a little terpineol, would be the most suitable and easily made. Naphthalene and ortho-dichlorbenzene are coal-tar derivatives.

Metal to Glass Adhesive

I HAVE a leather-covered glass spirit flask, the metal top of which has become detached from the bottle neck. Could you please inform me of the ingredients and make up of a suitable cement for re-fixing this top?—D. Musson (Sheffield, 8).

AN excellent metal-to-glass adhesive for your purpose can be made by grinding together in a mortar four grams of Portland cement and one gram of shellac. When the mixture has been reduced to a fine powder,

(*Continued on page 562*)

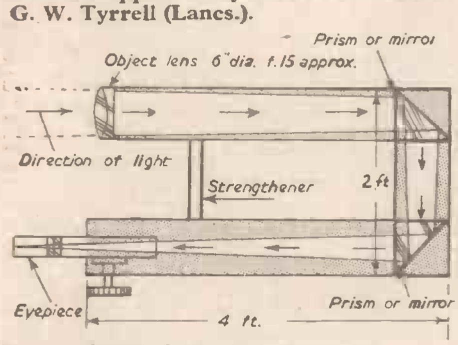
slake it with a mixture of two parts methylated spirit and one part water, to a mortar-like consistency. Then, after applying the cement thus prepared, bake it in a hot oven at 250 to 275 deg. C. for two to three hours. It is important to see that the mixture is baked while moist.

Another cement may be made by slaking calcined magnesite with a solution made by dissolving 40 parts of magnesium chloride in 60 parts of water. This takes about 30 hours to harden.

An alternative is a solution of poly-vinyl chloride in acetone or methyl-acetone. A good cement of this type may be obtained from Portland Plastics, Ltd., Wear Bay Road, Folkestone, Kent, its trade name being "Eortex Universal Cement."

Astronomical Telescope Design

I AM considering constructing an astronomical telescope with an object lens of 6in. diameter. The suggested useful "f" number is 15. This, of course, means a tube length of 90in. is required. As this is somewhat unwieldly, I have been wondering if it is feasible to adopt the method shown in the diagram below. It necessitates doubling the light back, and I am anxious to know if the loss of light and definition, etc., will be very great. There is also the possibility that I would be incapable of setting the prisms or mirrors accurately. I would appreciate your observations.—G. W. Tyrrell (Lancs.).



Proposed telescope arrangement.

THERE are many objections to your scheme for shortening your 6in. telescope, by doubling the barrel back upon itself, the chief of which are: the loss of light, the dispersion and reflection by the prism surfaces, and the terrific cost of first-class prisms of such large size. If the prisms, or mirrors, are not of the very highest quality then the definition will certainly suffer; moreover, as you appear to anticipate, there will be difficulty in setting the prisms or mirrors so accurately that the collimation of the object glass will be perfect.

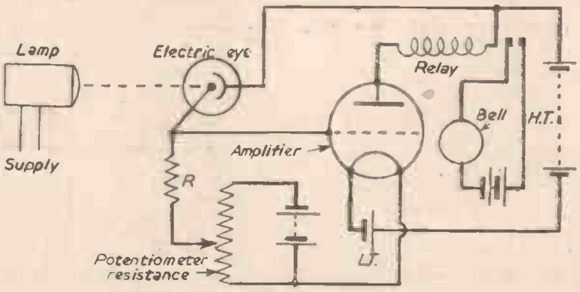
The scheme introduces mechanical as well as optical difficulties. For instance, how is the whole telescope to be mounted equatorially, and how is the small telescope or finder to be mounted?

Our advice is: first find out what the cost of high-class prisms will be. Then the cost of mirrors, but in connection with the latter it must be borne in mind that they will require resilvering every few months.

Photo-electric Cell Burglar Alarm

COULD you kindly send me a circuit for a photo-electric cell-operated burglar alarm, with source of components?—W. Salmon (Bournemouth).

YOU could use a 40-watt lamp, fed from the mains, which directs light through an infra-red filter, which cuts out visible radiations on to a gas-filled photo-emissive cell or "electric eye." The output of the cell is then amplified by applying it to the grid of an amplifier valve, the output of the amplifier being used to energise the coil of a relay which holds open a pair of contacts. These contacts are connected in circuit with a bell and battery so that, in the event of the ray being interrupted, or the supply to the amplifier being cut off, the contacts close to ring the bell. A circuit diagram is given above.



Theoretical circuit of burglar alarm.

An amplifier from an old radio set could be used, whilst the "electric eye" could be obtained from one of the following firms: Londex, Ltd., Anerley Works, 107, Anerley Road, London, S.E.20; Radiovisor Parent, Ltd., 1, Stanhope Street, London, N.W.1; General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2; British Thomson-Houston Co., Ltd., Rugby. A suitable relay could probably be obtained from one of the same firms.

Removing Stains from "Ebony" Furniture

I HAVE an ebony dressing-table set which has been splashed with eau-de-Cologne, leaving burned marks on it. Could you please advise me what to do to restore the ebony finish?—P. Hulbert (Towcester).

A GOOD eau-de-Cologne consists mainly of rectified spirit, and it is not likely to attack a surface of real ebony. The fact that the eau-de-Cologne has marked your dressing-table suggests that this article of furniture is not one of real ebony, but is merely an ebony-finished one; in other words, that the table has merely been artificially stained to an ebony colour. In this case the spirit will have merely dissolved away the stain from the table surface and exposed the underlying lighter woodwork. It will be fairly simple for you to dissolve about 1 part of ebony spirit stain in about 3 parts of methylated spirit and then very carefully to brush this stain on to the marked surface and its immediate surroundings to obtain a uniform colour matching up with the rest of the surface. Finally, the re-stained surface is wax- or shellac-polished in order to match the adjacent surfaces.

Corrosion Between Dissimilar Metals

IT is proposed to augment an existing hot water supply by the addition of another boiler, tank and the necessary piping, etc.

The existing cold water feed tank and the supply pipe to the hot water draw-off taps will be required to serve both heating units. The whole of the present supply system is carried out in galvanised iron, and the proposed addition has copper tank and piping with brass fittings.

Is there any danger of electrolytic action or other forms of corrosion taking place if the two systems are intercoupled or would you advise keeping both systems entirely separate?—L. R. Payne (Beds.).

THE electrolytic action and corrosion to which you refer only takes place between two dissimilar metals which are actually in contact as, for example, where a copper pipe is fitted to a galvanised cistern. It would be quite safe to use the two intercoupled systems which you describe provided that there was no direct contact between different metals. In instances in which one metal pipe has to be joined to a tank of a different metal, the difficulty is sometimes overcome by using an insulative ring, usually of bakelite or some similar material which is internally and externally threaded and which is screwed on to the inserted pipe, the ring itself being screwed into the wall of the tank. By this device a ring of insulative material is made to separate the two metals so that direct contact between them does not occur and so that electrolytic corrosion is not set up. These insulating rings are usually obtainable from dealers in plumbers' materials and from firms dealing with hot water systems and equipment.

If it is not feasible or convenient to fit these insulating rings separating directly-contacting dissimilar metals, it would be better to keep the two systems entirely separate.

Information Sought

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

Camera Viewfinder

COULD you let me have the dimensions and construction for making the collapsible type of direct viewfinder for Kodak 620 ($3\frac{1}{4}$in. $\times$ $2\frac{1}{4}$in.) camera? — A. BATTLE (Sheffield).

Pump for Emptying Washing Machine

I WOULD like to use a pump for emptying my electrically-operated washing machine. What type of pump is used and where can I buy one? I had in mind the type operated by a lever which moves the pump on to the belt.—H. PARTRIDGE (Cradley).

Bird Cage Construction

I WISH to make a small number of bird cages; can you give me a simple method of construction?—J. NASH (Loughborough).

A Collapsible Salmon Landing Net

COULD you give me particulars on how to make a telescopic collapsible salmon landing net? I would like to make it in aluminium alloy for lightness.—E. B. K. OWENS (Londonderry).

A Fine Paint Spray

PLEASE tell me how to make, or where I can purchase, a paint spray suitable for spraying plaster and plastic moulded objects with very small and intricate detail? The spray needs to be controlled to fine limits. —A. WOOLDRIDGE (Norwich).

Pedal-operated Boat

I AM intrigued with the little two-seater pedal-operated boats which are so popular at seaside resorts. Could you give me details for making one?—C. OWEN (Salop).

400-day Clock Mechanism

I AM greatly interested in electric clocks and have always wondered if it were possible to make the 400-day type of clockwork motion, but being energised by electricity. The contact method for operating the torsion wheel and the "link" between this and the clockwork mechanism, with sizes and coil values for magnet and solenoid, with any other points important to note, would be appreciated.—R. THOMSON (Dublin).

TELEPHONE SETS MODERN DESK TYPE

For Office, Factory or Home. Each unit is complete with 6ft. of 3-way flex and 3-way connecting block. Price for 2 Units with battery ready for use, £8/17/6. 3-way Flex available at 5d. per yd.
WALL TYPE also available, 2 complete units £5. Batteries 5/6. Twin Wire 5d. per yd.
GENALEX EXTRACTION FANS.—230/250 volt 50 cy Induction motor, 1,350 r.p.m., 85 watts, 9 in. blades, silent running, £6/15/-. Cge. 7/6.
BLOWER MOTORS.—Dual voltage 12/24 volts. Recommended for car cooling or heating, 25/-. Post 2/-.
A.C. MOTORS, ¼ h.p. 1,425 r.p.m., ⅝ shaft, Ball Bearings, Standard foot mounting 220/230 volts Single Phase made by Crompton Parkinson, Continuous rating, Brand New. £7/15/0.
A.C. MOTORS, Capactitor start and run. 230 volts 1/10 h.p., 1,425 r.p.m., foot mounting, 7in. x 6in. x 5in. overall. £3/17/6. Cge. 5/-.
12/24 VOLT D.C. MOTORS with double ended shaft 2in. x 3in., 8/6, postage 1/-.
KLAXON GEARED MOTORS.—230 volt A.C. Induction type, No. 1K5SB3-W7. Torque 15 lbs./in. 175 r.p.m. £10.
HEADPHONES HIGH RESISTANCE.—4,000 ohms. New, 12/6 pr., post 1/6.
ACFIL PUMPS.—These pumps enable you to fill all accumulators on the bench with the carboy at floor level. Brand new. Only 30/-, post 2/-.
LOW VOLTAGE CIRCUIT TESTER.—A self-contained unit for making a complete and rapid check of the generator-battery circuit of a vehicle. Battery voltage, regulator and cut-out settings and generator performance can all be easily determined American made. Complete with instruction book. £5/10/-, post 2/-.
BALL RACES.—No. EE2, ⅜in. x ⅞in., 3/-. 30/- doz., post free.
THRUST RACES.—13/16in. x ⅜in., also ⅜in. x ⅞in., 1/6. 15/- doz. Post free.
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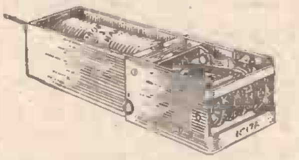

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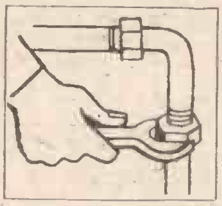

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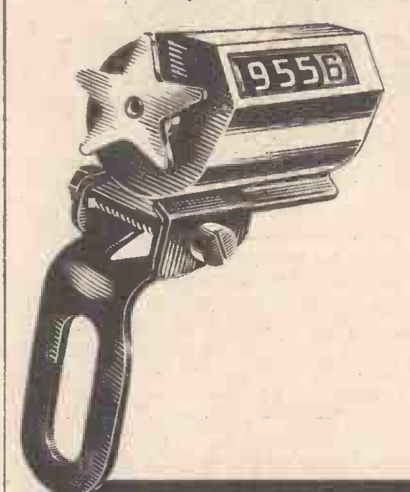

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THE Cyclist

Editor: F. J. CAMM

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

Phone: Temple Bar 4363
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WHAT I THINK By F. J. C.

The Cycle Show

FROM information available at the time of going to press it seems obvious that, as in previous years, there will be no great surprises at the Cycle Show as far as bicycles are concerned. There will be many new accessories, but the bicycle remains as it was 50 years ago, with minor changes excepted. We are speaking here of basic design and not detail improvement. The sum of all the detail improvements in bicycles over the past quarter of a century does not add up to any main major change in the safety bicycle as developed by Lawson and, to some extent, by Paul Renouf. New materials, as they have come along, have been incorporated, even to the use of plastics for certain accessories. There has been in the past a general tendency to lighten bicycles, and the lightweight machine undoubtedly has done much to popularise cycling. There is a limit, however, with the existing type of diamond frame beyond which weight reduction cannot go, without sacrificing rigidity. One or two lightweight frames deflect badly when extra pressure is applied to the pedals as when climbing a hill or "dancing on the pedals." We have had improvements in gears and improvements in precision manufacture. Electroplating, unfortunately, especially on steel parts, leaves much to be desired.

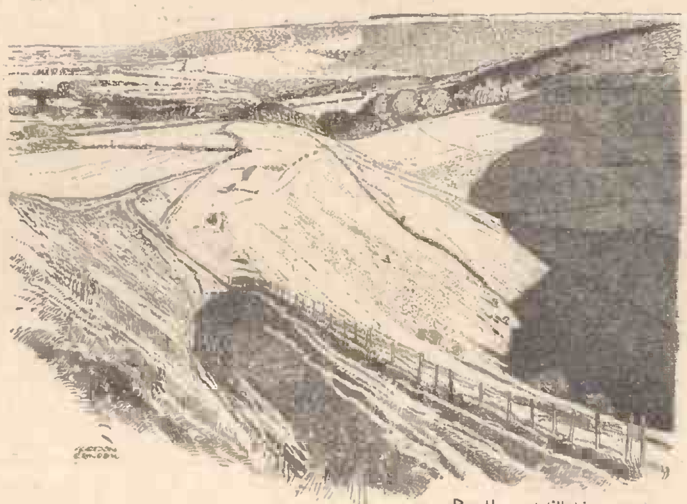
Can it be that the bicycle has reached finality in design ?

The International Cycle and Motor Cycle Show to be held at Earls Court between November 12th and 19th, 1955, will be opened by Captain The Right Honourable Peter Thorneycroft, M.P., President of the Board of Trade.

Power-assisted Bicycles

THE number of cyclists who are now turning to power-assisted bicycles increases month by month, as the license statistics show. The movement now has its own association to watch its interests and to co-ordinate the movement. The C.T.C. labelled these lively mounts, with a supercilious sneer as "neither fish nor flesh" some years ago. What is their viewpoint now ? Unlike earlier attempts to market motor-assisted bicycles (the Autowheel was a good example) the present machines are well-designed, their power is adequate for the strength of the machine, and they have brought into the ranks of two wheelers those who for physical or other reasons would not or could not pedal a bicycle. They will never, of course, oust the two-wheeler, which is a machine for the zest and energy of youth, with the hope finally of turning to power-driven machines or to a car. Out of the vast numbers of cyclists only a comparatively small percentage remain cyclists throughout their lives. The more perhaps the pity, for the bicycle is the greatest aid to continuing and life-long good health the world has known—far better than being assured in a welfare State of a comfortable cradle at birth and a decent funeral at death.

The motorised bicycle is here this time to stay and the inevitable development will be that the engine, instead of being clipped on, will be incorporated into the general design of the bicycle, still retaining the use of the pedals. They will never become motor cycles in the accepted sense of the term.



Bratton – Wiltshire. Looking from the ramparts of the ancient hill camp towards the lovely Vale of Pewsey . . .

Road Accidents

THE road accident statistics for June, issued in August, show that in reports received from the police, road casualties totalled 24,241. This is 2,914 more than in June of last year and it includes 451 deaths, an increase of 82, and 5,337 serious injuries, an increase of 197.

The final total for May was 23,650. Compared with May last year the total shows an increase of 3,637, but part of the increase may be accounted for by the fact that May this year included the Whitsun holiday with its heavy toll of road accidents.

Casualties to children rose by over a fifth compared with a year ago, reaching a total of 4,952. Seventy-three children died from their injuries and 999 were seriously injured. To avoid a further increase in casualties while schoolchildren were on holiday, the Ministry asked parents to impress on children the need for extra care when cycling or walking along roads with which they are not familiar. Motorists were asked to keep a particularly sharp look out for children. When they see children near or on the road they should take at least 10 miles an hour off their speed. Parents should instruct children when cycling to keep off busily-trafficked roads and when walking to keep to the pavement or footpath. On roads without footpaths they should walk on the right and face the oncoming traffic. When crossing the road the children should remember their kerb drill and use a zebra or light-controlled crossing if possible.

The greatest increase in casualties in May, as in previous months, was among motorists. There were 5,401 casualties to motor cyclists; and their passengers, an increase of 1,035; and 7,347 casualties to occupants of other motor vehicles, an increase of 1,393.

The provisional total for all road casualties in the first six months of the year was 114,997. This is 12,777 or 12½ per cent. more than in the first half of last year. Deaths numbered 2,292, an increase of 186; and serious injuries 26,333, an increase of 1,823.

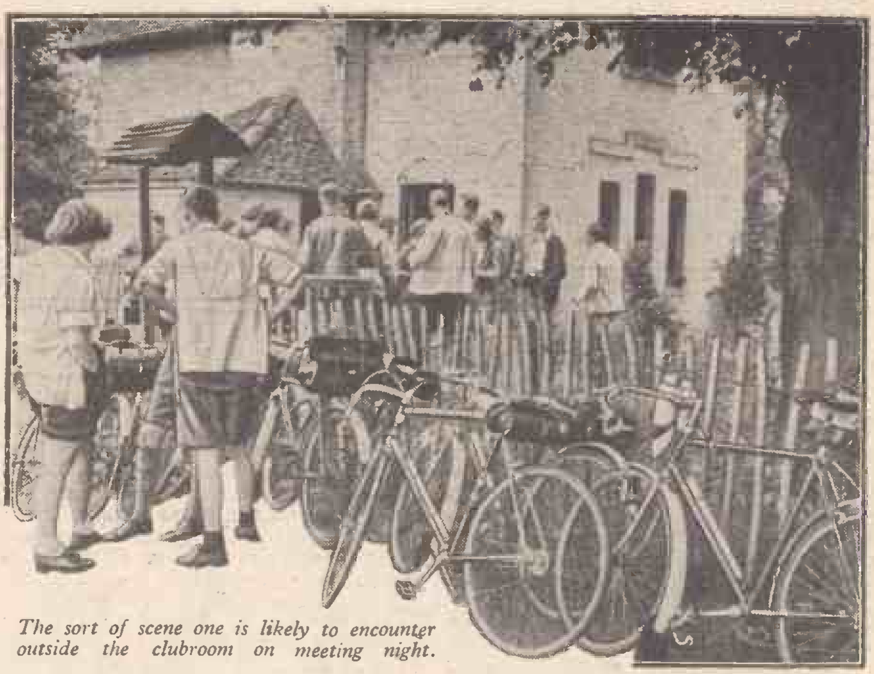
Attention is again called to the marked increase in the numbers of motor vehicles on the road.

These statistics prove one thing, above all others, that our Road policy is totally unequal to the ever-expanding volume of traffic, and that few, if any, of the measures taken to prevent accidents have been successful.

The Minister of Transport, when asked to make a statement about the road programme, said that the list of schemes already circulated covered those costing more than £500,000 "which it is hoped to authorise in the three years 1956-7, 1957-8 and 1958-9." This is rather like using a steam hammer to crack a nut. It must be admitted that most of the safety measures have been designed to protect pedestrians, and these measures have greatly added to the cost of commercial transport, traffic congestion, higher cost of private motoring (less miles to the gallon) and danger, for it should be obvious that motor vehicles which are brought to a standstill by traffic lights and pedestrian crossings every hundred yards or so (in one journey of a mile and a half we recently counted 67 traffic lights) are rendered more dangerous to pedestrians. There is a tendency for the motorist to exceed the limit in such circumstances to make up for some lost time and to "beat the lights." In fact, traffic in busy places must break the law if it is not to be brought to a complete standstill. If every vehicle using the roads of London strictly obeyed the law, conditions would be quite impossible. A general speeding-up of traffic must be introduced very shortly, in any case, since it will be some years before new roads are built.

How to FORM and RUN a CLUB

The Author of this Short Series has had Lengthy Experience of Club Life, and has Held Many Offices



The sort of scene one is likely to encounter outside the clubroom on meeting night.

NEW clubs are springing up in alarming numbers, especially in the London area. I am perfectly satisfied in my own mind that many of these organisations are entirely unnecessary and that 50 per cent. of them will die inside five years.

Nearly every district in which there are fair numbers of active cyclists has its cycling club. Obviously there are still a few towns and some newly developed suburbs in which no club exists; but, taken all round, there are nothing like so many vacancies as there are new clubs coming into being.

Added to this we have the sad fact that many old established and well-managed clubs are crying out for new members. Two instances come to mind. The journal of one of the most famous clubs in the country bemoans the trouble of finding new blood, in spite of a very complete programme of road, track and social events. Again, another quite well-known club has recently been compelled to wind up because it failed to attract recruits as fast as the old members dropped out. This particular club has a fine name and reputation, and had been carrying on for many years. It was in a sound financial position, and possessed some fine challenge cups, yet it had to put up the shutters. And how ironical to read that, within the space of two years, four clubs have been started in the district for which this club catered.

How much better would it have been if the men who started these fresh clubs had joined the old-established body. They could have availed themselves of the experience of officials who have learned their duties thoroughly, and all the accumulated benefits of a decade of spade-work would have been at their service. Also, the support of these members would certainly have saved the old club from petering out.

I hope, therefore, that ambitious novices will, at least, consider the advisability of joining an already established club. Now to advise those who are convinced that a new club is essential to their cycling enjoyment.

The Preliminary Meeting

One presumes that the sponsors of the suggested club have already got together a few friends as a nucleus. The next step is to call a meeting of all those who are likely to be interested in the project. This meeting should not be held at a private house. A room on licensed premises may generally be borrowed or the local authorities might give the use of a schoolroom or Scouts' H.Q. If possible induce some well-known local man (preferably a cyclist) to take the chair and get preliminary notices of the meeting into the local papers.

Put your scheme into some sort of shape before the meeting, so that those who are present need not waste time discussing generalities. The first thing to decide is whether you want a "mixed" club (boys and girls) or a "men only" affair. Each has advantages, which I need not point out! Then settle whether you want to race or just to indulge in social runs and tours. The most energetic of your group should explain these various items to the meeting, then somebody should propose "that a cycling club be formed." That being seconded and carried (I hope with acclamation) the meeting should decide upon a name for the new body.

Let me suggest that the name should give some idea of the locality which the new club is designed to serve; this will guide likely members, and save a lot of time and misunderstanding in the future. Such names as the "Universal Paragon C.C." are inadvisable.

Fixing the Amount

Then fix the amount of the annual subscription. These formalities having been arranged, the meeting should appoint an hon. secretary pro tem., who should immediately begin to take notes of the proceedings with a view to writing up "minutes" of the meeting. These consist of a brief statement, without comment, of the various propositions, with names of the proposer and seconder, and the result of the voting, whether they are carried or lost. Do not think that a record of the accepted motions will suffice; at some future date you may want to refer to a proposal which was defeated on a vote.

Now the chairman will be wise to allow a general discussion. This will give those present an opportunity of showing their ability and airing their knowledge, and thus guide the meeting when the time comes to elect the officers and committee. If time permits the meeting can go ahead and elect the various officials and discuss rules, but it would probably be wiser to elect only a pro tem. committee, with power to draw up a list of suggested rules and submit them to a further general meeting to be held in about a fortnight's time.

During this interval it is presumed that all those present will talk about the club to their friends, so that the second meeting should secure a larger attendance than the first.

It will be a very great help if the promoters can secure the presence of at least one man who has experience of club management, and who can explain matters of club etiquette, the proper proceedings at meetings, and give advice to the members of the new club; these, one assumes, will be inexpert in such problems. The local centre of the National Cyclists' Union H.Q., 25, Doughty St., London, W.C.1, will probably be pleased to help.

Beware lest your club develop into a "one man" affair. This is possible when the idea of the club arises in the mind of a single individual, who calls the preliminary meeting, has most to say at it, gets himself elected secretary, and proceeds to run everything. The main idea of club life is mutual co-operation, and the main official duties, like the pleasures and benefits, should be shared out amongst as many as possible of the members.

The Right Spirit

Occasionally, disruption occurs, when one official of a club who has done much of the pioneer work finds that the views of the members are against him on some matter of policy. If, however, all officials take office in the spirit of co-operation, realising that their duty is to act in accordance with the views of the majority of the members, such difficulties should be avoided. Every member, and more particularly every official, should be proud of his club, and should consider always the good of the club before his personal desires.

Constructive criticism, whether at meetings or otherwise, should be invited, not stifled. Rivalry among members is certain to arise, particularly if racing is indulged in. Healthy and friendly rivalry in competitive effort will be beneficial not only to the club, but to the sport; but above all to the riders themselves. It brings out the best in a man.

(To be continued)

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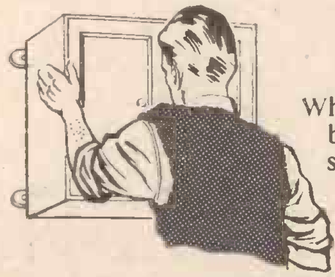

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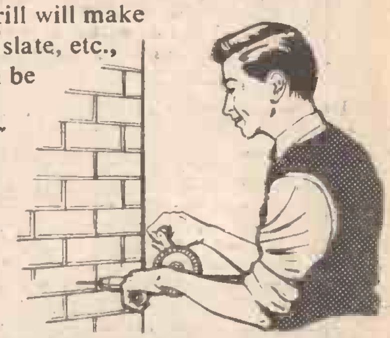

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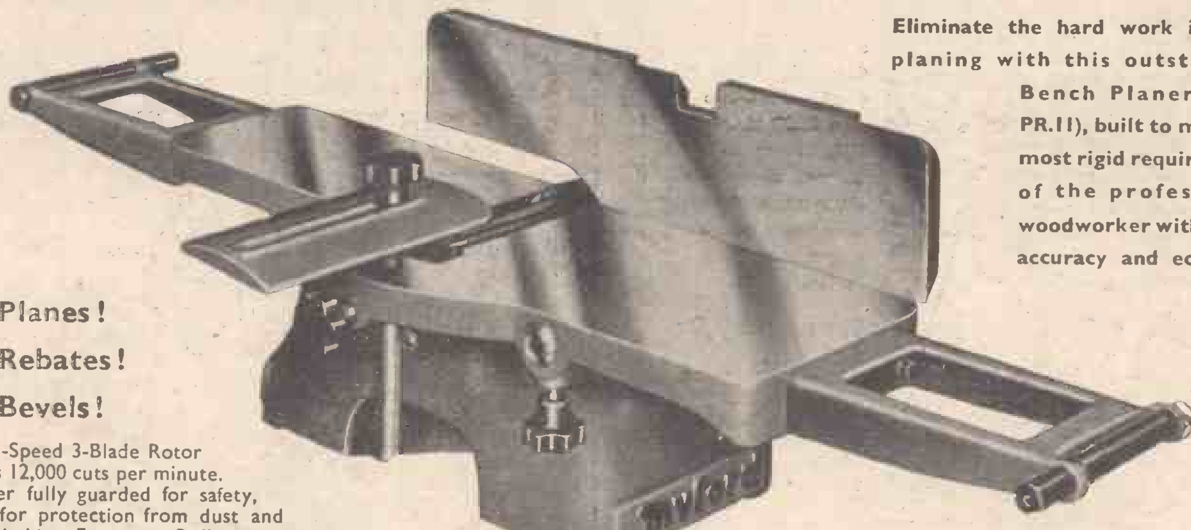

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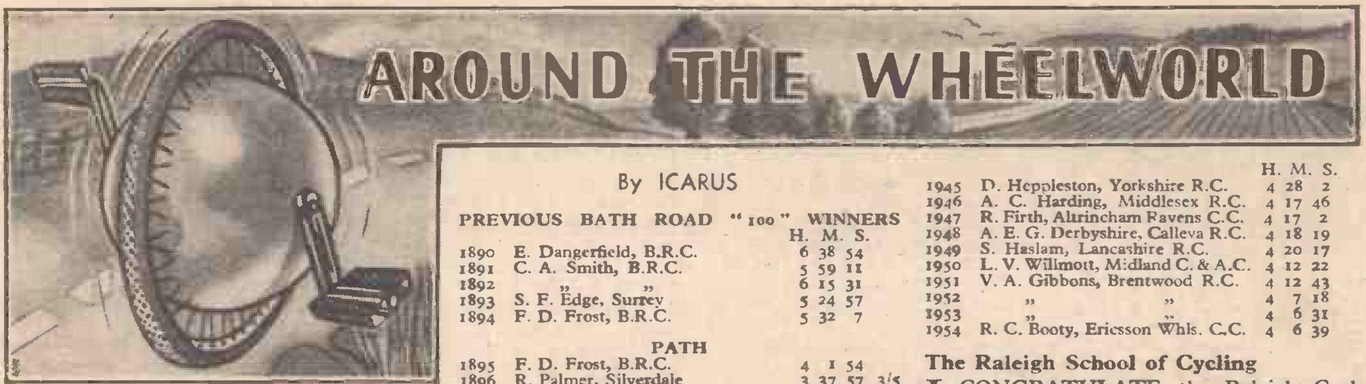


By ICARUS

Results of "The Oats"

DESMOND ROBINSON, of Mirfield, near Huddersfield, 27-year-old joiner member of the Yorkshire team, won "The Oats," the Amateur Circuit of Britain for the Quaker Oats Challenge Trophy, from July 15th to 23rd, Europe's toughest cycle race of the year.

Wearer of the race leader's yellow jersey for seven consecutive days, Robinson completed the 1,066-mile course over some of the roughest terrain in England, Scotland and Wales to finish at Chiswick Polytechnic Stadium on Saturday, July 23rd, in 49 hours 16 mins. and 31 secs.

Second in the general classification was Derek Evans, 22-year-old draughtsman from Wolverhampton (South Central), who was also runner-up in "The Oats" last year. Evans completed the course with a time of 49 hours 18 mins. and 2 secs. Another Wolverhampton rider was third—Ray Holliday (R.A.F.), 23-year-old installation mechanic, with a time of 49 hours 20 mins. 57 secs.

Winner of the "King of the Mountains" award and fourth on general classification with a time of 49 hours 23 mins. and 9 secs. was John Kennedy of Glasgow, 24-year-old cycle mechanic (Scotland).

Stage winner of the 136 miles of the 9th and final stage from Wolverhampton to Chiswick was Donald Sanderson (21), of Newcastle (North East), with a time of 6 hours 5 mins. and 58 secs. Second was Richard Bartrop (North Central) with 6 hours 5 mins. 59 secs., and third was John Perks (South Central), with a time of 6 hours 6 mins.

Of the 74 riders who started the race in Manchester, 57 completed the entire course in conditions of sweltering heat which made "The Oats" this year an even greater test of endurance.

At a dinner held at the Oldfield Hotel, Greenford, Middlesex, the Quaker Oats Challenge Trophy was presented to Robinson by Mr. B. C. L. Summers, director of the company.

The Bath Road 100

THE Bath Road 100, once regarded as the Blue Riband of the Road, when the club was in its heyday, and Bath Road Smith, Edmund Dangerfield and others vied with one another in a spirit of true sportsmanship, passed off uneventfully again this year. You will see from the following table of previous Bath Road 100 winners how times have shortened since the first race in 1890. The original Bath Road 100 Club Trophy which was won outright by Bath Road Smith in 1892 is now in the possession of the editor of this journal. It was presented to the Bath Road Club by C. A. Smith when he rejoined the club during the war. The old disputes, however, which caused Smith to resign still arose and the old dislikes of him by certain of the members still obtruded, as a result of internecine disputes, he again resigned and withdrew his cup.

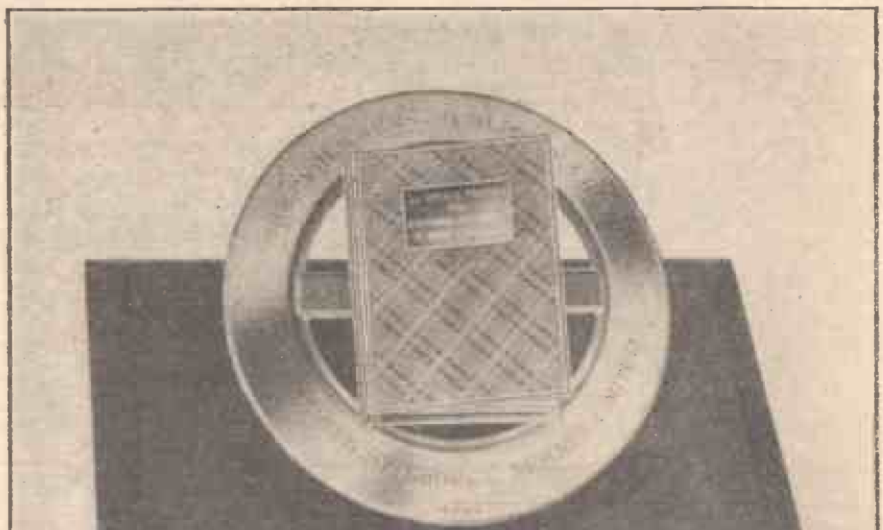
PREVIOUS BATH ROAD "100" WINNERS

		H.	M.	S.	
1890	E. Dangerfield, B.R.C.	6	38	54	
1891	C. A. Smith, B.R.C.	5	59	11	
1892	" "	6	15	31	
1893	S. F. Edge, Surrey	5	24	57	
1894	F. D. Frost, B.R.C.	5	32	7	
	PATH				
1895	F. D. Frost, B.R.C.	4	1	54	
1896	R. Palmer, Silverdale	3	37	57	3/5
1897	F. D. Frost, B.R.C.	3	58	5	3/5
1898	" "	3	47	34	1/5
	ROAD UNPACED				
1903	A. Powell, M.C. & A.C.	5	50	4	2/5
1904	R. Shirley, Poly. C.C.	5	5	53	
1905	E. H. Wingrave, N.R.C.C.	5	19	54	2/5
1906	" "	5	9	58	4/5
1907	C. Moss, M.C. & A.C.	5	7	41	
1908	" "	5	13	8	
1909	" "	5	7	48	3/5
1910	F. H. Grubb, Veg. C. & A.C.	4	50	49	3/5
1911	C. Moss, M.C. & A.C.	4	51	20	
1912	H. H. Gayler, Poly. C.C.	5	0	43	4/5
1913	H. Peters, Essex Roads C.C.	5	3	19	
1914	W. H. Henry, North London C.C.	4	49	25	
	(The event was not held in 1915-18.)				
1919	C. F. Davey, Veg. C. & A.C.	5	1	51	
1920	L. Meredith, B.R.C.	4	48	1	
1921	A. J. H. Gott, Unity C.C.	4	59	2	
1922	D. E. W. Hunt, Kentish Wheelers	4	57	29	
1923	S. G. R. Hunter, Warren	4	47	45	
1924	G. Greenwood, M.C. & A.C.	4	49	9	
1925	F. W. Southall, Norwood Paragon	4	45	19	
1926	" "	4	45	58	
1927	" "	4	37	22	
1928	L. Cave, Veg. C. & A.C.	4	41	18	
1929	F. W. Southall, Norwood Paragon	4	34	26	
1930	F. G. Frost, Allondon R.C.	4	33	49	
1931	" "	4	39	40	
1932	J. J. Salt, Anfield B.C.	4	35	53	
1933	F. W. Southall, Norwood Paragon	4	30	10	
1934	E. J. Capell, Allondon R.C.	4	32	1	
1935	K. H. Mosedale, Calleva R.C.	4	27	23	
1936	F. A. Lipscombe, Century R.C.	4	27	16	
1937	Norman Hey, Bronte Wheelers	4	30	18	
1938	H. Earnshaw, Monkton C.C.	4	29	1	
1939	R. Firth, Bronte Wheelers	4	26	15	
1941	D. Gawman, 13th Wheelers	4	30	28	
1942	D. K. Hartley, Dukinfield C.C.	4	29	27	
1943	A. C. Harding, Middlesex R.C.	4	29	26	
1944	" "	4	28	12	
1945	D. Heppleston, Yorkshire R.C.	4	28	2	
1946	A. C. Harding, Middlesex R.C.	4	17	46	
1947	R. Firth, Altrincham Ravens C.C.	4	17	2	
1948	A. E. G. Derbyshire, Calleva R.C.	4	18	19	
1949	S. Haslam, Lancashire R.C.	4	20	17	
1950	L. V. Willmott, Midland C. & A.C.	4	12	22	
1951	V. A. Gibbons, Brentwood R.C.	4	12	43	
1952	" "	4	7	18	
1953	" "	4	6	31	
1954	R. C. Booty, Ericsson Whls. C.C.	4	6	39	

The Raleigh School of Cycling

I CONGRATULATE the Raleigh Cycle Company on instituting its school of cycling a few months ago. Mr. Leslie Hartwell, their sales director, in a recent address to parents and pupils, stated that more than 100 children had successfully passed through the training scheme and a second course is now in operation. "We are going to give a special badge to all children who have passed the road test, but I want to make it quite clear that they can still go on learning. And I do hope that all these children will now go in for the police test. When we started the Raleigh School of Cycling we did not realise how popular it would be. There are now more than 600 names in the school register. For the efficient running of the school we owe a great deal to Mr. and Mrs. J. Norman and their colleagues who have quite voluntarily come along every Monday and Wednesday evenings to help us. We are also indebted to the Raleigh dealers who have acted as voluntary instructors, outstanding amongst whom are George Mellors, S. C. Joselyn, H. Savage, R. Lamb, H. Rogers, G. Stafford and A. Dobbs."

My only comment on this excellent scheme is that it is inserting the thin edge of the wedge to invite the pupils to undergo a police test, a suggestion which has been mooted and criticised by all of the organisations on a number of occasions during the past 20 years.



This silver trophy, in the form of a silver circle on which is mounted a book with silver cover and silver leaves, was made by Mr. F. J. Camm for presentation by the publishers, George Newnes, Ltd., to The Publishers Publicity Circle for annual award for the best example of book publicity.

The famous old theatrical inn—the "Rose and Crown"—opposite the King's Theatre, Hammersmith. Famous stars of stage, past and present, regularly visit this hostelry, in which is a portrait gallery of autographed photographs of actors and actresses of stage and music hall.

Wayside Thoughts

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

I WAS expecting some warm weather this summer, the kind of temperature when you feel comfortably moist and move easily through a limpid air, but that first Sunday morning of the season nearly blew me off the saddle, chilled my thin blood and when it rained I was glad to don macks. As there was little traffic about I came home along a sinuous main road with the wind behind and quite enjoyed the spin; but having reached there a lively fireside was good value with a storm-facing window rattling with rain. At the moment of writing the weather seems to be saving its worst specimens for the week-end, which always makes the worker feel he is being given a raw deal. I don't like my leisure hours too rain-bespattered any more than the next fellow, but maybe I have by now absorbed the philosophy that whatever the elements decide to mix for me, they can scarcely be ill enough to keep me from indulgence in a gentle ride. I'm glad therefore I went out; for it was difficult to believe that the tingling wind in July would have whitened my finger-tips and made a pair of gloves welcome. And yet I remember once climbing to the ridge of Carter Bar from the Scottish side on a July day, and on the long glide down Redesdale would have given quite a lot for a pair of protecting gloves and an extra pull-over, so you see this is not the only summer of high cool winds and disappointing days. Nevertheless, I would like to brouse in the warm sun as would most other folk.

Village by the Sea

MENTION of Carter Bar reminds me that in mid-June some friends who had never been to Northumbria persuaded me to go that way and explore the area for a week, and I fell for it. This was the result of gentle bragging of one's knowledge of the country, and how the most beautiful places are usually hidden amid the byways; and so I was involved and to be candid thoroughly enjoyed the few days of idleness. We glanced at York for one night and the best part of next morning, looked in at Durham and then sped to Bamburgh, still an unspoiled village by the sea, where every inhabitant knows the next and they hold "bring and buy" sales on the village green. A few miles south is Sea Houses, once a typical fishing village and now "developed" into a bungalow and caravan repository, an aching contrast to the peace of Bamburgh sleeping under the shadow of its great castle so excellently restored from its near-ruined state by the late Lord Armstrong. Our week in comfortable headquarters at the Victoria Hotel was good; only one wet morning and a few showers. But we disappointed the hotel folk by our inability to consume the gargantuan meals the north countryman is expected to demolish. Not counting the journey out and home we roamed nearly 600 miles, mainly inside the thirties, for I like to look at the surroundings without too much head-swerving, and to stop and stare occasionally. How excellent these byways are. Narrow, yes, gated frequently, but encompassing some of the loveliest land and sea scapes in these beautiful islands.

A Five Miles Bouquet

ONE of our first trips was to Rothbury, turning off A1 for Chatton Moor and in a mile we were in the wilds, with the rain-spangled and sun-tinted Cheviots looming largely in the clear air. Not a thing did we see on the road over the next ten miles except numerous lively rabbits (evidently myxomatosis has not penetrated Chatton) and one hen grouse which I had to put on the wing just to see her circle and settle and watch us off before rejoining her brood on the heather. A lovely road—empty of human movement—and I'm selfish enough to have been glad of it, and to dally on the way and remember how first I came here on two silent wheels and was enchanted. The main moor road to Rothbury with its wide visions is very beautiful and had attracted a few roamers, but when we turned into the grounds of Cragside on that day we had them almost to ourselves. It was just the right time of year for such a visit, for the rocky park is just five miles of colour, rhododendrons and azaleas in full bloom in every variety of colour, and without a break. We made a meal above the lake and revelled in the riot of colour. Cragside belongs to Lady Armstrong and it costs the visitor just one shilling to make the round, and if he can do it under two hours he has no eye for beauty. It is the best display I know in all these isles, better even than the blooming miles of Brodick Castle on Arran Isle. We returned over Chatton Moors with the level light making mystery of the hills, and this time a couple of Land Rovers full of lambs and the old farmers in charge were the sole inhabitants of the road.

The saloon bar of the "Rose and Crown."

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