RADIO CONTROLLED BOAT MECHANISM

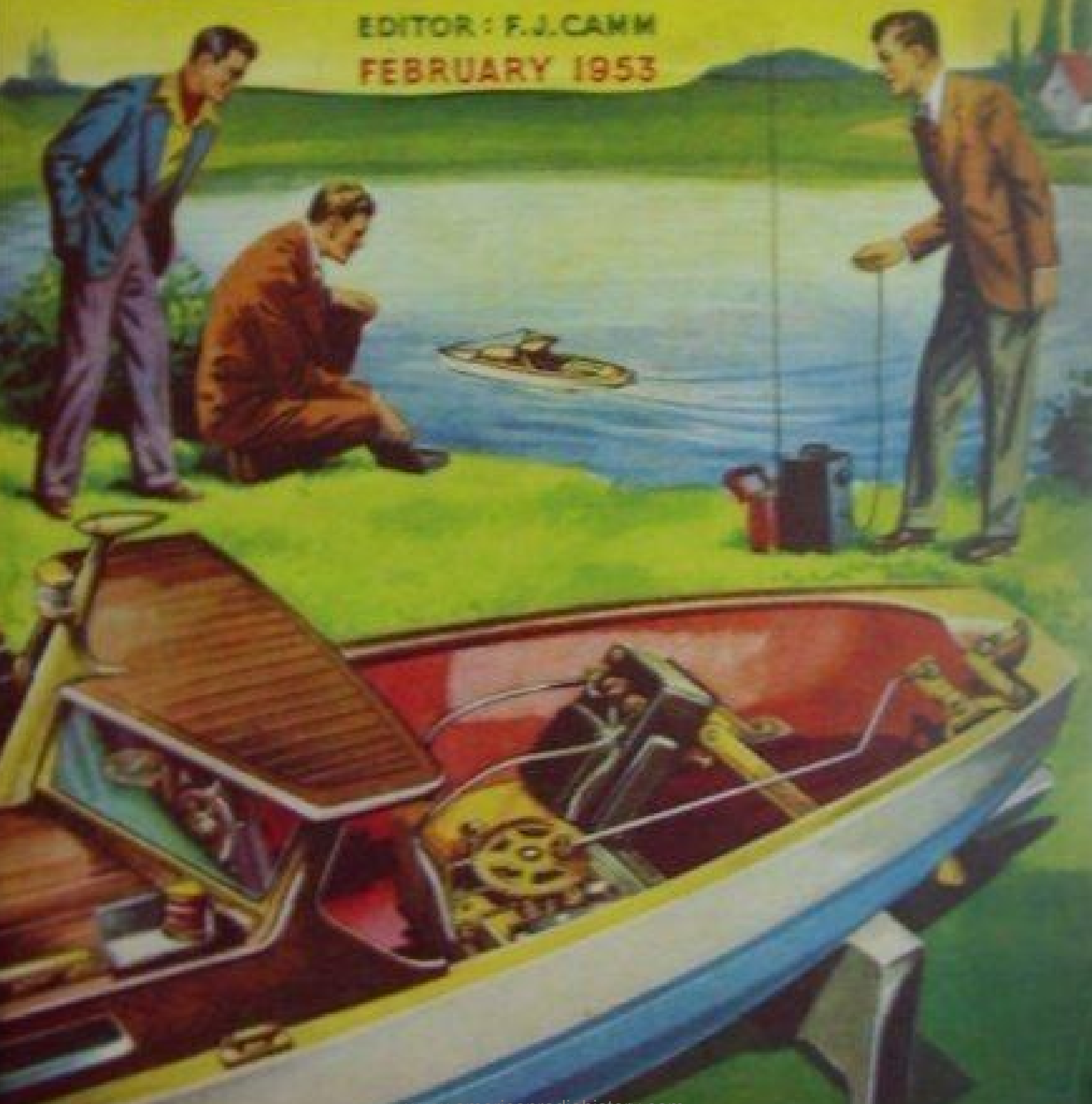
NEWNES

PRACTICAL MECHANICS

1/-

EDITOR: F. J. CAMM

FEBRUARY 1953



FEBRUARY, 1953
VOL. XX
No. 230

PRACTICAL MECHANICS

EDITOR
F. J. CAMM

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

FAIR COMMENT — By The Editor

Threat From the Conjurors!

READERS will remember that just before the war this journal was attacked by the magicians for daring to publish a series of articles by Norman Hunter, a conjuror of repute and many years' experience with Maskelyne. A member of the Institute of Magicians, which at that time was a comparatively new body, threatened to sue this journal, myself, Norman Hunter and the printers for infringing the "copyright" in certain tricks. Undismayed by this stupid threat, we continued to publish those articles and left the conjurors, who had raised a fighting fund subscribed to by conjurors themselves, to find out in an expensive way that there was no such thing as a copyright in a trick.

The spearpoint of the attack came from the late Brunel White, and he had apparently been goaded to take action by his fellow members. It would have been difficult to have found anyone less qualified than Brunel White to espouse the cause of the conjurors. His particular grievance was that in publishing details of a trick hat we had divulged the secret of his "Master Hat" out of which he had made considerable sums in money. We were able to show that he did not originate that hat and that it had been used on the stage fifty years previously; also that he had falsely claimed to be the originator of it. Needless to say, the threats of prosecution were not proceeded with and the conjurors were forced to acknowledge, in the course of a lengthy apology in a paper which deals with conjuring matters, that they were wrong.

In view of this it is somewhat surprising that the Institute of Magicians leads with the chin again in connection with our article on conjuring in the Christmas number. The Secretary wrote to us stating that its Council "takes great exception to articles of this nature," stressing that harm is done by exposing to the public the *modus operandi* of how magical effects are performed. Before we had time to reply to this letter we received a telephone call, and a Voice informed us "that a dim view" was taken of the article in our Christmas number. Moreover, the Voice went on to issue a dire threat. It proposed, unless we desisted, to circularise all its members advising them not to purchase this journal, or any other with which it is associated! Rest assured, readers, that I do not go in fear that one day a man in evening dress will arrive outside Tower House, utter a few magic words and transport me and Tower House to the Gobi Desert!

We have since pointed out to the Institute of Magicians that many conjurors owe their livelihood to what they have learned from conjuring articles and from books written by magicians themselves, and from what they have learned from selling tricks behind the counters at popular stores. The greatest illusion of the conjurors is that they own any rights in their illusions! I do not anticipate a similar threat from various trades unions because we publish articles dealing with engineering and electricity!

A CENTENARY OF INVENTIONS

THE Patent Office, in Chancery Lane, London, has been the home of British patents for 100 years, and the centenary has been celebrated by an exhibition in the excellent Patent Office Library, which houses technical books and periodicals, past and present, on almost every known scientific and technical subject. The exhibits at the exhibition are but a fragmentary sample of the patents which have been launched. The earliest known English patent was granted in 1449 to John of Wynam. Over a million patents have since been granted. The first patent was for stained glass to be placed in the King's Chapels at Eton and Cambridge.

The exhibition undoubtedly underlines what I have written so many times—that failure rather than success is usually the reward of the inventor. Fees may be not so high now as when Dickens wrote "A Poor Man's Tale of a Patent," but patent fees are still high.

Some of the specifications exhibited have been responsible for changes in the structure of our existence. For example, the aerial torpedo, patented in 1921 by the Sperry Gyroscope Co., of New York; Sir Frank Whittle's specification of 1931 for jet engines; the application in 1904 for a provisional patent for Fleming's radio valve. Of course, there are some amusing specifications, such as a London tailor's invention in 1907 for a pair of trousers cut alike in front and behind so that they could be reversed and equalise wear! And I wonder how many women bought the device whereby a vacuum-cleaner is worked by being attached to a rocking chair? Apparently, the hand that rocks the cradle is intended to sweep the floor at the same time! And did anyone ever market the waterproof wristbands intended "to prevent moisture running down the hands and wrists when eating crayfish"? There are inventions of devices to awaken the snorer whenever he commenced his nocturnal tintinnabulations!

The Patent Office is well worth a visit at any time. You may not only consult the patent specifications to make quite sure that your own idea has not been anticipated, but you may freely consult the technical books and periodicals of the world. The periodicals and volumes are easily found from the authors and titles indexes.

"READERS' SALES AND WANTS" PAGE

IN response to numerous requests we have commenced publication in this issue of a page of "Readers' Sales and Wants" miscellaneous advertisements. Through the medium of that page readers may advertise books, tools, or apparatus for which they have no further use; or advertise for similar things which they may require. These advertisements appear in a very large market-place which rapidly puts readers in touch with buyers or sellers. As announced in the previous issue, this feature will be run for an experimental period.—F. J. C.

SUBSCRIPTION RATES
including postage for one year

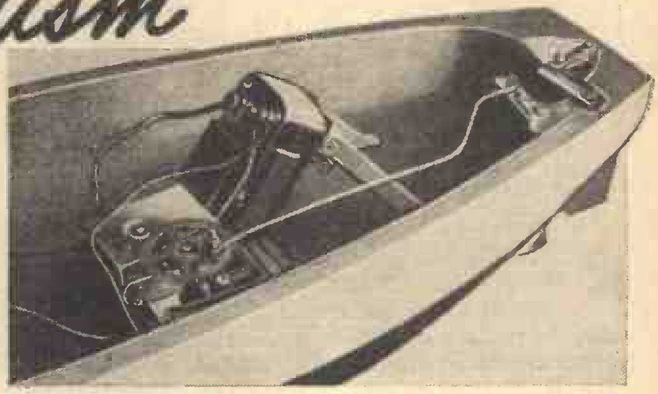
Inland - - - -	14s. per annum.
Abroad - - - -	14s. per annum.
Canada - - - -	13s. per annum.

Editorial and Advertisement Office: "Practical Mechanics," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2
'Phone: Temple Bar 4363
Telegrams: Newnes, Rand, London.
Registered at the G.P.O. for transmission by Canadian Magazine Post.

RADIO-CONTROLLED Boat-Mechanism

Steering and Motor-reversal Arrangements

By F. G. RAYER



A view of the stern of a model boat with the radio-controlled mechanism installed. Note.—The propeller tube is not seen as it is behind the near stay of the propulsion motor.

THIS mechanism is small and can be accommodated in model boats of no great size, but it allows a good deal of control to be achieved. With the usual 3-channel reed receiver, the boat may be fully steered, caused to reverse, and the propulsion motor halted in a "straight ahead" position of the rudder. It should be noted that control of steering is by infinitely small stages, in that the rudder can be brought to rest in *any* position within its limits of movement. This is very different from the simplified form of steering sometimes found, where the rudder may be held in one of three positions only—full to port, full to starboard, or straight ahead.

The addition of a position where the propulsion motor may be halted is of great advantage in securing effective control of the model.

The mechanism can also be operated from a single channel (e.g., 1-valve interrupted carrier-wave) receiver. Reversing is not then provided for, but the propulsion motor may be halted with the rudder straight ahead. It also becomes necessary for the rudder to move to the limit of its travel in one direction before a setting in the other direction can be obtained. However, this is no great disadvantage, unless very exact control is required.

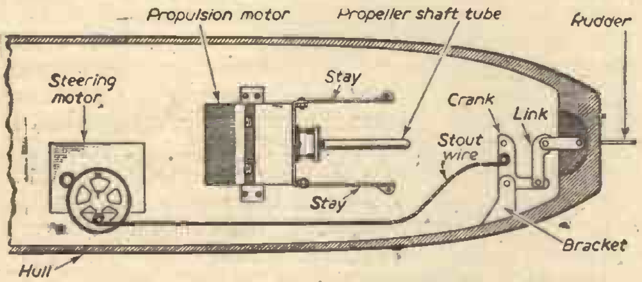


Fig. 1.—Plan view showing layout of the equipment.

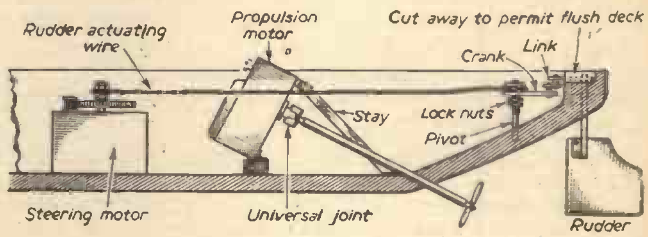


Fig. 2.—Sectional side view.

An examination of Fig. 1 will show how steering is accomplished. The steering motor drives a large gear through reduction gearing, and the rudder is actuated through suitable linkage. A number of holes are provided in the crank, offering optional positions for the bolt upon which the operating wire is pivoted. By this means the maximum extent to which the rudder can turn may be adjusted.

A cam is secured to the spindle holding the large gear, and this allows contacts to open when the rudder is in one straight-ahead position, thereby switching off the propulsion motor. A second straight-ahead position arises when the gear has turned 180 degrees, but the propulsion motor is not switched off. Accordingly it is possible to drive the boat straight ahead when required.

For steering, a Type 240 "Electrotor" was used, and found to operate satisfactorily on supplies of 3 volts and upwards. It may be reversed by reversing the polarity of the supply, thus permitting full control of rudder position. As the consumption of this type of motor is only about ¼ amp, power may be drawn from small dry batteries.

For propulsion, a 6-volt motor was used: a 4-volt supply was found to provide satisfactory speed. Since the consumption was approximately 3 amps, dry batteries were not suitable for operating this motor. Some motors of this type may be operated from dry batteries, and permanent magnet motors are especially suitable. With such motors, direction of rotation is reversed when the polarity of the supply is reversed. If the motor actually used has a wound field, connections should be arranged so that polarity to it (or to the armature) can be reversed, if it is desired to provide motion "astern."

Fitment Details

No attempt was made to provide a watertight gland for the propeller shaft as it was thought that friction might arise. Instead, the shaft tube is carried up above water-level. This tube was fitted by drilling a suitable hole (¼in. dia.) and hammering the tube into it. The propeller shaft was 1/12in. dia. steel, with bushes ⅛in. in diameter at the ends only. As the inner diameter of the tube was ⅛in. this assured that any slight bending of either tube or spindle would not impede rotation. A 4 B.A. threaded brass piece, drilled and soldered on, was provided at the bottom end of the shaft, so that various propellers could be tried without difficulty. The propeller is held by means of lock-nuts.

The propulsion motor was mounted upon a strip of wood, and the latter screwed to the hull. Stays were then added. A simple form of universal joint was provided, projecting pins on the motor shaft engaging a piece secured to the propeller shaft. A solid joint between motor shaft and propeller shaft should not be made.

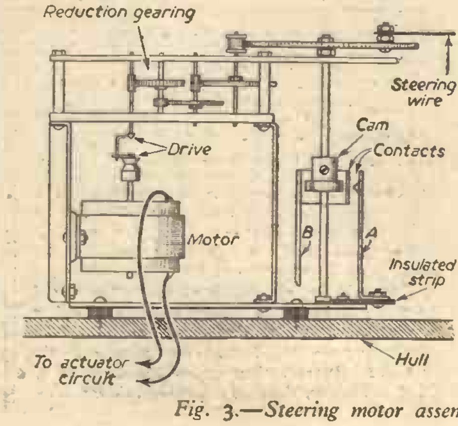
The pivot for the rudder-actuating crank was held at its top end by means of a bracket screwed to the hull; the lower end passes into a hole drilled in the hull. (The latter should be of ample thickness here.)

No. 6 B.A. rod was used for the rudder pivot, the top arm being soldered on. The rudder itself was subsequently bolted to a small metal piece soldered to the lower end of this rod.

The actual size of these parts could be varied between large limits, and would depend upon the dimensions of the boat.

Steering Motor Assembly

This is shown in Fig. 3, a form of drive being employed which does not require exact alignment between motor shaft and the first spindle. (A projection is soldered upon the motor pulley, and engages with a second projection on the driven spindle.) Clock



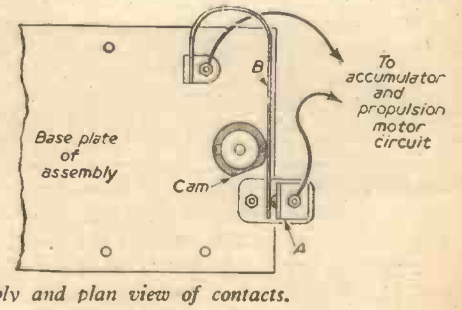


Fig. 3.—Steering motor assembly and plan view of contacts.

gears were used in the assembly. The actual ratio between motor and steering gear is not critical, but should lie between about 1 : 100 and 1 : 500. If the ratio is too high, the rudder will take an appreciable time to reach the desired position; if too low, proper control will be lost. If necessary, the voltage of the battery may be modified to achieve satisfactory results in this direction.

The cam is of ebonite, tapped for a grub screw. Contact "B" is bolted directly to

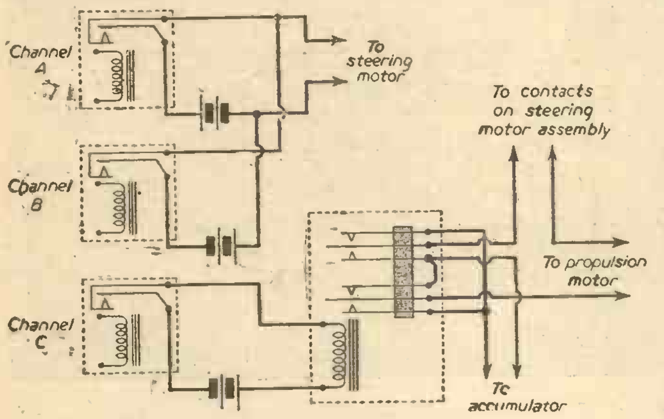


Fig. 4.—Circuit for three-channel operation.

the base plate, but contact "A" is secured to a small strip of insulating material. Sound contact between "A" and "B" should be achieved except when the flat side of the cam is adjacent to "B," when the contacts open.

Most of the required parts may be cut from sheet brass. A section of the clock end-plates may be retained to provide suitable bearings for the gearing.

The cam is so positioned that the contacts open when the rudder is straight. The completed assembly is screwed to the hull of the boat. The motor and gearing should run freely, turning the rudder from side to side, and the throw of the crank may be adjusted, as mentioned, if necessary, to obtain a suitable degree of movement.

Controlling Circuits

The circuit for a reed, 3-channel receiver is illustrated in Fig. 4. When none of the channels is in use, the three relays will be open. Upon a signal being radiated from the transmitter, one of the relays will be closed, according to which channel is used.

When the relay associated with channel A is energised, the steering motor will rotate in one direction; channel B permits the direction of rotation to be reversed, since the polarity of the supply batteries is dissimilar. The rudder may thus be turned to any desired degree in either direction. When neither channel is used, the rudder remains in the position it had taken up.

Channel C reverses the propulsion motor through a double-pole double-throw secondary relay, the latter being wired so that the model is normally moving forwards. The propulsion motor may be stopped at any time by operating either channel A or channel B relays until the "dead" straight-ahead position is reached.

Upon channel C ceasing to be energised the boat will return to forward motion, unless switched off by the appropriate use of channel A or B. This is no great disadvantage. The boat may be reversed upon a circular course by previously actuating the rudder until it reaches the desired position.

The circuit for single-channel operation is shown in Fig. 5, and no reversing is provided for here. The relay will be of the usual sensitive, high-resistance type, and the armature will be held down by the anode current of the valve. Upon a signal being radiated the anode current falls and the relay contacts close. When these contacts are closed, the steering motor commences to run, and is kept running until the rudder has taken up the desired position. Since the steering motor cannot be reversed with this circuit, it may be necessary to allow the rudder to pass through undesired positions (e.g., a starboard setting) to reach a desired position (e.g., a port setting). Since full movement only takes a few seconds, this does not prove to be a very great disadvantage in practice. Upon each rotation of the steering gear, the propulsion motor will be momentarily switched off. This, again is scarcely discernible when the model is afloat. A pilot bulb may be wired in parallel with the propulsion motor so that the "off" position may be more easily located when the boat is at range.

Notes on Transmitter and Receiver

For single-channel operation, any carrier-wave transmitter and receiver can be employed. The range of operation will depend upon the aerials, power of transmitter, etc., but with a 1-valve transmitter powered from a 120 volt H.T. battery, and 1-valve receiver using a gas-filled triode, a range of 250yds. should be easily achieved using an 8ft. transmitter aerial and 2 to 4ft. receiver aerial. As is usual with such equipment, the range depends largely upon the care taken in setting up the receiving apparatus, so that the valve is operating in its most sensitive condition, and the relay immediately actuated by a very small change in anode current. If the receiver uses a "hard" (vacuum) valve, the range will be much decreased.

The transmitter and receiver used for 3-channel operation will naturally be more complex, and receivers of this type normally employ three valves. With such receivers, the tonal reeds should be carefully adjusted (or the transmitter audio-tones set to the correct frequency), or one or more channels may begin to fail at range. With such

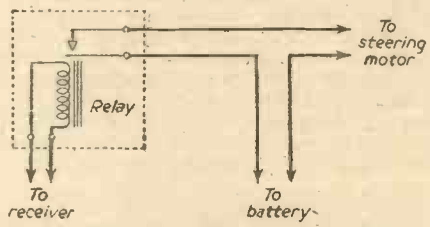
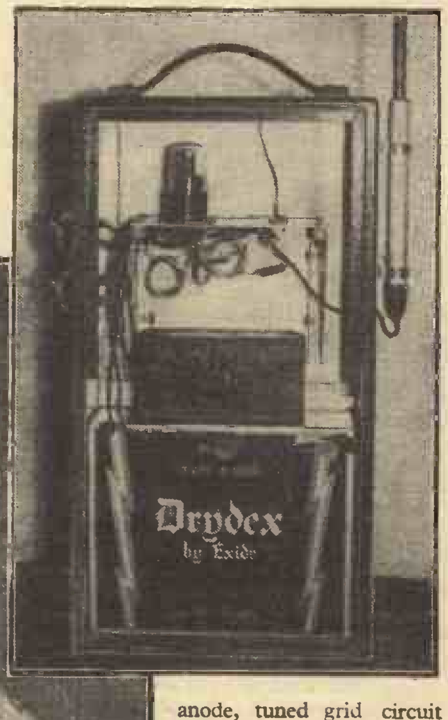


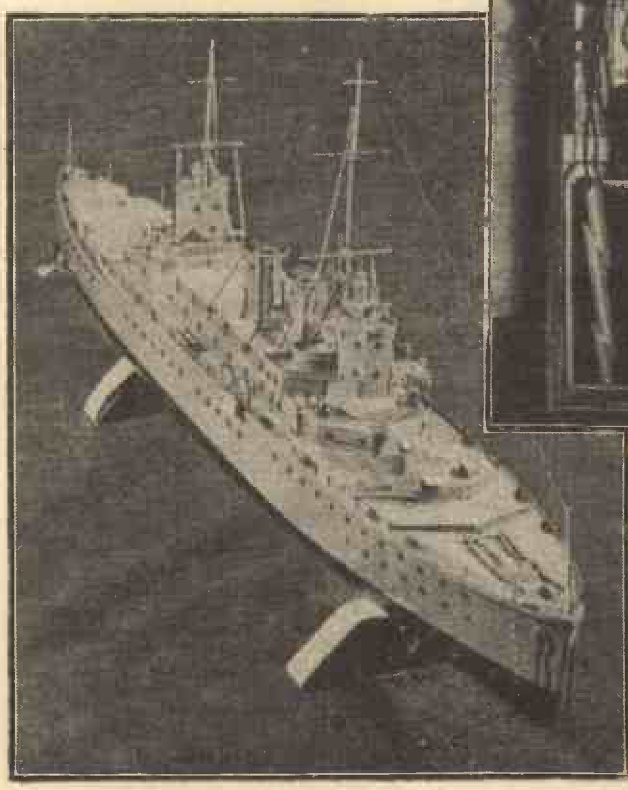
Fig .5.—Circuit for single-channel operation.

equipment, a little extra care in setting up initially is generally worth while, so that control of the model is not lost.

Radio-controlled Model Cruiser

THE illustration given below is of a radio-controlled model cruiser which was described in the March, 1950, issue of PRACTICAL MECHANICS. The model is 5ft. 1in. long, with a beam of 8½in., and propulsion is by twin electric motors. The receiver uses a miniature gas triode (RK 61) and the transmitter is a two-valve tuned anode, tuned grid circuit using two 1.4 volt battery pentodes (Mullard D.L. 35). When the transmitter is in operation an unmodulated R.F. signal is transmitted.





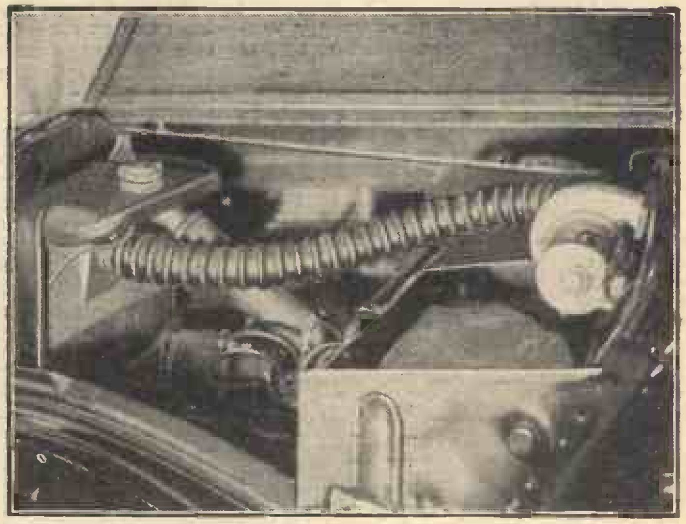
(Above).—The portable transmitter in its carrying case.

(Left).—Three-quarter front-view of the radio-controlled model cruiser.

Making a Car Heater

Constructional Details of an Inexpensive Appliance for Heating the Interior of a Car

By S. R. CARTER



This close-up view of the heater in position in a car shows how the neat and compact lay-out of the components takes up little room under the bonnet. Note the position of the blower on the inner side of the bulkhead.

THERE are, no doubt, many motorist readers who have recently inquired the price of a good heater, and thought it too expensive for an article which is only used during the winter months. There are a few cheap heaters on the market but there is usually a snag somewhere.

There is one in the form of a copper tube which is coupled to the cooling system and fitted under the dash. This is handy to warm the hands, but it does not appreciably heat the air in the car.

Another type is in the form of a jacket fitted over the exhaust pipe. Air is collected in a funnel at the front of the car, passes through the jacket and into the car. This does function, but there is always a slight smell owing to the dust particles being burnt when passing over the near red-hot exhaust pipe.

Most of the other heaters on the market will not work on a car with a thermo-syphon cooling system unless a water pump is added. This alone is quite an expensive item.

Owing to the small cubic capacity of a car, it is not desirable to heat and re-circulate the same stale air, but to heat fresh air from outside. As there will be a slight positive pressure in the car, air will be going out of the spaces around doors and pedal holes, thus eliminating those annoying cold draughts which occur in even the most luxurious cars.

Bearing these points in mind, I have designed and made an efficient heater which will raise the temperature of the air in a car 15 deg. in 20 minutes, starting the engine from cold.

The materials required are as follows:

1 Ex-Army blower.
1 piece of flexible rubber tubing.
1 piece of tin plate, and
About 2ft. of 6 B.A. screwed brass rod.

Constructional Details

To proceed with the construction, a piece of tinplate is cut 4in. wide and 1in. shorter than the width of the radiator. This is the baffle which is fitted on to the front side of the radiator, leaving a ½in. gap at each end, as shown in Fig. 1. This ensures that the incoming air has to pass the longest way through the radiator, thus picking up the maximum heat.

A second piece of tinplate is then cut out 4in. wide and its length equal to the full width of the radiator. This is the collector plate. To mark the six bolt holes, hold the tinplate in position as high as possible behind the radiator and mark with a long thin scribe from the front side. Care must be taken when scribing and also when finally pushing through the fixing bolts as the vertical radiator tubes are very thin and brittle and are easily fractured.

The hot-air outlet from the collector plate can be made from the top portion of a quart-size oilcan. This can then be placed into position as near the centre as possible, making sure that it or the tubing does not foul the fan or radiator hose. After marking ready for soldering, cut a vertical slot 3in. long and 1in. wide inside your circular marking (Fig. 2). This is in effect a manifold which draws air from several layers of the radiator.

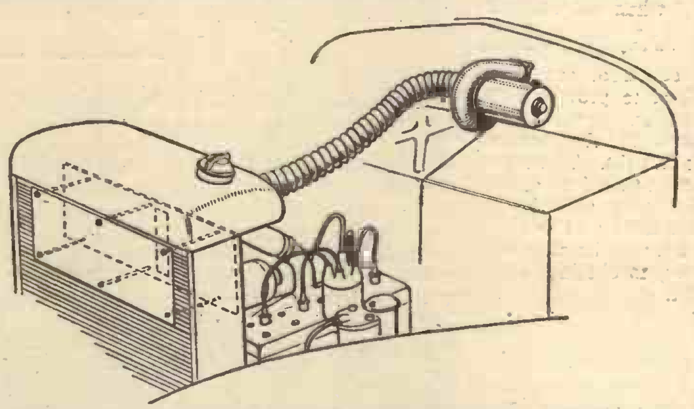


Fig. 1.—General view of the completed heater, showing the position of the front baffle plate.

After soldering the air outlet in position and drilling the six holes in the baffle, using the collector plate as a template, bolt the baffle and collector plate together through the radiator.

The Blower

The best blower to use is the ex-Army dual voltage 12v.-24v. Hoover (Ref. 10k 6/115), which can be bought for about 10s. If your car uses a 12v. battery, use the two red wires. If you wish to run it on 6v. it is necessary to dismantle the motor and put the field coils in parallel (see Fig. 3). In this way the motor runs at a good speed and has a consumption of 2 amps.

There are two small condensers fitted across the brushes with the centre point earthed, but these need not be disturbed. If you should be troubled with radio interference, a .05 mfd. condenser across the motor, on the outside, will correct it.

Another quart oilcan top can be used for attaching the tube to the inlet side of the blower. Four holes are drilled through the rim of the oilcan top, and four corresponding holes drilled and tapped on the inlet side of the blower, bolting the two together with a thin cardboard or Hallite joint.

Fitting the Rubber Tube

After cutting a 1½in. hole in the bulkhead and bolting the outlet flange over it, it only remains to fit the tube. Owing to the large volume of air the blower will handle, it is essential that "wire drawing" or frictional loss must not be caused by using a tube of too small diameter. There is a convoluted rubber tubing on the market with an internal diameter of 1⅝in. which is suitable. It can be bent without any reduction in diameter and can be secured with Jubilee clips.

As will be understood, this heater is very simple and cheap to construct, and can be made in a couple of evenings, the time spent being well repaid.

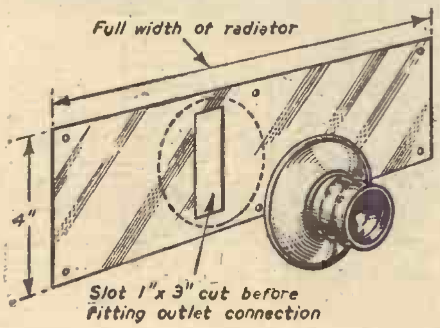


Fig. 2.—The rear baffle plate and hose connection.

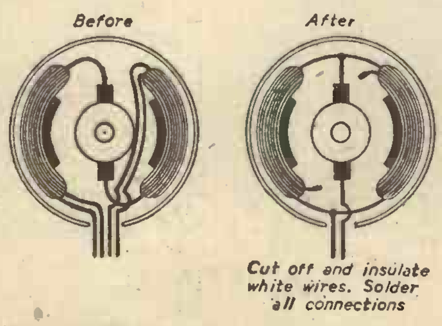


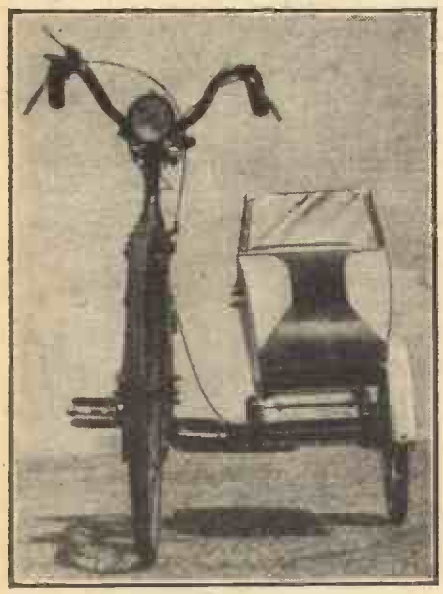
Fig. 3.—Alterations in wiring for converting blower motor to 6-volt working.

A Cycle SIDE-CAR

An Efficient Outfit with Brake and Retractable Rests

By D. V. PRIEST, A.M.Inst.Mechs.

TWO views of component "F" are given half full size in Fig. 6 (January issue), a piece of 1in. x 1in. x ⅛in. angle iron being used. It is cut to a length of 1in. and in the vertical flange an O/B.A. tapping-size hole is made with an ⅛in. slot running to it from the flange edge. This is to hold the adjusting screw for the brake cable, and though the thread is a cycle thread it will be found that O/B.A. is not amiss for the purpose. The hole centre is ⅝in. from the heel



Front view of the side car attached to a cycle.

of the angle-iron and on the centre line of the 1in. length.

The hole in the horizontal flange is 9/16in. from the heel and of ¼in. dia. The method of joining the part "F" to the cross-member "H[1]" is shown and to give clearance for the adjusting screw the hole in "H[1]" is countersunk and a countersunk head-bolt used. The reason for placing "F" with its flange under "H[1]" is to keep the cable low enough to meet the link L6, but high enough for the cable to reach.

Cable Details

This cable, incidentally, is the rear cable for a lady's cycle which is longer than the ones retailed for gent's cycles. The cable is only just long enough and so it is necessary to arrange the components with a view to conserving the cable. Thus, if "F" were bolted inversely to the position shown it would join up with the link L6, but the cable would be taut, particularly when the rider leant his machine to the right. If placed on top of "H[1]" it would be far too high to connect comfortably with L6. As it is it becomes necessary to give an upward bend to the connecting strips in order to bring them into alignment, as may be seen in Fig. 2. This is not detrimental, of course, but any more would definitely be so.

(Concluded from page 161, January issue)

The Brake Trigger

The brake trigger, "T," as fitted to the cycle handle-bars, is detailed in Fig. 7 and is simple to make. The trigger housing is of 1/16in. thick sheet material and the trigger of ⅜in. mild steel cut to taper, having its widest end ½in. parallel for a distance of 1in. The outside width of the complete housing is ½in., which affords an inside measurement of ⅜in. to take the trigger as illustrated. The length of the trigger before bending is 4in. and by gripping the 1in. x ½in. parallel section in a vice the bends can be made quite satisfactorily without the application of heat. The holes in the housing and those in the trigger should be drilled on completion of the bending operations to guarantee alignment. These are 3/16in. dia. for pins of the same diameter which are riveted when the component is complete. The end view of the housing shows details of the slot cut to accommodate the cable when inserted. The visor (b) is simply a freely moving metal loop, to the specifications shown, also having a slot, and when assembled the slot in the visor is inverted in relation to the slot in the housing (a). The wings of the upper half of the clamping lugs are integral with the housing, the bottom half being made separately. These are formed by bending the wings to the handle-bar tubing and then bending back sufficiently to enable 3/16in. holes to be drilled for the securing bolts. A rough sketch accompanies Fig. 7 to illustrate the position of the trigger on the cycle handle-bars. As already stated the leverage required to work the brake is so slight that it may be applied with the rider's thumb or finger-tip, and the fitting can be placed according to the rider's preference on the handle-bars. The edges of the trigger should be smoothly chamfered for the sake of appearance, as the full thickness of ⅜in. is rather bulky, but a good chamfer gives it a more slender look. A more detailed sketch of the method of bending the material for the trigger housing is given in Fig. 9.

Fig. 8 is a plan and side elevation of the brake mechanism on a larger and clearer scale than that in Figs. 1 and 2. The specifications are plain and the lay-out easy to see from these views, the only notes necessary being that the brake release spring is made from the type of spring used for hanging curtains. The tension is decided by trial during the final setting of the brake shoes in relation to the wheel rims. The spring

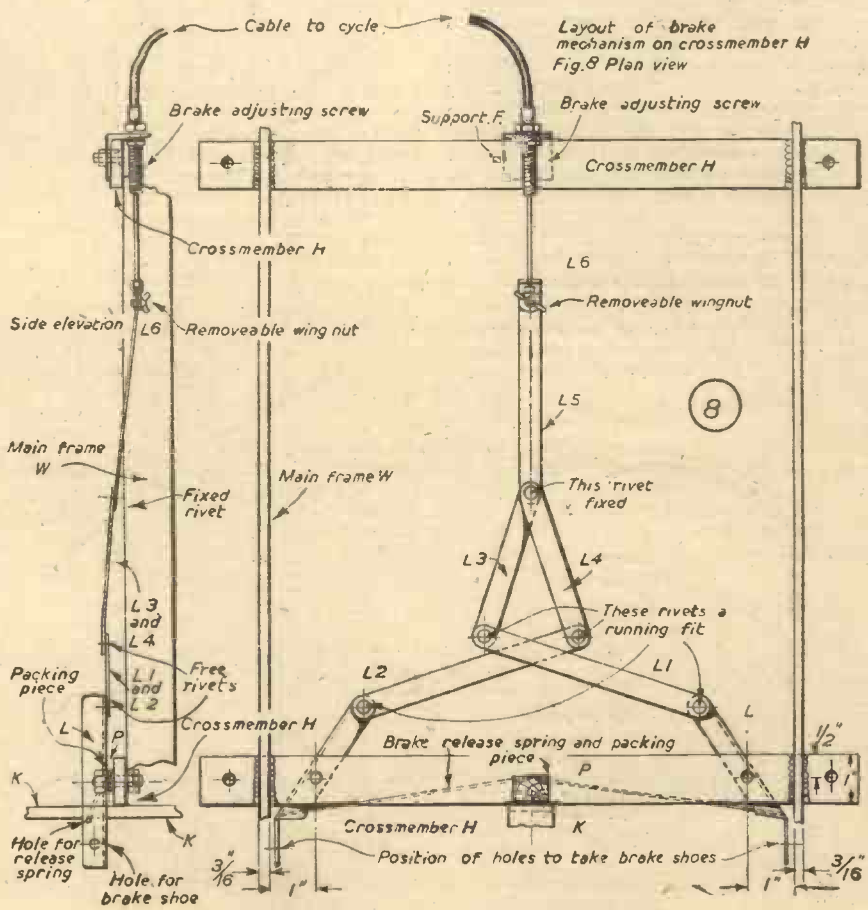


Fig. 8.—Layout of brake mechanism.

is then cut to length and the hooks, provided with these springs, are screwed into the ends and then locked into the holes in the brake arms. This type of spring is ideal because of its protective coating which preserves the fitting from corrosion. The simplicity of the small hooks screwed into the ends enables the spring to be cut and the hooks used on any length of spring required. A wood packing piece, "P," is used to hold the spring in tension and a groove is provided (see Fig. 9) to seat the spring. The groove, plus the tension, is all that is needed to hold the packing piece in place at the back of the splash-guard support, "K," and it is prevented from any downward movement by the nuts on the wheel axle which is also accommodated in item "K." Only on removal of the wheel will the packing piece be displaced and, since to remove the wheel the brake tension has to be released, as previously explained, this is all to the good. Referring to the strips L3, L4 and L5, they are seen to form an inverted "Y." The arms of the "Y" should be very carefully trued and firmly riveted to the leg L5, because should they tend toward either side of the leg a difference will show in the operation of the brake shoes. For example, if the pieces L3 and L4 are set thus X the connecting strip L1 will bring its brake arm into contact with the rim first and the braking action will be uneven. Likewise, with an opposite setting. To ensure uniform contact of both brake blocks the arms and shoes must move evenly towards the wheel rim, and the true setting of the "Y" piece is therefore most necessary. In the side elevation (Fig. 8) the gradual slope of the connecting strips towards the cable is seen. This is also a matter for attention during the final construction. Not only does it conserve the length of the Bowden cable but it also serves to prevent wear by chafing of the cable in the adjusting screw, were it to function in a downward direction. In action the cable reciprocates and, though the amount of action is small and infrequent, any downward tendency would cause drag on the cable in the bore of the adjusting screw. Thin washers or shims of brass should be placed between the connecting strips that are fitted with slack rivets (designated "free" rivets in the drawing), and every precaution taken to ensure ease of movement at these points. The wing-nut holding the link L6 need only be finger tight, because if the link is slack, the pull of the cable causes it to centre itself on the strip L5.

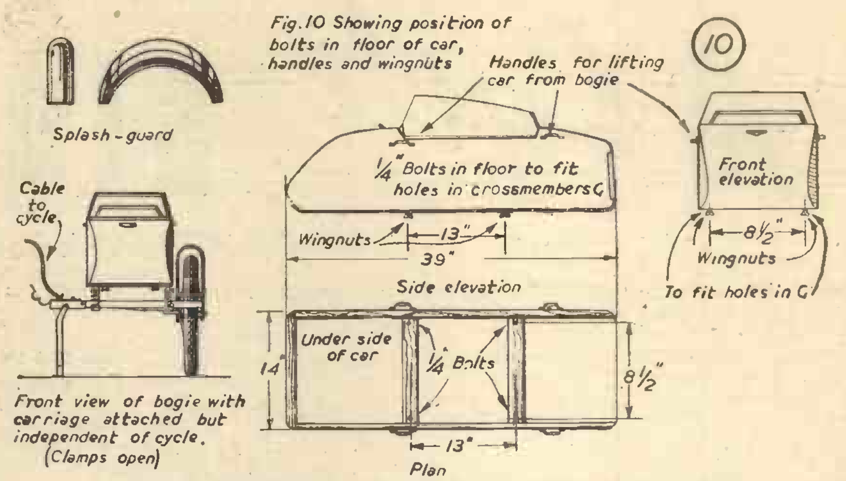
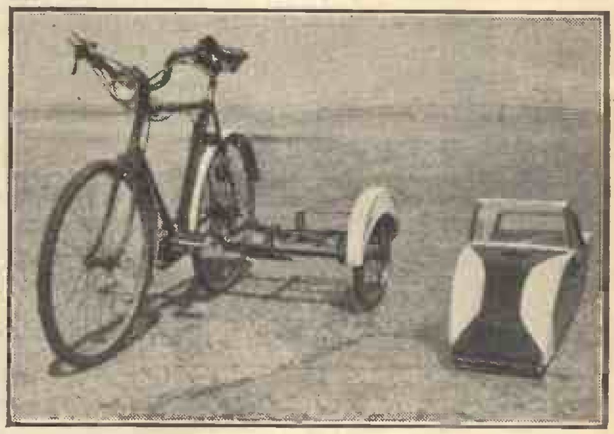


Fig. 10.—Front view of car bogie and details of side-car bolts.

The Bowden Cable

The method of connecting and disconnecting the Bowden cable is illustrated and described in Fig. 9, and when detached it is left coiled up on the side-car bogie. A sketch of the packing piece and brake release spring is also given along with the form of the trigger housing in its first stages of manufacture. The whole process of connecting and disconnecting is very easy and the cable is held to the cycle frame by the clips provided with each cable when it is purchased. These, like the trigger fitting, are left on the cycle, and each time the side-car is used the cable is clipped into position by this means.

Fig. 10 is a sketch of the car with the positioning of the securing bolts shown. These bolts are ¼in. diameter, and in one direction they are on 13in. centres and in the other 8½in. centres to suit the holes in the cross-members "G." Wing-nuts are fitted to facilitate quick removal of the car when so desired. All the wing-nuts used throughout the design are obtainable at any well-stocked ironmongers, and the cost is most reasonable. The position of the handles on the carriage is indicated in Fig. 10, and these can be bought or made. The bought ones, chromium plated, and with 3in. grips and securing screws, are in the region of 3s. 6d. each, making a total of 14s. for four, so it is definitely cheaper to make them if suitable material is available. It is not the intention of this article to describe the construction of the carriage itself, but with any carriage fitted to the bogie described the securing bolts should be so placed as that the weight is evenly distributed on the bogie with the nose slightly elevated for preference. A couple of washers made a press-on fit on the forward bolts suffice to elevate the nose, and being tight they will not fall off when the car is removed for carrying purposes.


Showing the side car detached from the bogie.

The retractable rest leg (rear) is detailed in two views by Fig. 11. The offset is designed to enable the leg to fold up parallel to the ground and to clear the member "H," as outlined in Fig. 2. The bends in the legs are identical but the turned-out feet are bent in opposite directions. The feet shown are pieces welded to the legs. The tie-rod merely holds the legs in line so that they retract simultaneously and it is of 3/16in. diameter rod pushed through the holes and riveted over. No shoulder is necessary, as the splay holds the legs in tension against the riveted heads of the tie-rod. In the side view the rubber absorber may be more clearly seen, as indicated at "Y." The wing nuts are again a feature of this useful attachment, and being of the ⅜in. diameter size a good safe "nip" is attainable while the fitting of a spring washer is an added safeguard.

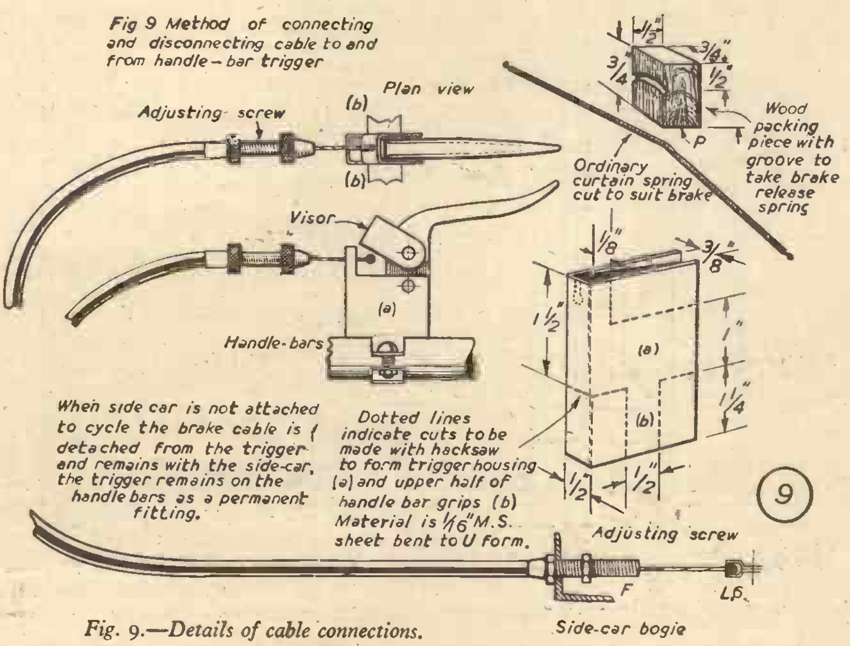


Fig. 9.—Details of cable connections.

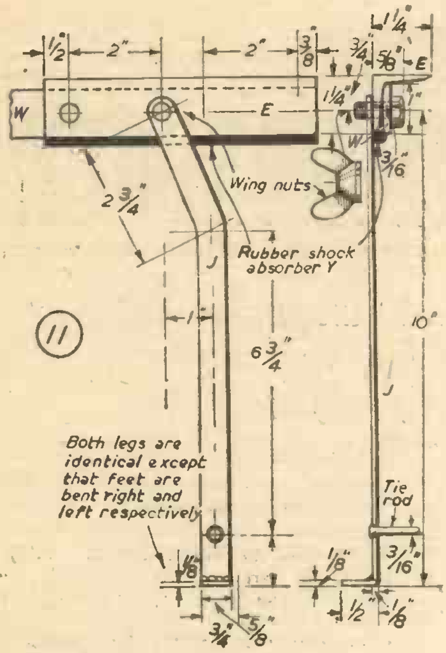
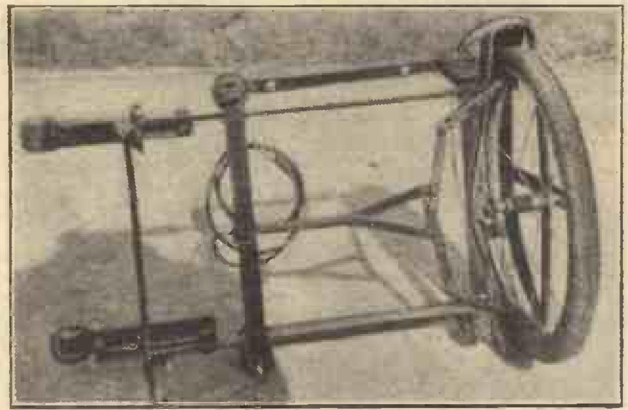


Fig. 11.—Details of retractable rest

Coupling Tube and Fork Clamps

In the final sketches, Fig. 12, the coupling tube and fork clamps are illustrated. These views are self explanatory, but it should be noted that the fork clamps are identical as to design but not as to dimensions. The groove in the rear clamp is placed with its axis 2¼in. from that of the large tube carrier, as compared with the 2in. centres of the forward clamp. This is to compensate for the tilt of the cycle forks, and by utilising these measurements the coupling tube is parallel to the road surface, so causing the bogie to ride in a like relationship to the road rather than nose down. The tube is of 1in. outside diameter and is pushed through the clamps, as shown in the oblique view. To fit the clamps to the forks it is necessary to spring them open and on to the forks. The ⅜in. bolts hold them firmly in place, and if the tube is cut to the length given, with the ferrule as shown, it will take up its working location when brought flush with the forward clamp marked "A." This clamp must be comfortably clear of the rider's heel as it moves round on the crank with the ball of the foot on the pedal. Clamp "B" is then adjusted to the 5½in.-centres specified. The whole coupling is then brought into line with the fore and aft line of the cycle frame to ensure that the bogie does not run towards or away from the track of the cycle. The bolts are permanently tightened when this position has been ascertained. The distance between the rear edge of clamp "A" and the front edge of the ferrule "B" is 12in., corresponding to the 12in. measurement across the hinged clamps on the bogie (see Fig. 1). The coupling tube and fork clamps are left permanently attached to the cycle, and even when removing the wheel for repairs it is not necessary to disturb the clamps or the tube. The rear mudguard, when released from its stays, will pull sideways sufficiently for the wheel to be slid down the slots in the forks and then backwards and out. When fitted to the cycle the coupling tube has the appearance of a small exhaust pipe and the extra weight is so small as to be of no consequence. The material for the tube and ferrule is galvanised piping of 1in. outside diameter and 1¼in. outside diameter respectively. It may be found advisable to clean the tube at the points the hinged clamps occupy, as ridges are often a feature of galvanised piping. A strip of emery cloth serves this purpose, and by checking the work with calipers a good bearing surface is ensured.



View of the underside of the bogie chassis, showing the brake mechanism.

In order to couple the side-car bogie to the cycle the hinged clamps "C" are opened, looped over the coupling tube and closed again, being retained by the wing-nuts. The cable from the brake is connected to the trigger on the handle-bars of the cycle, the slack of the cable is clipped to the cycle frame and the combination is ready to receive the carriage. Another useful feature of the whole arrangement is that in place of the baby carriage on the bogie a luggage or parcel-carrying adaption can be fitted (see Fig. 13). This will be found useful to housewives who travel into towns from country places to do their weekly shopping. Purchased articles can be placed in the side-car instead of being carried in an ever-increasing burden to the end of the expedition. Anyone who builds the baby carriage as well as the bogie, of course, can design it so that a sizeable compartment is embodied to the rear of the part occupied by the child. Such a compartment will be found invaluable on day trips, for carrying the child's food and clothing; but these are points for the maker's choice.

Used as a commercial vehicle, the combination is a useful asset to the spare-time electrician, or other tradesman, whose business activities do not run to the status of a small van. He can leave his tool-kit, etc., in the side-car ready for coupling to the cycle whenever those familiar calls on his services are made by distant clients.

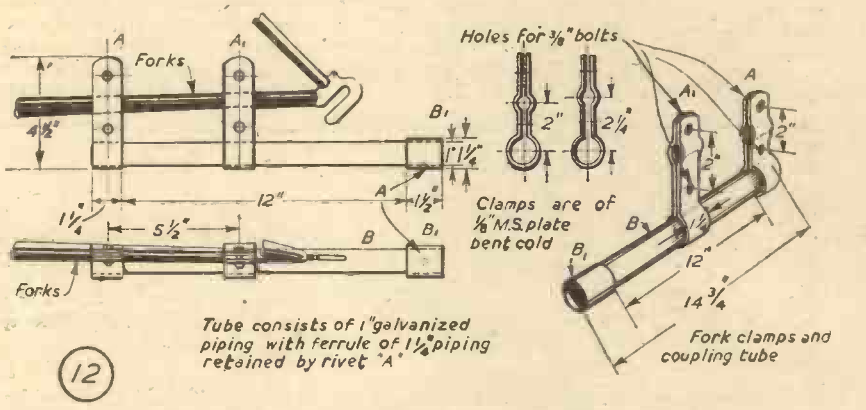


Fig. 12.—Details of coupling tube and fork clamps.

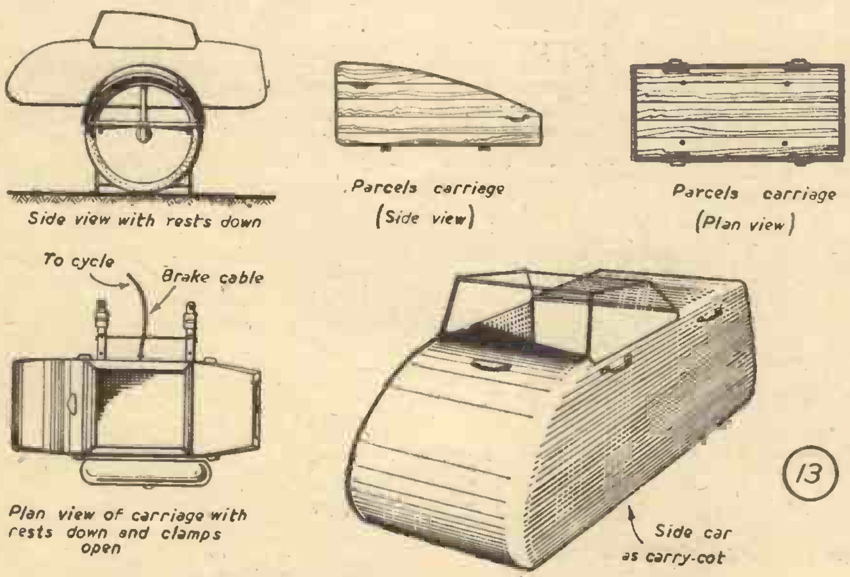


Fig. 13.—General views of the side-car and parcels carriage.

Making a MICROSCOPE

Constructional Details of a Practical Instrument for the Student and the Laboratory

By E. W. TWINING

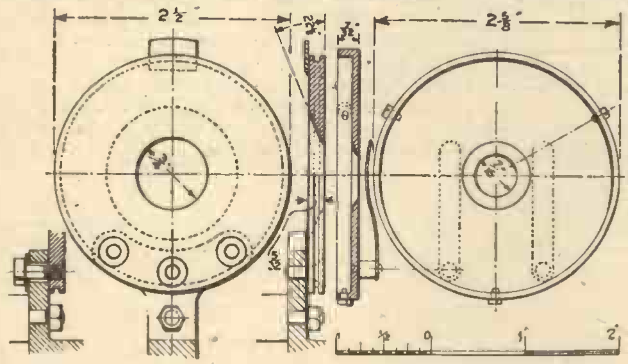
(*Concluded from page 144, January issue*)

THE pin will be turned in the lathe, dead parallel, and both the brackets, after mounting on the base, must be drilled and, with the limb L in position between them, reamed out with a parallel reamer, so that the pin makes a good sliding fit through the holes. The clamping nut, tapped ¼in. B.S.F. thread, must be knurled in the lathe. The castings for the base and brackets are in either brass or gunmetal and the pin is machined from ⅜in. brass rod.

The Stage

Fig. 10 shows details of the stage which is designed to be of circular form and to have a rotary upper plate. Usually rotating stages are fitted with rack and pinions or other mechanical means of revolving and are occasionally complicated by cross slides. All these refinements are useful, but for the purpose of the present microscope a rotary table, turned by the finger and thumb, will meet most needs. If the reader cares to have it so, the cylindrical edge of the upper plate can be calibrated to 360 degrees and either a single pointer line, or a vernier, engraved on the little plate which is drawn projecting from the edge of the fixed stage. By means of the calibrations and the line, or vernier, angles can be read off; such, for instance, as the angles of crystals and of cross-veining and striae in transparent substances. A great advantage of the rotary stage is the ability to view the object in all attitudes of the illuminating beam, for it is very much easier to rotate the object than it is to move and re-adjust the lighting.

One point of importance is that the geometrical centre of the rotary movement of the stage must fall exactly upon the optical centre-line of the microscope, for if it does not, then a one-half revolution of the stage may, with a high power objective, cause the object to pass out of the field of view. In the drawings, Figs. 7 and 8 and the section across the centre of Fig. 10, the fixed lower plate of the stage is shown held down on to the bracket, at the foot of the limb, by three countersunk screws. It is possible here for the stage to be set excentrically to the axis by inaccuracy in drilling the bracket, so at the foot of Fig. 10 is shown an alternative method of fixing the lower plate. Here the stage itself is tapped for three cheese-headed screws and these are quite a loose fit in the clearance holes in the bracket. When the whole stage is completed and on the bracket, a mandrel of close-grained hardwood is carefully and very accurately turned to the shape shown in Fig. 11 and with a diameter the same as that of the objective tube M. This mandrel should be fine glasspapered and shellac varnished. With the tubes D and M removed, the mandrel is passed down through F (in Fig. 7) in which it should make a good sliding fit. The ⅜in. spigot on the mandrel, fitting the hole in the lower stage plate, will automatically bring the plate into the optical centre line of the microscope and the three screws can then be tightened up. The 7/16in. spigot is provided on the mandrel to serve as a check after the rotary plate is put on.



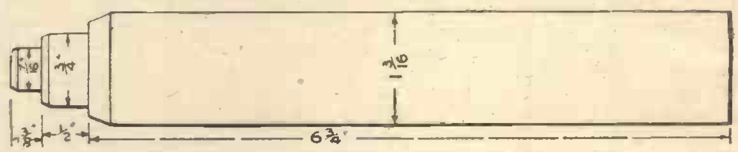


Fig. 10 (Left).—The fixed and the rotary plates of the stage.

Fig. 11 (Above).—Mandrel for use in centring the stage.

Sub Stage

The last drawing, Fig. 12, shows below-stage fittings, the mirror or mirrors and a diaphragm of stops SD. These are carried by sockets on clips C, which grip, can be rotated upon and slid, up or down, upon the sub-stage bar SB. As shown in Fig. 8, the diaphragm clip will be placed on the bar above the mirror clip, though when the stops are not needed either the clip can be removed or the split plug on the end of the arm, on which the diaphragm is pivoted, can be pulled out of the clip. This upper clip can be used to carry a condenser, but this is an item which has not been drawn.

Two double mirrors are shown in Fig. 12; on the extreme left is a standard type flat, FM, on one side, and concave, CM, on the other. The curvature of the concave is, of course, spherical and the mean focus—for there is much spherical aberration—is about 3in. for parallel incident rays. Messrs. Broadhurst, Clarkson and Co.'s price for this is 17s. 6d. without the arm or gimbals. The case is black, and is ready drilled to take the gimbal pins. It is extremely neat and well made. The group of drawings in the middle of Fig. 12 show a much smaller mirror of a type devised and made by myself. There is no concaved reflector, both mirrors, FM, being flat, but one of them is covered by a

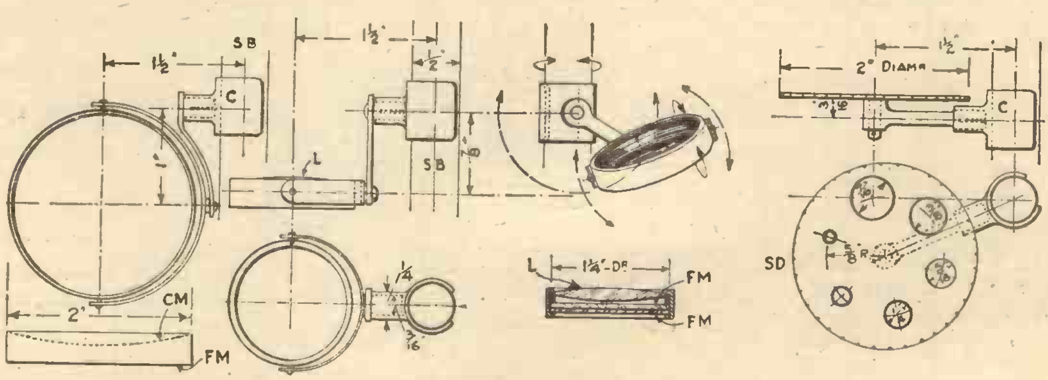


Fig. 12.—Details of mirrors and stop diaphragm.

$1\frac{1}{2}$in. focus lens L, which from a lamp, gives a fine point of brilliant light. The double-sided mirror can be cut from one of those of the kind carried in a lady's handbag. The 2in. standard mirror requires the carrying arm to be cranked and curved, as shown. The clip C will, of course, take either mirror.

Referring again to the stops, it may be wondered why the largest opening is the same diameter as the aperture of the rotary plate of the stage. The reason for this is that by tilting the diaphragm it is possible to have a slender elliptical light slit for illuminating a long, narrow object and, by so tilting, cut off the side disturbing rays. The same attitude can, of course, be resorted to for all the stops.

The Finish

There are two alternatives for this. The fashion nowadays with all optical apparatus, cameras, photographic enlargers, astro-telescopes and microscopes is to have, like most motor-cars, chromium plate and black, whereas the older style was polished and gold-lacquered brass. The latter calls for greater time and labour in getting surfaces, especially on castings, fit for lacquered finish. The base, the brackets and limb of our microscope are cases in point, but these may instead be filed, emery clothed and given coats of black enamel, or better, two or three of cellulose black—flat for the first coat, and then one or perhaps two of glossy. Certain parts must be sent for chromium plating; these will be the two barrel tubes D and M, the fine adjustment screw S, Fig. 7, and the pivot pin in Fig. 9, with their milled heads and nut; also the substage bar, SB. All the rest, including the outer tube F, can be black, except the rotary plate only of the stage, which plate ought to be oxidised black or brown, for if it were black lacquered it would probably become scratched. If it is oxidised and there is a divided circle the engraved lines can be filled with white and wiped off.

In conclusion, I would recommend the reader to see a copy of a standard work, "The Microscope," by Jabez Hogg, M.R.C.S. I would also call the attention of the reader who makes the instrument which I have described to another article in a back number of PRACTICAL MECHANICS, the date of the issue being December, 1950. It was contributed by Mr. G. A. Henwood under the title "A Micro-projection Adaptor," and describes an excellent method of projecting an enlarged image from the microscope, either horizontally or downward on to a screen placed on the table. It is noteworthy that there is nothing about "The P.M. Microscope" to prevent it being used as Mr. Henwood described, and there is no reason why such projection should not be made upon a sensitised plate or film from which photographic prints can be made.

Battery Operated Door Chimes

A Modification to the Set of Chimes Published in "Practical Mechanics" for July, 1949

By K. C. DAVEY

THE Editor's invitation, in the December issue of P.M., to readers who have constructed the Westminster door chimes to report results, has prompted me to send the following information. I constructed the chimes last May, but the sight of the weights hanging in the hall caused me to make modifications. I envisaged my small daughter playing happily beneath them and the trigger mechanism failing—with disastrous results. After a little experimenting and much drawing, I constructed a set of chimes working entirely by battery.

The baseboard must of necessity be a little larger to accommodate the extra motor, but otherwise no great structural modifications are required.

A small electric motor—of the type used to drive small models and running off $2\frac{1}{2}$ volts, or thereabouts—is mounted on the baseboard, coupled to the clockwork mechanism used previously. This clockwork mechanism was in turn coupled to the camshaft. The couplings used were the same as those used in model boats and were sweated to their respective shafts. A piece of rubber, cut from an old inner tube, was inserted between the motor mounting and the angle-bar support of the clockwork mechanism, and this acted as a resilient mount, helping to avoid excessive vibration and sound. The angle-bar from a discarded bed was found to be ideally suited to this purpose (Fig. 2).

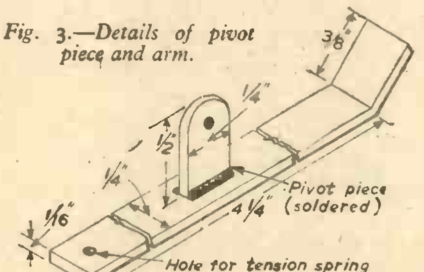


Fig. 3.—Details of pivot piece and arm.

At the trigger end the trigger attachment was removed and a length of brass $\frac{1}{2}$in. x $\frac{3}{8}$in., slotted as shown, was screwed in its place. An arm (Fig. 3) was pivoted in this and a light tension spring fixed at one end ensured that the pivot arm kept contact with the adjusting screw. This adjusting screw was fixed to the baseboard by a brass angle piece (Fig. 1).

Wiring

A grid bias battery mounted in the centre of the baseboard has proved sufficient since last May and obviated the necessity of reducing the mains current. One wire was led from the battery to the adjusting screw with another wire tapped off this to the bell-push. The other wire from the battery was taken direct to the motor, then to the main frame and finally to the bell-push.

Operation

When the bell-push is depressed, the circuit is completed, which causes the motor to revolve and so rotate the camshaft. Immediately the camshaft turns, the pivot arm completes the circuit from the main frame, via the adjusting screw, and back to the battery, independent of the bell-push. Hence the motor will continue to revolve until the stop on the pulley lifts one end of the pivot arm, breaking contact between the main frame and the adjusting screw.

Finally, if the motor and the clockwork mechanism are encased in a thin wooden box lined with felt, the whole operation of the mechanism will be noiseless.

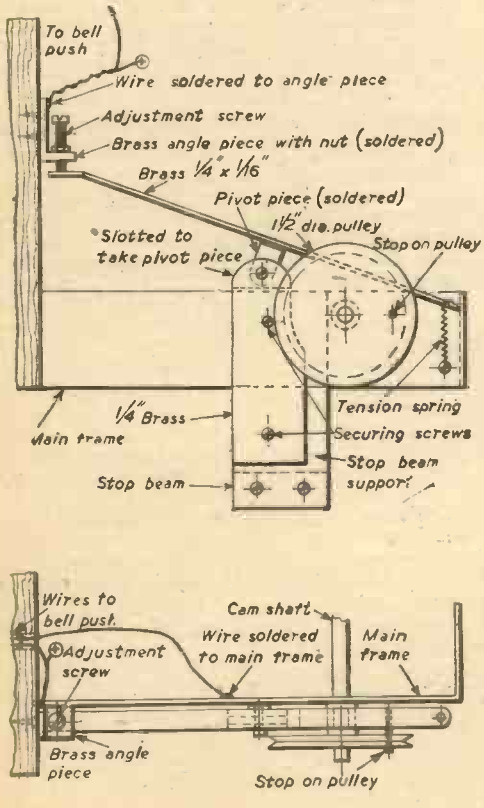


Fig. 1 (Left).—Elevation and plan of the trigger end.

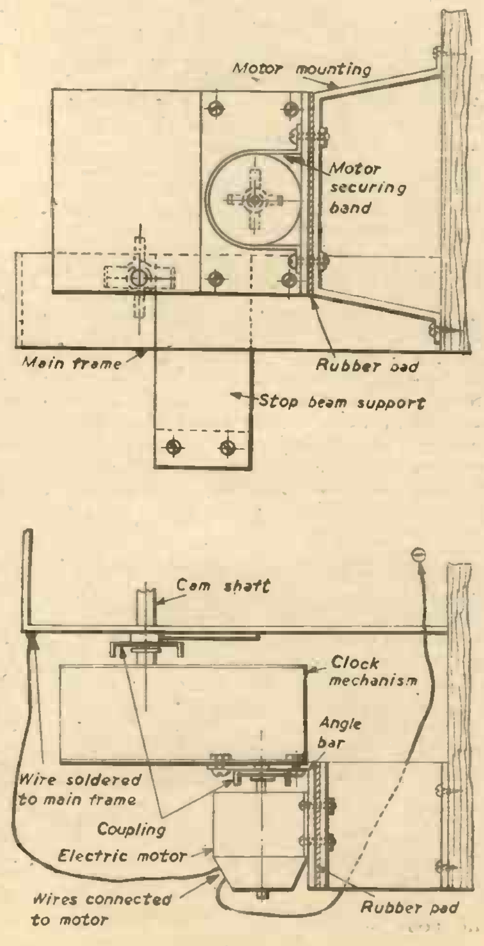


Fig. 2 (Right).—Elevation and plan of the driving end.

Making a Spot Welder

Constructional Details of a Small Machine for Model Work and Light Shop Use

By "HOME MECHANIC"

MOST readers can soft solder and some can braze and weld, because these processes require little apparatus. Spot welding is entirely electrical, the two metals to be joined being brought to fusing temperature over a very small area, hence the term "spot." Briefly, the work is placed between two pointed electrodes which are brought together with as much pressure as possible, and the current is then switched on for a fraction of a second. On examination, the metal is just joined over a pin spot. At the point of contact the resistance is so high and the current so strong that the heat produced, C^2R, is enough to melt the metal. In practice, several spots can be placed side by side, but never one spot over another. Currents vary from 100 amps. upwards, and the voltages from 1.25 to 7.5 or slightly more. It must be understood that if these large currents are to flow at the low voltages mentioned the resistance of the circuit must be very low. Hence all leads are as short and as fat as possible, and the only material to use is copper of the best quality.

For Model Work

In this article we only deal with a small machine for model work and light shop use. A spot welder can be used in almost any job that requires the quick, clean and sure joining of metals. Of course, a spot welder cannot make a watertight seam, and for this a special machine is required with revolving electrodes, etc. Since the advent of stainless steel, the welder has been very prominent in dentistry and other professions where fine wires require joining.

We cannot enumerate all the uses of the welder, but after one has been made and installed in the shop, it will be found as useful as the machine vice.

The two types of welder to be described are actually identical in detail, but the power supplies are different. The first is battery-operated and the second draws its power from the mains through a transformer. Details for making a transformer will be given later. To supply the necessary current a six-volt high capacity battery will be required. A car battery of the lead-acid type is quite good, especially if it can be trickle-charged from the mains. It must be a multi-plated cell of very low resistance and fitted with suitable and large terminal posts. The voltage to the electrodes is varied by changing the tappings on the battery. A suitable battery is one of the nickel-iron type. The big advantage of these cells is that they can be left for long periods without deteriorating in any way.

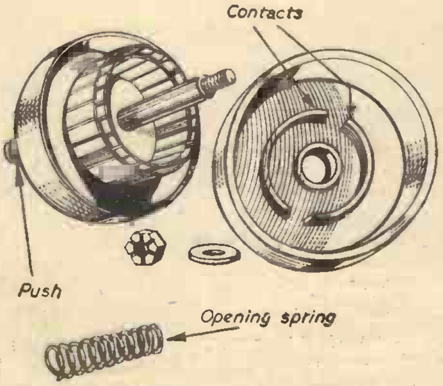


Fig. 1.—Details of the contact switch.

Simple Construction

The actual construction of the welder is very simple and can be followed from the illustrations (Figs. 2 and 3) on this page.

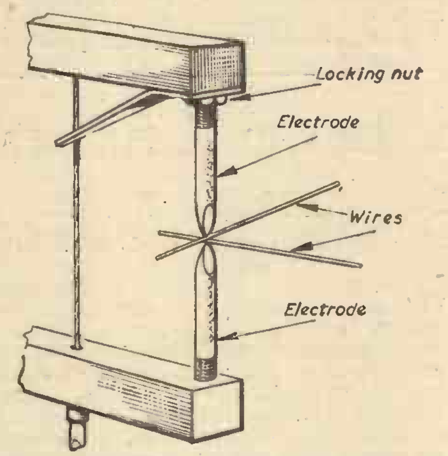


Fig. 2.—Electrodes welding two wires at right angles.

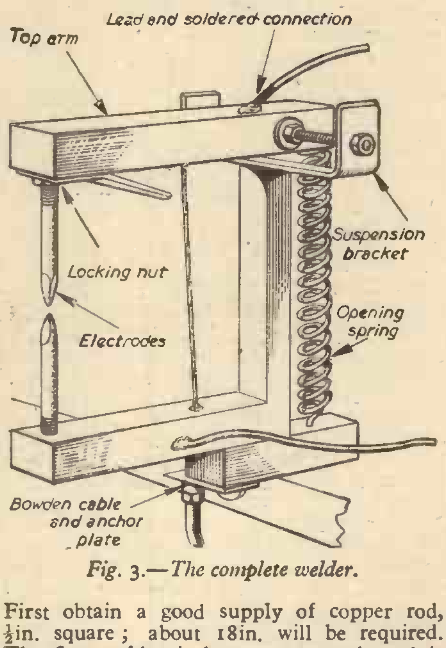


Fig. 3.—The complete welder.

First obtain a good supply of copper rod, ½in. square; about 18in. will be required. The first welder is battery operated, and is actually mounted on one terminal post of the battery so as to do away with one lead. The lower limb of the welder is 8in. long and is bolted to one terminal of the contact-maker or switch. The pillar is 5in. long and is fixed to the limb by a ¼in. copper bolt tapped into it. The two surfaces must be filed dead flat and the pillar must be at right angles to the limb. Screw up as tightly as possible, but remember copper is soft and will strip easily. When tight, soft solder must be flushed all round the pillar to make a good join, and, if possible, get it to run between the metals. The top arm is movable and hinged over the pillar. In order to make this arm free to move and yet obviate side play, i.e., so that the electrodes will meet when they are closed, the suspension bracket is made as wide as possible; in this case about 4in. The top arm is a little larger than the bottom and is drilled with a 5/16in. hole 2in. from one end. Through this hole a rod has to pass and is secured so that it does not make electrical contact with the arm. Reamer out the hole to a little over 5/16in. The supporting rod is of brass and ¼in. dia. threaded any suitable number to the inch. Study the various sketches to get a good idea of the general layout of the machine. Slip a length of thin-walled rubber tubing on to the rod and then push this into the arm. It should be a tight fit. Screw up the nut tightly, so that the arm is rigid (Fig. 5). Test on six volts and then on 230 volts, just to make certain. The bracket is of brass strip, ½in. by ⅛in., bent to shape and fixed to the pillar with one screw and soft solder. It will be observed that the arm is insulated from the remainder of the machine. The upper arm is centred over the lower and held in place by two nuts on either end of the threaded rod.

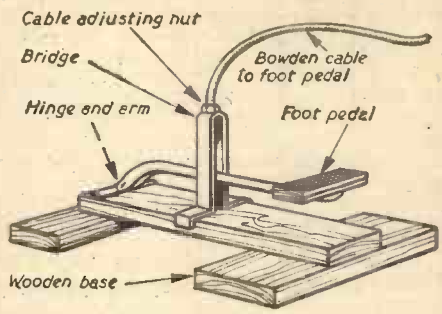


Fig. 4.—The foot control.

Electrodes

These are made from 3/16in. or ¼in. diameter hard copper rod to any shape desired. It is essential that the welding current, in order to get a spot, be concentrated to or over a small area, and therefore the electrodes are pointed. This is not a sharp point, but a flat one of approximately 1/32in. diameter, depending, of course, on the material to be welded and the capacity of the machine. For thin steel plate of tinplate gauge, a diameter less than 1/16in. should be used; the point to be quite flat and kept in this condition by an occasional touch with a fine file. The pointing of the electrodes can be easily accomplished with a file. Make the points fairly blunt, but do not have a long taper to them like a needle. The heat of the weld will soon soften the end, causing mushrooming, and faulty welding will result. The upper and the lower electrodes are both the same for simple plate welding and should be about 2in. in length. Each one is screwed into its respective arm and adjusted so that the points meet.

A Useful Tip

A good plan is to make some electrodes larger than others, so that the gap is not in the centre, but can be made higher or lower according to the electrodes used. This is

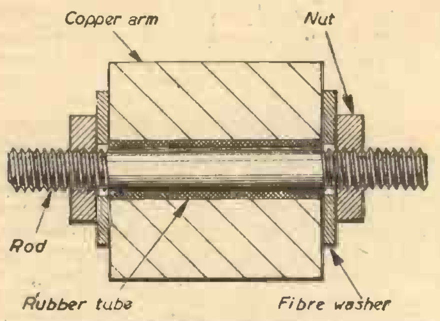


Fig. 5.—How the top arm is insulated from the supporting rod.

an advantage when awkward slopes are being welded. The electrodes are threaded any convenient size and then fixed in holes in the arms. In order to lock them in the arms, make small adjusting or locking nuts from strips of copper and tap them to fit the electrodes. A pair should be made for each pair of electrodes and must be fitted to them ; this will save a lot of time when the pairs have to be changed. We will deal with the types of electrode required before going on to discuss the method of using them for welding. In some cases it is necessary to weld on the outside of a cylinder, like the handle attachments on a tin can or "billy-can." A straight lower electrode cannot be used and a special swan-necked one is required. Make this from similar material as before, and turn up the end to just touch the upper one. The depth of the neck will depend on the distance along the tube that is required to weld, but if this is greater than 1in. or so, make the electrode from stouter material. A swan-neck is required for all work where the article is said to be under cut, such as rings or tubes of no great length, etc. (Fig. 6). Wires have frequently to be welded together at right angles and at a simple tap joint ; but welding cannot be done with this machine. In these cases straight electrodes must be used with grooves in them to accommodate the wire. The depth of the groove must be just under half the diameter of the wire as its function is to hold the wire firmly and get as big a current density as possible. For right-angle welding, the grooves are at right angles and in the same line for top joints (Figs. 2 and 7). Of course, they can be in any other intermediate position.

The Contact Switch

In the original machine this was very successful and was a starting switch from a motor-car. We advise readers to obtain a switch rather than to make one. The cost from a "breaker's yard" is anything from 1s. 6d., depending on the "breaker" and not the switch. Dismantle the switch and clean it, trim the contacts and make them true, and remove the powerful spring that normally works the switch and fit a light one. If your switch is foot-operated this is essential because it is hand-operated on the welder. It should be possible to make contact with one finger and yet the switch must open quickly (Fig. 1).

Oil the sliding mechanical parts but not the electrical ones. The switch is bolted directly to the bottom arm of the welder by the contact screw on it. It is a good plan to make this contact to the frame of the switch so that both are firm mechanically and a good electrical join results. The other switch contact is connected to one pillar of the battery. To keep all leads as short as possible, it is necessary to have this contact welded to a battery terminal clamp ; the usual battery clamp is ideal, but the weld must be a good, heavy job. If the battery is fitted with screwed terminal posts as in traction batteries and crane batteries of the nickel-iron type, the switch is fixed directly on to the pillar by the terminal nut. This gives a good electrical contact.

Bringing the Electrodes Together

Some device must be fitted to the machine for bringing the electrodes together, and the simplest is a coil spring between the arms. This must, of course, be insulated from the top arm, and if a spring is fitted, a means for opening the contacts is required. The best way of doing this is to fit a spring to keep the arms open and close them to suit your own needs. This is done by using a Bowden cable and foot pedal. A length of Bowden cable such as is used on cycles is ideal. The method of connecting up is very simple. First make a small arm about 1in. long and fix this on the upper electrode arm supporting rod, using lock nuts, etc. The arm is made from sheet brass and is soldered or brazed to a nut to screw on the rod. The arm must not turn on the rod, it has to be well made and quite strong as considerable pressure can be brought on it by the foot pedal. A small catch is fixed on the lower arm or pillar to which is anchored the outer cable.

The Foot Pedal

The foot pedal is very simple to make and can be just a board hinged to a fairly heavy

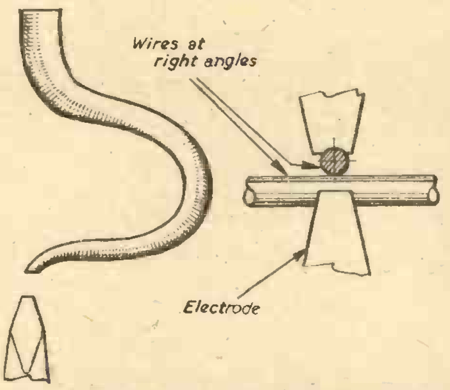


Fig. 6.—Swan-neck electrodes. *Fig. 7.—Position of electrodes for wire welding.*

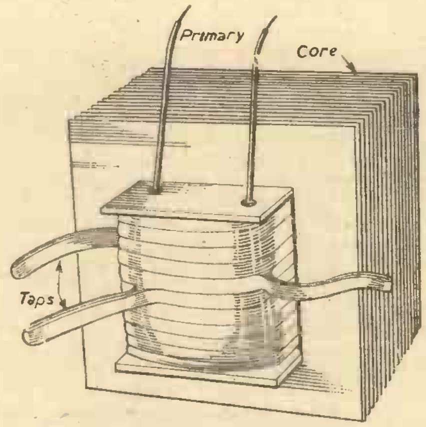


Fig. 8.—The finished transformer.

base, the cable being anchored in the usual manner. The simple foot control shown is more robust, and is very simple to make and easy to handle (Fig. 4). It consists of a mild steel strip, ½in. by ¼in., with treadle, 1½in. by 2in., welded on one end. The other end is welded to a simple wood hinge which is screwed to the baseboard. A bridge piece from ½in. by ⅛in. strip is bent over the arm and screwed into the base. A fine hole is drilled through the bridge to take the wire which passes through a hole in the pedal. At one end, the wire should be easily adjustable so that when necessary any slack can be taken up. Grease the wire well so that the arm opens quickly when the foot is removed from the pedal. A connection made from a short length of cable as flexible as possible must be fitted to the top arm. For this make up your own sample, having first determined the minimum quantity required, by trial with a length of stiff wire. Take about ¼lb. of No. 20 wire, anneal until soft and clean and straighten it out. Cut into lengths as required and twist them all together to give a firm yet flexible cable. Solder one end to the top arm, and to the other end fix a large spade terminal to make good contact to the battery.

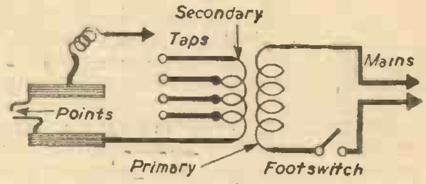


Fig. 9.—Circuit diagram.

Connect everything up. Place the battery and welder on a bench of suitable height, and connect the flexible lead to the lowest voltage, say, 2 or 1.25. Place two thin pieces of steel plate between the electrodes and bring them together with moderate pressure. Close the circuit for 1/25 second (this may sound impossible, but it only requires a touch on the switch). The metal between the electrodes should not flow, because if it does so, the weld has been too long. A little practice will soon produce good results.

Adapting for A.C.

The welder itself remains virtually unchanged. Briefly the differences are that this machine is operated from a transformer and the finger push switch dispensed with. A foot switch is used, leaving both hands free to hold the work, etc.

Start the work by removing the contact switch and then drill another hole through the bottom arm so that the whole may be bolted down to the bench or a large wooden base.

The Transformer

The transformer (Fig. 8) is the heart of the machine and must be made with care. A 500-watt transformer can be operated from a light socket and is heavy enough for most work, but a 1,000 watt requires a 5 amp. plug, and this wattage is too great for the lighting wiring. If possible, try to obtain a secondhand transformer with an open casing rated for your supply, and with an output of 500 watts. On conversion it will be as efficient as a commercial 500-watt transformer, and the work of conversion will be easy. The output required is a maximum of 100 to 200 amps. at 1, 1.5, 2, 3 and 5 volts. In watts this is 500 or 1,000 depending on the current required. Five volts is not often required in the home shop.

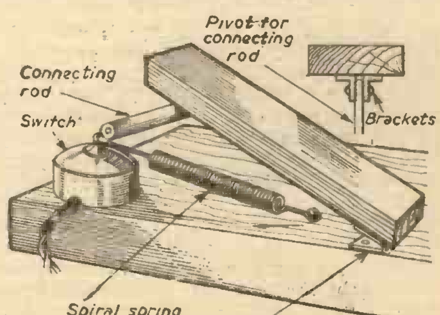


Fig. 10.—Details of the foot switch.

To carry over 100 amps., large cables are necessary, and as the resistance has to be kept very low we are using sections on the heavy side to allow for drops in voltage across joints, etc. On a core of this size, which must not be less than 3.5 square inches, we can allow five turns per volt, thus one needs a total of 25 complete turns with taps at the 5th, $7\frac{1}{2}$, 10th and 15th turn respectively.

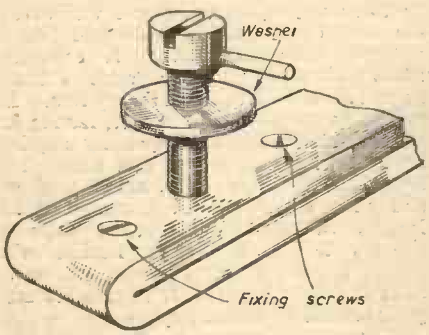


Fig. 11.—Method of making the taps.

The length of strip of suitable section is obtained, and if hard drawn, is annealed. The section must not be less than 0.7in. by 0.1in. Now it must be cleaned and insulated from end to end with good quality tape.

The Tappings

The taps are brought out as double lengths of wire to avoid soldering, etc.; they should be hammered flat so as to lie neatly together. The starting end is connected directly to the bottom bar as before, while the top bar has the flexible connector for use with the taps. In making a tap, bring out the wire for 6in., bend it over on itself, and take it back and continue winding to the next tap. Remove the insulation from the bent end, clean the copper and press together, and then run solder between the two to make a solid bar. Drill the bar and tap $\frac{1}{4}$in. fine, and fit with a cheese-headed screw.

When the transformer is mounted on the base the taps also are screwed down to the wood by two small wood screws, countersunk and passing through the copper, one in front and one behind the tapped hole. The top surface of the copper is dead flat. A suitable washer must be used under the screw in order to make good contact. When different tappings are often required, the screws are fitted with an easily turning head. Do this by drilling a 3/32in. hole diagonally through the head and then hammer a 2in. length of 3/32in. silver steel rod through it. The spade end of the connector is made to suit the taps. Arrange the five taps in a neat row behind the welder. Keep the leads as short as possible. See Fig. 11 for details of the taps, etc.

The Primary and Secondary

If a secondhand transformer is used, do not dismantle it but thread the secondary through the spaces; this is a matter of minutes with the core clamped in a vice. The reason for this is that we cannot reassemble the core and clamp it as tightly as the maker does. Several that we have made are only about 25 per cent. efficient when tried out again. We have assumed that the primary was suitable for your supply. If not, rewind to suit. This means 1,150 turns to take 5 amps. As the transformer is short-rated we can cut the wire size down a little to economise. Winding 1,150 turns on a fixed core when the wire is passed through and through is no joke; we have done it, but would advise dismantling the core and winding in the ordinary manner.

A 500-watt transformer of this type will cost from £7 10s. to make, and so we do not think it necessary to deal with the construction of a new instrument.

The Foot Switch

Here we have the same idea as that used for closing the points. Mount both the

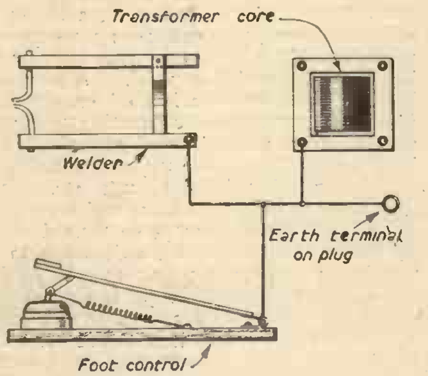


Fig. 12.—The connections for earthing the welder and the foot pedal.

Bowden control to the points and the switch on the same base. The switch is a piece of wood 3in. wide and 9in. long, and is hinged, at the end nearer the operator, to the base. The switch proper is a tumble switch with a brass knob. It should be capable of carrying 5 amps. with a quick make and break. This is mounted under the pedals and is connected to it through a brass connecting rod. Make a saw cut at right angles to the pivot in the knob, open it out with a file until it will take a 1/16in. hole through the knob. The connecting rod, which is a simple strip drilled with 3/16in. holes at each end, is cut from sheet brass 3/16in. thick. Put the switch in the off position, place the connecting rod in the knob and push the pin in, now work the switch by manipulating the knob. The pedal must work the switch, and for this mount two small brackets on the under-side of the wood, drill and put in the rod. The best position for the brackets and switch will be found by experiment, but we use it with the bracket on the end of the wood and the switch about 2in. from the end, the rod being 3in. from centres. A powerful spring is hooked round the knob and round a screw in the base, so that the switch is always *off*. It should take quite a lot of pressure to close the switch, and on removing the foot it should fly open. Fig. 10 shows the finished switch. With this means it is possible to get very accurate time control, and good work can be done. Twin flex from the switch is taken up with the Bowden wire to the welder base and there connected to a porcelain junction box. This gives a neat and workmanlike finish. Fig. 9 shows the circuit.

A Press Switch

A simple press switch can be made from bits of brass similar to a bell push, but we do not recommend this because of the difficulty of protection, etc. The whole welder *must* be earthed and so must the foot pedals, etc. (See Fig. 12.)

Since the transformer is worked off the mains, and the little extra electricity used is not noticed, it is a good plan to arrange a small light just by the points. This should be a 6-volt car side-lamp with switch on the base, and is run from the 5-volt tapping. Mount it on a small flexible arm and cut a tin shade so that the light is exactly as required. It will dim a little when the 5-volt tap is used.

A Greenhouse Fitment

By E. S. PAYNE

AFTER putting tomato plants in the greenhouse the next job usually is to fix a line of cord about 4 to 5ft. above them stretching from one end of the greenhouse to the other, after which bamboo canes are inserted in the soil (one to each plant) about 6ft. high; then comes the tiring job of tying each one to the above-mentioned cord to hold them up for the plants to be fastened to as they grow.

My idea was to make something to hold the canes up without tying them with either string or raffia, so I obtained some 6-gauge galvanised wire and cut it into pieces about 8in. long. I then fixed a piece of $\frac{3}{4}$in. round steel in the vice in an upright position, and bent the wire round and twisted it three times to make the $\frac{3}{4}$in. round ring which made it appear as at A in the accompanying diagram.

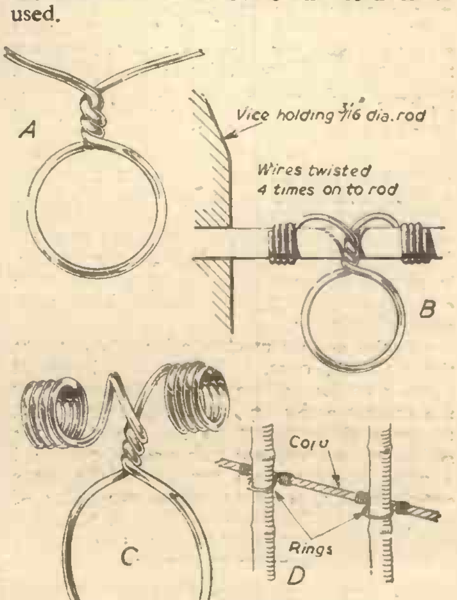
Twisting the Wire

Next, I put a piece of 3/16in. round steel in the vice in a horizontal position leaving about 4in. projecting beyond the end of the vice jaws, and then twisted the ends of the wire as shown at B.

The completed gadget then appears as at C, the whole procedure taking about three minutes. After making a number of these they were threaded through the 3/16in. holes on to the cord, which runs the length of the greenhouse, one ring being provided for each cane, as at D.

The canes are then put through the rings, the bottom ends of the canes being pushed into the soil at the side of the plants. Afterwards, the rings can be taken off and used again year after year.

I have used these rings now for the past two years, and they have proved well worth the time spent in making them. It will be understood that the diameter of the ring and the smaller coils are made according to the diameter of the canes and cord to be used.



Details of the wire fitment for greenhouse use.

A NOVEL EXTENSION SPEAKER

With Constructional Details of the Metal Cabinet

By E. TUNLEY

THE radio extension speaker described below is very easily constructed at a comparatively low cost. It is small and neat with a 5in. m/c speaker, and is especially suitable for fixing in a kitchen.

The cabinet is simply one of the popular aluminium sandwich boxes which are plentiful and cheap. These boxes are 5½in. x 7½in. x 3⅜in. deep, made from light gauge

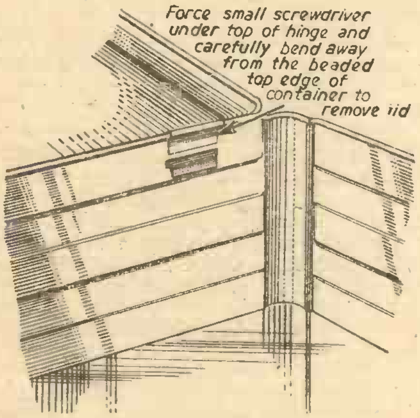
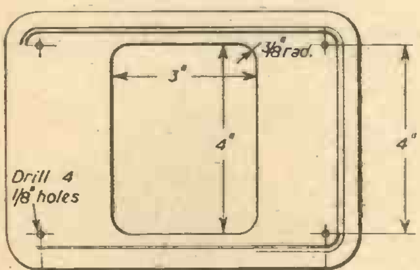


Fig. 1.—Method of removing the lid.

aluminium with corrugated sides, giving ample strength yet of very light weight.

First, it is advisable to remove the lid completely for convenience of working. This is quite simple as the hinges consist of thin aluminium straps. These may be carefully prised off as shown in Fig. 1. The next step is to cut out the aperture in the lid. The reader may wish to follow his own design here, but I will give my own dimensions in case they may be preferred.



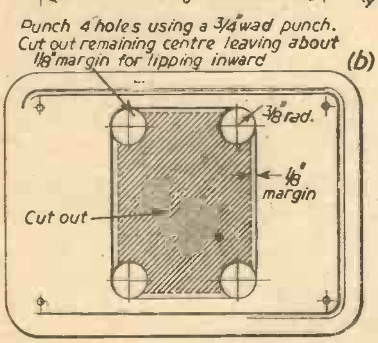
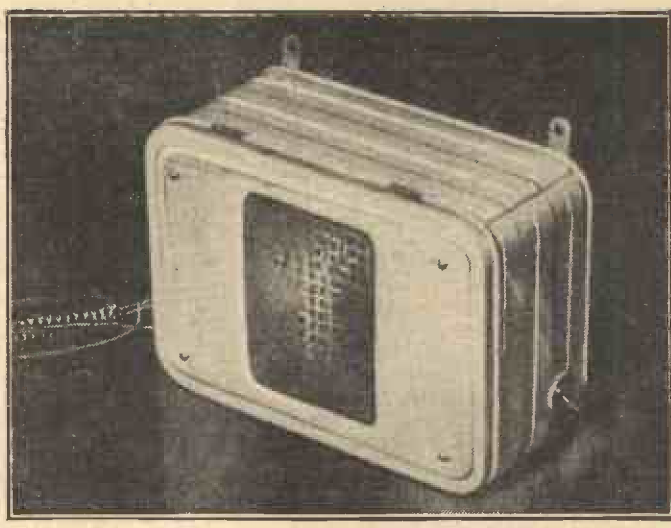


Fig. 2.—Marking out the lid for aperture.

Fig. 3.—Alternative method of forming aperture in lid.

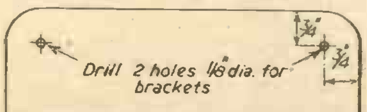


This view of the completed extension speaker gives a good idea of its neat appearance, and shows the fret, switch and wall brackets. It employs a 5in. moving coil speaker, and measures overall 5½in. × 7½in. × 3⅜in. The case is an aluminium biscuit box.

Marking Out

Mark out carefully as detailed in Fig. 2, and using a small pair of shears cut out as near to the outline as possible. Should you not feel too competent using the shears, I advise leaving up to 1/32in. wide margin, which you can later carefully file away using one of the coarser Swiss type files. Alternatively, a far better way for appearance sake is to use a ¾in. dia. wad punch, intended for punching holes in leather, felt, etc. Cut out the four holes as illustrated in Fig. 3. This punching should be done with the lid supported on a piece of flat, smooth, soft wood, preferably radiused at two edges to fit the contour of the lid underneath. The punch used like this will depress the surrounding metal as it cuts.

Next, cut out the remaining centre-piece of the aperture, this time leaving about ⅛in. margin (Fig. 3). Then supporting each side in turn with a piece of hard wood or metal, tap the overhanging material inward very carefully with a small hammer to form a



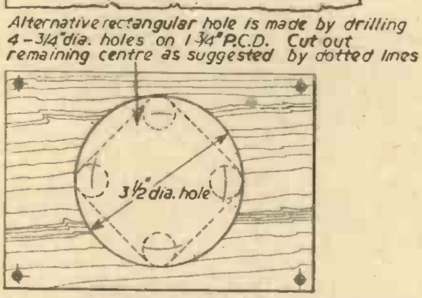


Fig. 4.—Details of holes in bottom of container.
Fig. 6.—Baffle details.

neat lipped aperture. Four ⅛in. dia. holes are drilled in the lid as shown. These are to secure the plywood baffle. Four more holes are needed to complete the metalwork on the cabinet. One ⅜in. dia. hole is required on one of the ends to accommodate a suitable rubber grommet, obtainable from most radio stores, for the lead to pass through. A larger hole to be made on the opposite end is for the on/off switch. The size of the hole depending on the particular switch used. Almost any small switch will do, especially those small, all plastic, ex R.A.F. type, which I believe are still available. The remaining two holes are drilled as shown in Fig. 4, and carry the brackets for use when the speaker is hung on the wall.

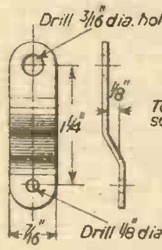
The brackets (Fig. 5) are optional, but if fitted use about ⅛in. aluminium rivets with suitable plain washers to add strength and prevent any tendency for rivets to pull through the thin aluminium.

The speaker baffle consists of a piece of plywood, 6½in. x 4½in. and not less than 5/16in. thick. A hole is cut out about 3½in. dia., or alternatively a rectangular hole may be made as shown in Fig. 6.

Assembling the Speaker

Next, secure the speaker in position on the baffle board. M/c speakers are easily obtainable these days. There are one or two radio firms advertising in PRACTICAL MECHANICS from time to time, and I notice that a suitable 5in. speaker is obtainable for less than 15s. Now glue or tack a suitable piece of gauze to the front of the baffle, covering the hole so that when assembled in the lid the speaker gauze will be framed by the aperture in the lid.

To assemble, position the baffle behind the



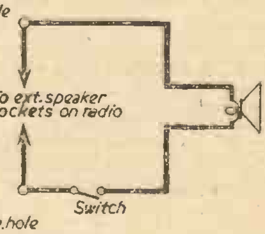


Fig. 5.—Details of bracket

Fig. 7.—Wiring details.

lid, mark through the four holes four ⅛in. holes, remove the lid and drill the ⅛in. holes into the plywood. A profession finish can be obtained by using ⅛in. dia. aluminium round head rivets for holding these together, but great care is needed when riveting as the lid is easily distorted. Place a distance piece, approximately ¼in. thick, between the lid and baffle at each corner. A few plain washers together would be sufficient. This space between the lid and baffle should help to reduce any tendency of rattle when on full volume.

When the cabinet is required to match a

colour scheme, it may be painted at this stage. Spraying is obviously the best finish, but this is not always possible to arrange. The hinges described earlier may be replaced before or after painting. If left unpainted they provide a slight contrast, as do the aluminium rivets if fitted later.

Wiring

Wiring details are given in Fig. 7. It is, perhaps, worth noting that most modern radios are provided with extension speaker sockets fed from the low impedance side of the output transformer. This, in effect, means that the wire to the extension speaker carries only a small voltage and no trouble should arise. Incidentally, too long a lead from the radio to the extension speaker may cause some mismatching and loss of power. However, the average listener would hardly notice any difference unless considerably more than 50ft. of wire is used.

For those whose sets have extension speaker sockets fed straight from the output valve, that is high impedance, then an extension speaker fitted with output transformer is obviously required. Where a speaker and transformer are bought together, the extra cost is very little. In the above case care must be taken and only good quality wire must be used as the voltage is probably that of the house supply, or even higher.

Spectroscopy in Industry

With Notes on the Uses of the Spectroscope By D. URCH

THE wireless set has passed its infancy and television is here to stay. X-ray machines are in common use for the internal examination of the human body and other complex structures, and also for medicinal therapy. Ultra-violet and infra-red waves, artificially generated and natural, are used for photography and again medicinally. Gamma rays are used for chipping pieces from the atom. Our sensitivity to waves of certain length and frequency is responsible for the gift of sight. The list is endless.

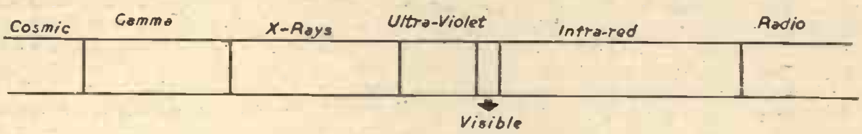


Diagram of the complete electro-magnetic spectrum.

Radiation Groups

All these radiations are of a similar nature, but the groups (see accompanying diagram) are of such diverse frequency and wavelength that each group must be identified by its own peculiar method, and used in widely varying fields. In many branches of science and industry the search into the behaviour of these waves is carried on, and the knowledge gained utilised in a multitude of ways for the benefit (and sometimes otherwise) of mankind.

This article was written to bring into focus a lesser publicised use of visible and adjacent waves, the science of spectroscopy, which is a science in its own right, and also embraces many fields of research. It is based on two fundamental principles:

(1) A beam of light passing through a prism splits into the colours of the rainbow, or to be more specific, light (visible and invisible) can be split into its individual wavelengths.

(2) An atom, under certain conditions, can emit light of certain wavelengths, each chemical element having its own characteristic and individual group of wavelengths.

Uses of the Spectroscope

The most common use of the spectroscope is in the metal and chemical industries for routine examination of the materials being manufactured. For this purpose it is very useful, for not only will it determine the constituents of a material and the quantity in which they are present, but it will also faithfully record any undesirable impurities. The latter is an almost impossible task for the analyst using chemical methods. It is because of this faithful detection that a dozen or so of the elements have been discovered. Many of them are minutely present in very complicated chemical structures. Probably they would have remained unknown if the "magic eye" had not first warned of their presence.

Accuracy

An idea of the accuracy and sensitivity of the instrument may be obtained when it is realised that the spectroscope can analyse many elements when they are present in less than one part in 10,000,000. This has enabled many tedious, expensive and often ineffective chemical methods of micro-analysis to be discarded.

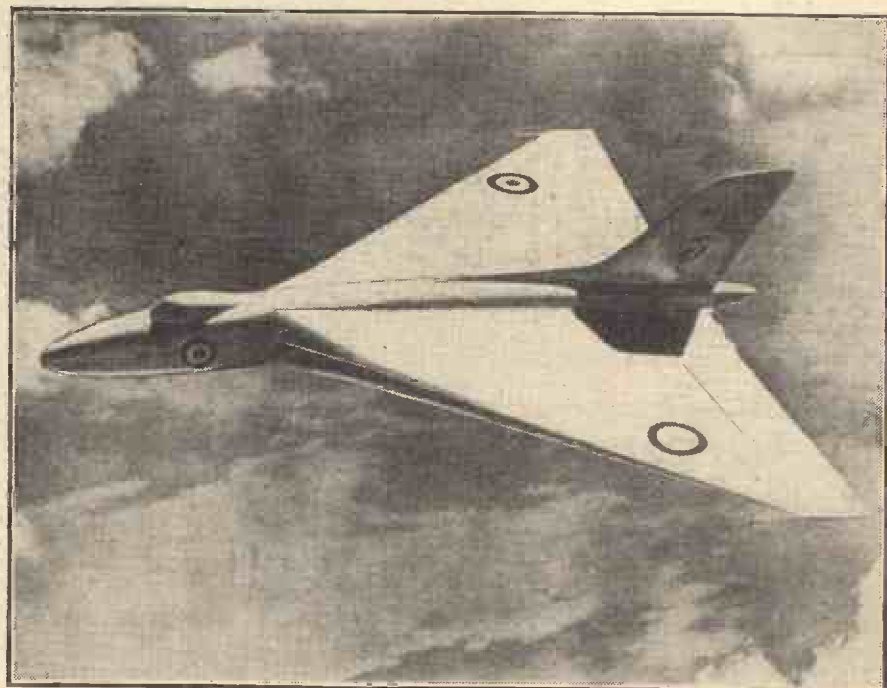
Astronomy benefits directly, for the elements comprising the sun and other stars have been accurately determined and, more astounding still, their relative speeds deduced.

The Doppler Effect

Because of a freak occurrence, known as the Doppler effect, the wavelength of the light from a star which is moving away from the earth is stretched or elongated (and vice versa); and, if this light is passed through a spectroscope the wavelengths will show a slight shift from normal. By measuring very accurately this shift, and making some rather complicated calculations, the speed of the body under examination can be determined.

In this and many other ways spectroscopy it proving its inestimable value, and is another essential stepping stone provided by science for our mutual advancement. Truly has it been adjudged one of the seven wonders of the modern world. We have travelled a long way since Sir Isaac Newton carried out his first simple experiments with a ray of sunlight and a prism, but spectroscopy will always remain an epitaph to that remarkable man of science.

The Avro Delta Bomber



The world's first four-jet operational Delta bomber, the Avro 698, in flight, piloted by Avro test pilot R. J. Falk. This remarkable aircraft thrilled the crowds at the S.B.A.C. Air Display at Farnborough last September.

MODEL LOCOMOTIVE BOILER MOUNTINGS

The Correct Shapes and Curves of Chimneys, Domes, and Safety-valve Casings

By "ENGINEER"

(*Concluded from page 157, January issue*)

The London and South Western Railway

THE first chimney illustrated in Fig. 24 is that which was carried by the engines of Dugald Drummond. Mr. Drummond's predecessor was William Adams who came from the Great Eastern and whose chimney for the South Western engines was as I have drawn it on the left of Fig. 18.

It has always seemed to me that this South Western chimney of Drummond's, on the left of Fig. 24, was much too slender for the engines and was not in accordance with the typical Drummond, as exemplified on the North British and the Caledonian Railways, and by Mr. Dugald's brother: Peter Drummond on the Highland Railway. A year or so ago a correspondent, whose erudition can be relied upon, told me that this South Western smoke vent was not designed by Drummond himself but by an assistant; why Drummond did not bring his own design from the north is difficult to understand.

The Drummond dome had two direct-loaded valves on the top as drawn in Fig. 25. There were no other safety valves on the boiler.

Robert Urie's chimney, shown on the right of Fig. 24, always looked rather small for most of the engines to which they were fitted. They were neat but reminded one somewhat of the American smoke stack.

The London, Brighton and South Coast Railway

I wish that all my readers could remember the beautiful engines of William Stroudley, one of the greatest artists in locomotive design. His chimney, with a polished copper top, is drawn in Fig. 26 and his dome, with dual valves, levers and spring cases in Fig. 27. The painted dome was rather small and there were no other safety valves.

R. J. Billinton, Stroudley's successor, adopted an all-black, cast chimney, and his dome was of the ordinary round-topped kind. The safety valve casing was unique: two

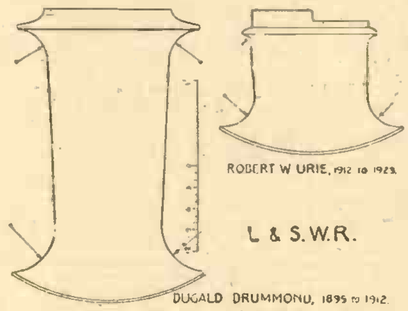


Fig. 24

round columns uniting about half-way down and becoming truly circular where it saddled over the firebox lagging. On some of Billinton's tank engines these valves were set crosswise over the firebox.

The chimney of D. E. Marsh is drawn on the right of Fig. 26. This is taken from Mr. Marsh's fine Atlantic engines. His successor, Mr. L. B. Billinton, reverted to the pattern originated by R. J. Billinton.

The South Eastern and Chatham Railway

The formation of this company was the result of amalgamation between the London Chatham and Dover Railway and the South Eastern Railway at the beginning of the year 1899. Previous to this, William Kirtley was the locomotive engineer for the Chatham and Dover line and James Stirling for the South Eastern. Mr. Kirtley's chimney is shown in Fig. 28 and in the centre of the same drawing is Mr. Stirling's design. James Stirling was the brother of Mr. Patrick on the Great Northern and the reader will doubtless recognise certain characteristics common to both designers. Without any question, however, the chimney of Mr. James, with its parallel shaft and graceful curves at the base, was the more artistic.

Neither of the Stirlings built domed boilers, but, whereas Patrick left the tops of his boilers as long, unbroken lines, Mr. James put his safety valves, of the Ramsbottom type, on the second ring of the boiler barrel, almost over the driving wheels. These valves are illustrated in Fig. 29, from which it will be seen that the tops of the columns and the base casing were of polished brass.

Mr. Harry Wainwright became chief mechanical engineer after the amalgamation and designed at the Ashford Works some of the most graceful and ornate engines running on any railway. His copper topped chimney with curves, not radii, at the base is illustrated in Fig. 28. The Wainwright dome was of normal shape like the Great Eastern and was of polished brass. The safety valves, of Ramsbottom type, had the two columns turned bright all over and the cover for the base was also bright brass.

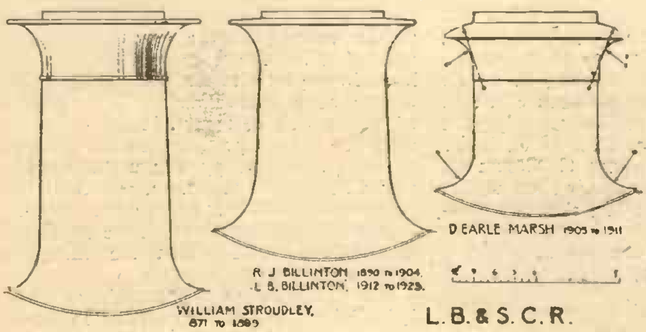


Fig. 26

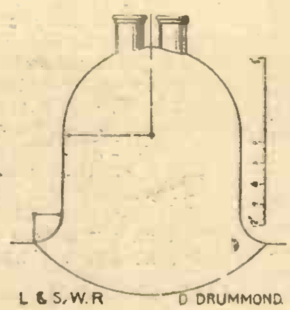


Fig. 25

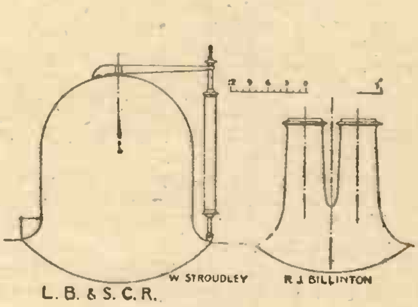


Fig. 27

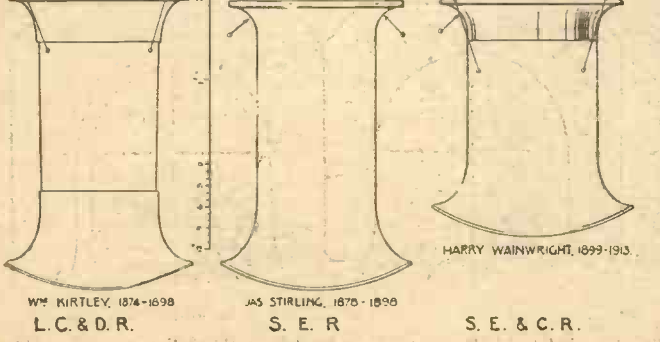


Fig. 28

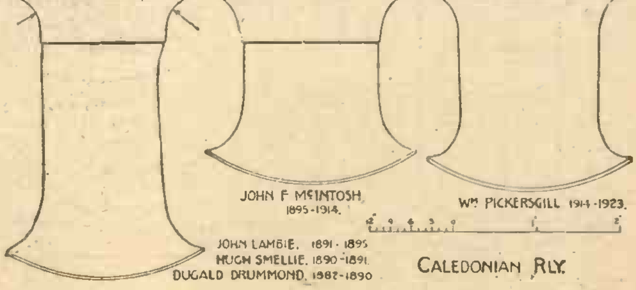
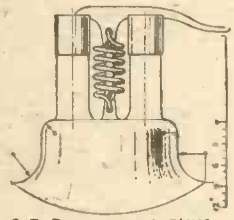


Fig. 31



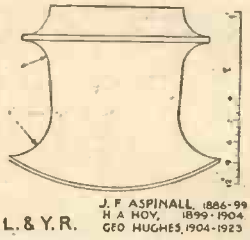


Fig. 29 (*Left*)
Fig. 30 (*Centre*)
Fig. 32 (*Above*)

The Lancashire and Yorkshire Railway

The chimney shown in Fig. 30 bears a strong resemblance to, and has some of the characteristics of, Patrick Stirling's and yet there are subtle differences which render it impossible to mistake one for the other. The chimney designed by J. F. Aspinall (afterwards Sir John Aspinall) had a rather more definite taper on the shaft, especially as it became shorter with higher pitched boiler, as in the case of the famous inside cylindered Atlantics. It is a point to be noted that, unlike most tapered chimneys on other lines, the angle of coning was not constant but varied with the height. When Mr. Hughes came into power this principle appears to have been dropped. Domes on this railway were of normal form with cylindrical shaft, a hemispherical top and a rather small radius at the base. The casing over the base of the Ramsbottom valves was like that of the Great Eastern and was painted, but the valve columns were without any casing around them.

The Caledonian Railway

In Fig. 31 we have all the chimneys in use from 1882 to 1923. Originated by Dugald Drummond, whilst he was with the North British Railway, the design was carried by him to the Caledonian and all its characteristics were copied by his successor. The only modification made by Mr. Pickersgill, after he succeeded Mr. McIntosh, was the omission of the line separating the top from the shaft.

Drummond's domes were generally of the pattern which I have illustrated for the South Western with the valves on top. These valves were of the Ramsbottom type with the spring between the columns, which columns were of polished bronze. The 7ft. bogie single, built by Neilson and Company for exhibition purposes, painted blue, afterwards acquired by the Caledonian Railway and numbered 123, had the Drummond chimney and dome, as well as so many other Drummond features, that he must have been responsible for its design.

The North British Railway

To give any other drawing than that of Fig. 32 is superfluous for Dugald Drummond's successor; Mr. Matthew Holmes, carried on the Drummond tradition, with the exception that the valves were direct loaded and the dome thus had exactly the shape and appearance of that of the South Western: Fig. 25.

W. P. Reid followed Mr. Holmes and it will be seen from Fig. 32 that the top and base are of Drummond shape, without any shaft in between. This particular chimney was on Mr. Reid's big Atlantic engines, the domes of which were like the L. & N.E.R., shown on the left of Fig. 7.

The Glasgow and South Western Railway

In Fig. 33 are shown two of Mr. James Manson's chimneys, the first of which is by far the better known. The second made its appearance in 1903 on the new 4-6-0 type engines of the 384 class. All Manson's domes were of normal round-topped type, with cylindrical middle portions. After his retirement, in 1912, Mr. Manson was followed by Mr. Peter Drummond, brother to Dugald, and so the Drummond patterns came also to this railway.

The Highland Railway

The chimney of David Jones was peculiar and unique in that the front half of the circumference was pierced and fitted with four rows of louvres, as shown in Fig. 34. The object of these was to induce a current

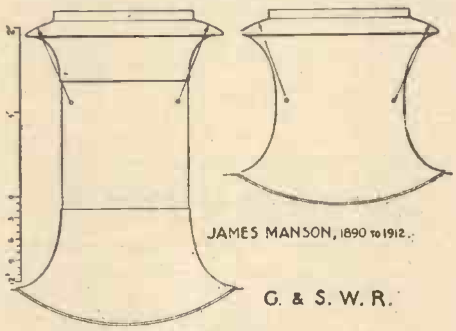


Fig. 33

of air upwards in the chimney. Whether it was effective seems to be open to question, except when travelling at very high speeds; but Mr. Jones persisted in using it, on all engines, up to the end of his term of office. He was succeeded by Peter Drummond, again with the standard type of Drummond boiler mountings. F. G. Smith and C. Cumming, in succession, carried the period up to the time of grouping and the last chimney illustrated is Mr. Cumming's adaptation of the Drummond pattern, to the top of which a small wind deflector was added.

Shaping Model Mountings

It is the almost unvarying practice, both in the case of the privately made, individual model and those made commercially in quantities, to use castings for the boiler mountings, and this seems to apply even when the engines are as large as 15in. gauge.

In quantity production of small models die-castings are used; in this case the faithful copying of the proportions and curves of a given prototype is in the hands of a die-maker and the resulting castings should require no further shaping to finish them.

Where sand castings have to be used the general outline is put into the foundry pattern, and in the making of this there must be an allowance for obtaining a perfect finish; that is to say: the pattern has to be made, either a mere trifle or a considerable amount larger than is required, to allow of machining and filing the resulting casting. The amount will vary according to the intricacy of the shape and the chances of obtaining smooth, clean castings or otherwise. I have invariably found that gunmetal gives cleaner castings than brass, but the chief trouble results from lack of alignment of the two sides of the casting at the parting line. This is, more often than not, caused by badly fitting or worn dowel pins on the moulding boxes.

Whatever mounting is being dealt with, be it chimney, dome or valve casing, it cannot be machined all over; the part which saddles on to the smokebox, or the boiler, must be finished by hand, with files, either of the half-round or the rat-tail kind, or both, according to the size. A dome is more difficult to deal with than certain patterns of chimney since the base curves have to blend perfectly with the straight line of the barrel, without showing any line, or lumps or hollows.

The symmetrical upper portions can be turned in the lathe, to carefully drawn and cut-out templates, and the turning carried down to the bottom of the truly circular barrel and beyond it to the point "A" in Fig. 35, where the curve meets the boiler centre-line. That is to say: to the point where the curves of the base change their radii though not their tangent points. After that it is file work with the use of at least one additional template for the largest curve or radius, at "B," which comes over the deepest part of the saddle, at right angles to the centre-line. It should be borne in mind that the thin edge of the metal, at the line of merging into the boiler lagging, must always be a true circle in plan, and this edge may well be turned in the lathe, along with the upper part, before filing is commenced. In Fig. 35 the angular outlines represent the two templates, and the stippled areas on the dome are those portions of the surface of the casting which the turning tool cannot touch and which the filing must remove.

When machining the outside of a dome it is difficult to hold the casting in the lathe and a mandrel must be turned to pass up inside the cored-out interior. If this mandrel,

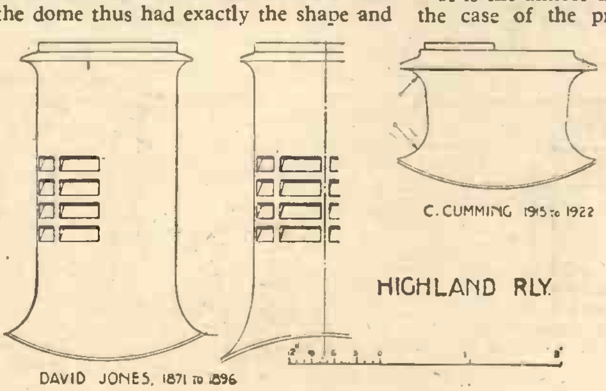


Fig. 34

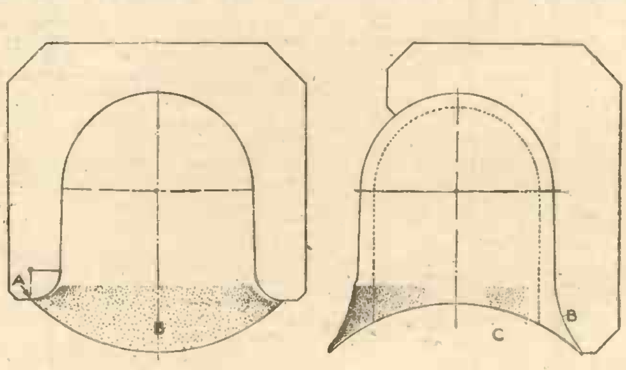


Fig. 35

which must be held in the chuck, is made a knock-in fit it creates the difficulty of removing the dome, without damaging either the turned work or the thin edge of the base. I have, therefore, found that the best way is to make the mandrel a good slide-in fit and cement the dome casting on to it by heating both mandrel and dome, and into the hot dome dropping a fair number of flakes of brown shellac. Insert the mandrel and see that there is just sufficient shellac to squeeze up to the opening. When the whole has cooled the casting will be firmly fixed and will stand up to the heaviest cuts. After turning the dome can be removed by reheating and the shellac removed from the inside by dissolving in methylated spirit.

The under-side, marked "C" in Fig. 35, is best finished, not by filing, but by saddling the casting over a wooden mandrel of the same diameter as the boiler lagging and with a sheet of medium-coarse emery, or carborundum, cloth wrapped around it; the cloth may well be tacked with glue. The casting is worked, under pressure, backwards and forwards along this, with a circular motion, until the under surface presents a good finish. It will be found by far the best to do the filework, not whilst the dome is in the lathe but by holding it by one hand firmly on the wooden mandrel, after removing the emery cloth, whilst the file is used in the other.

The file cannot, of course, finish the work; this is best done with strips of emery cloth, of different grades, glued on to several sticks of wood having rounded surfaces of different radii. If the dome or valve-casing is to be left as bright brass then metal polish will make the ultimate finish, applied with soft cloths.

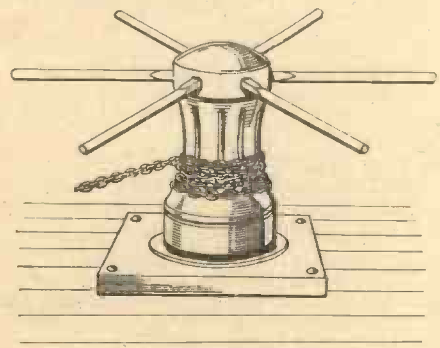
All the foregoing notes apply to the bases of chimneys and valve cases as well as domes.

Back to First Principles

1.—Action Equals Reaction

By W. J. WESTON

WE examine in this series problems of mechanics set in university and other tests. We comment upon the relevant theory; and we give full answers. You may not always approve wholly of these answers. All the better. A clash of opinions usually leads to greater clarity: it will be good that the answer suggested stimulates your own thought upon the problem.



The capstan problem.

The Problem

An anchor weighing a ton is being raised by its chain, being wound round a capstan of 9in. dia., which is turned by six men who work at the ends of capstan bars of 5ft. effective length. Assuming that each exerts the same effort, find what that effort must be if the efficiency is 56 per cent. (Neglect the weight of the chain.)

Comment

The mariners toiling at the bars would be very glad if they could neglect the weight of the chain. They would be glad, too, if more than 56 of the hundred pounds effort they exert could be brought to bear upon the anchor. But the effective work done by the most efficient machine falls short of the work supplied to the machine; for no moving part is without weight, and no movement is without friction.

The capstan is a machine of the wheel and axle type. The wheel has a diameter of twice a capstan bar: the axle has a diameter of 9in. The mechanical advantage is, therefore, 10ft.÷9in. We could increase the mechanical advantage by lengthening the bars, but we make our wheel more and more unwieldy. We could increase the mechanical advantage by lessening the capstan diameter, but we approach ever nearer to danger of snapping.

The weight is overcome 9in. by the force exerted over 10ft. But only 56 per cent. of Force is effective.

The Answer

Let x be the number of pounds Force exerted by each man.

Then 6x is the whole Force exerted.

Of this, $\frac{56}{100}$ is effective, that is $\frac{56 \times 6}{100}$ x.

Weight over Distance = Force over Distance. That is:

$$2240\text{lb.} \times 9\text{in.} = \frac{56 \times 6}{100} \text{ x lb.} \times 120\text{in.}$$

$$x \therefore = \frac{2240 \times 9 \times 100}{56 \times 6 \times 120} = 50\text{lb.}$$

The Problem

A piece of glass weighs 5 gm. in air, 3.2 gm. in water, and 1.7 gm. in sulphuric acid. Find the specific gravity of the glass and of sulphuric acid.

Comment

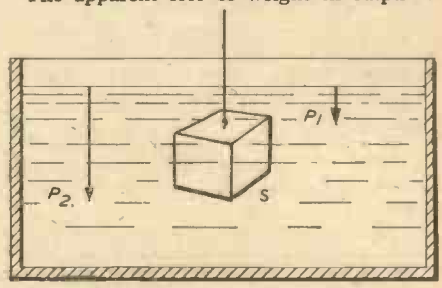
There comes an echo of Eureka!, the shout of Archimedes in his bath when he realised that the upward thrust on his body immersed in water was equal to the weight of the water he displaced. Here is a solid—assume for simplicity that it is a cube of brass suspended so that the upper surface is a horizontal plane—hanging wholly covered in a liquid. Molecules in a liquid move freely; as a result pressure is in all directions. Pressures on the sides balance. But pressure on the lower surface is that of a volume of water equal to $S^2 \times P_2$. Pressure on the upper surface is that of a volume of water equal to $S^2 \times P_1$. The difference is, of course, the pressure of a volume of water equal to the cube. And this holds good whether we tilt the cube or whatever the shape of the body immersed: the upward thrust on a body wholly immersed in a liquid is equal to the weight of the liquid displaced.

The Answer

The apparent loss of weight of the glass in water is 1.8 gm. 1.8 gm. is therefore the weight of the water displaced.

The S.G. of glass is ∴ $5 \div 1.8$ or $2^7/_9$.

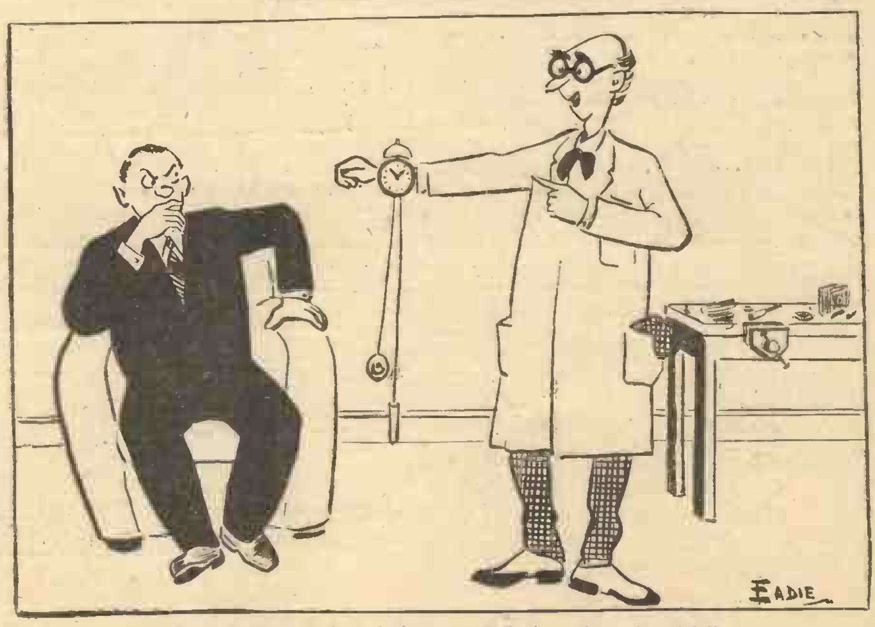
The apparent loss of weight in sulphuric



A problem in specific gravity.

acid is 3.3 gm. 3.3 gm. is therefore the weight of the sulphuric acid displaced.

The S.G. of sulphuric acid is ∴ $3.3 \div 1.8$ or $1^5/_6$.



Says Boffin: "Arm fatigue apart it is a first class job."

MODEL STEAM LAUNCH "Vanesa"

A Free-lance Model Powered by a Twin-cylinder Oscillating Engine

THE model launch described here will suit a beginner's requirements as both launch and power unit were constructed completely by hand, using only the usual hand tools. The hull design is of the simplest and the details and fittings, although sufficient to present a reasonably nautical aspect, are kept down to the minimum. The power unit was produced from odds and ends. With the exception of one or two items such as the mast and lifeboat the entire construction is of metal and the design will probably suit the modelmaker skilled in this type of work rather than the woodworker.

The model has had several voyages and these have proved satisfactory. As the hull is "flat bottomed," buoyancy is good, and being of a fair size she stands up quite well to a little rough water.

This illustration of "Vanesa" shows the smart appearance of the completed model.

The running time of the unit should be about twenty-five minutes; the rudder is fitted with fine adjustment, and can be locked in a required position to suit the run. A side elevation and plan of the launch are given in Fig. 1.

Hull Construction

This was made up in three sections, bottom, sides and transom, from 22-gauge tinplate, each section being cut with the aid of stiff paper templates made in accordance with the original drawing. These sections were of such a shape that when soldered together they naturally took up the necessary flare and sheer, with very little "hand-bending" to finish off. After the soldering up of the sections was completed, strengtheners were added in the shape of three bulkheads (one aft, and two for'ard), horizontal strakes of angle brass, and vertical supports in the shape of triangular pieces of tin soldered to the sides, and angle brass, as shown in Figs. 2 and 2a. The deck was fitted in two sections; the first one extending from the bow to the aft bulkhead, and the second, from the bulkhead to the transom. The join was filled with solder, and rubbed down smooth.

A beading of 1/16in. dia. brass wire was then soldered edge-on to the deck, to finish off. The cabin "walls" consist of four sections: front, two sides, and rear. They rest on the deck, and are soldered from the inside, an allowance of about ⅛in. being made on the overlap of the deck edge to provide a good bed for the solder.

The roof was made to slide on, while the upper deck, which carries the funnel, cowl ventilator and engine room skylight can be lifted off bodily, providing access to the whole power unit.

The windows were fashioned from Perspex, ⅛in. thick, each one being "stepped" so that it fits tightly into the window apertures.

The propeller tube (Fig. 3) is of ¼in. dia. brass, bushed at both ends with ⅛in. dia. collars, soldered into position. There is no gland and water is retarded by means

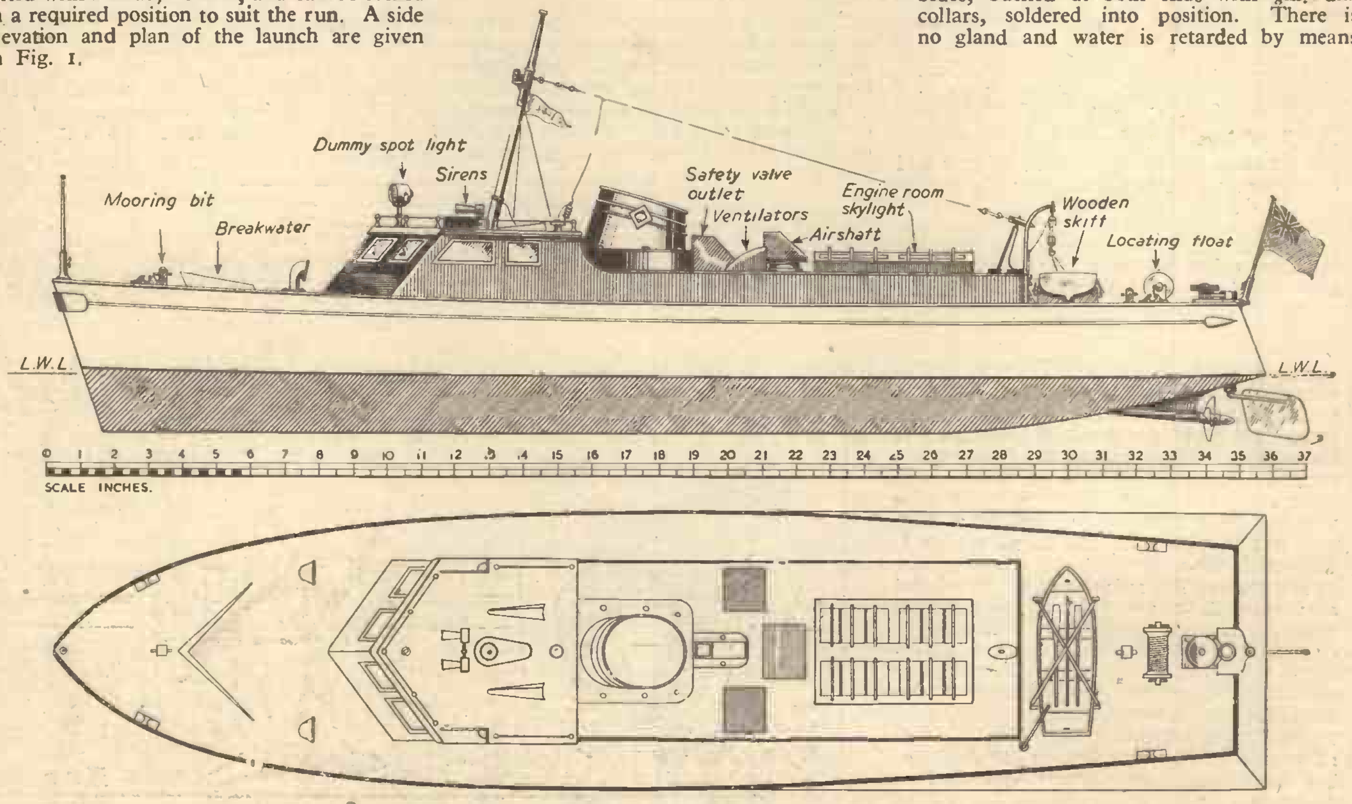


Fig. 1.—Side elevation and plan of the model steam launch "Vanesa."

UNCH

By J. E. J.

of grease pumped into the tube. This method is quite effective, and does not in any way check the engine. The propeller shaft was made from ⅛in. dia. silver steel. One end is threaded 5 B.A. to receive the propeller, while the other end is fitted with a simple "cruciform" universal coupling. The total length is only 6in., so there is no "whip."

The propeller is 2¼in. in diameter, four bladed, and was made in sections, each blade being ¾in. wide, ¾in. deep, and soldered into slots cut in the boss (see Fig. 3). This latter item was turned down from a length of ⅜in. dia. brass rod.

The pitch is fairly coarse, with the blades twisted until nearly at right-angles at the tips. Each blade had a sharp edge filed on, and was brought to a high polish with OO superfine emery paper.

The Rudder

As illustrated in Fig. 3, the blade, which was fashioned from 20-gauge brass sheet, fits into a slot cut in the stern post and was soldered. The stern post is a length of 5/32in. dia. brass rod. The top end is threaded 4 B.A. to receive the tiller head. This component was filed down from a length of ½in. dia. brass rod; it was drilled and tapped 4 B.A., at centre, then 5 B.A., at right-angles to receive a securing grub screw. The fine adjustment consists of a geared quadrant cut from an old gear wheel, soldered to the head, and connected to a small gear, which is situated on a pivot. A rounded head is provided; this is fitted with a grub screw, which enables the head to be locked in any required position.

The Funnel

This is rolled from 24 G. sheet brass, and is "flush joined" with silver solder. Both the capping and bands are of 1/16in. brass wire soldered on. The decorative "diamonds" were cut from brass, and soldered to the bands.

It is flanged, and is bolted to an upraised brass casing, which, in turn is bolted to the upper deck. The whole unit is left in a polished state.

The Latticed Air Vents

These are fashioned from tinplate, and are soldered permanently to the deck, on either side, and slightly aft of the funnel. Lying between these is a vent, which is directly over the safety valve.

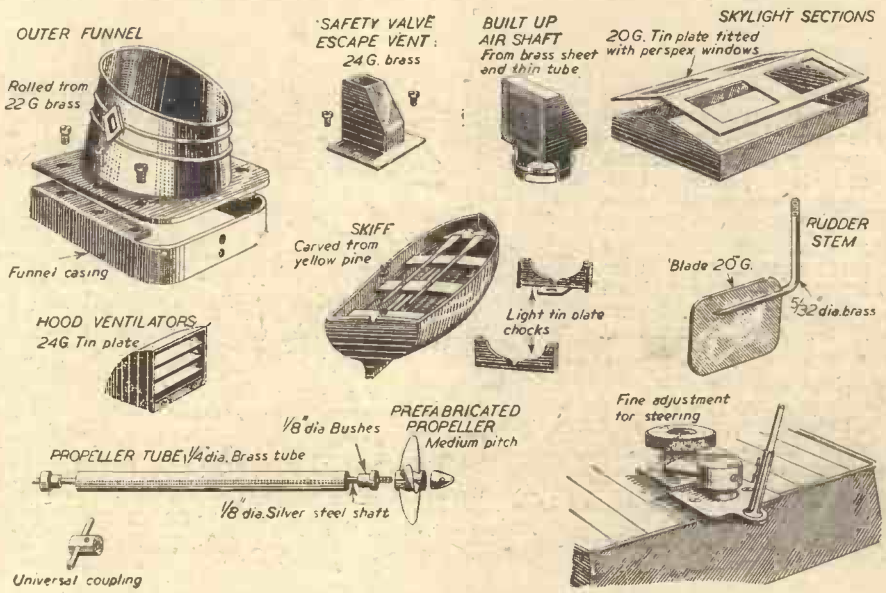


Fig. 3.—Details of the various deck fittings.

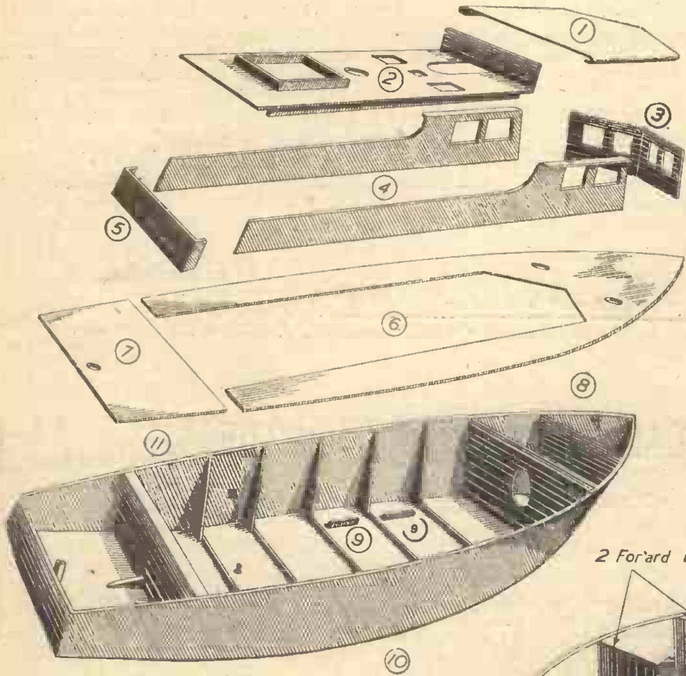
The Skylight

This was made up from odd bits of tinplate, and fits over a "wall" soldered to the upper deck. The "glass" is Perspex, each pane being cut to fit into the apertures, as with the cabin. The guards are pieces of 1/16in. by 1/32in. brass strip, soldered into position. (See Fig. 4.)

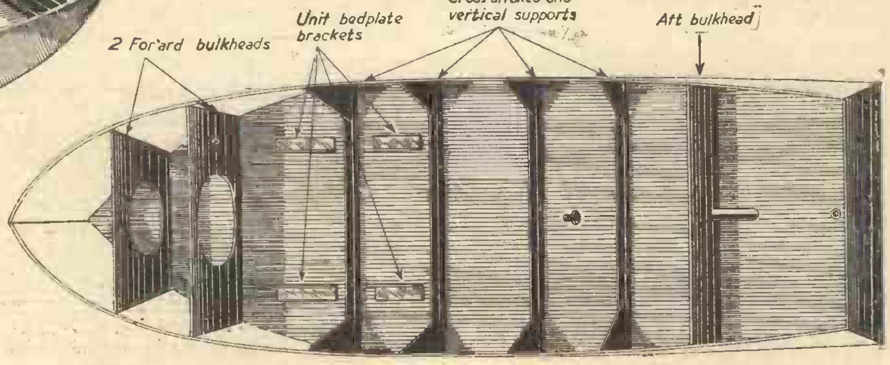
Sundry Fittings

Situated fore and aft, the ensign masts were filed to shape from ⅛in. dia. brass rod, and fit into sockets. The two pairs of fairleads for fore and aft, were filed from 5/16in. square brass rod, and are soldered to their respective positions on the deck.

The cowl ventilators were made by first beating out the cowls from sheet brass, on a



Figs. 2 and 2a.—Details of hull sections and plan of hull.



1. Roof section
2. Upper deck
3. Cabin front
4. Cabin side sections
5. Cabin transom
6. Main deck section.
7. Rear portion of deck
8. For'ard bulkheads
9. Power unit brackets
10. Complete hull
11. Aft bulkhead

block of lead, then soldering them to lengths of $\frac{3}{8}$in. dia. tube, the lower ends of which had flanges fitted, for the purpose of bolting to the deck. The hand rail is of 3/32in. brass wire, threaded through stanchions fashioned from $\frac{1}{8}$in. dia. brass rod.

The mast is split up into four separate groups: lower mast with socket; top mast; yard-arms and mastband. The lower mast, top mast, and yard-arms were carved from $\frac{3}{8}$in. beech dowlings, while the sockets and mastband were built up from various pieces of brass tubing. The rigging is simplified, and consists only of two mainstays, port and starboard, and two pennant half-yards, suspended from each yard-arm. Both the pennant and ensign are made of red linen, with the insignias hand-painted on with poster paint. All these fittings are illustrated in Fig. 5.

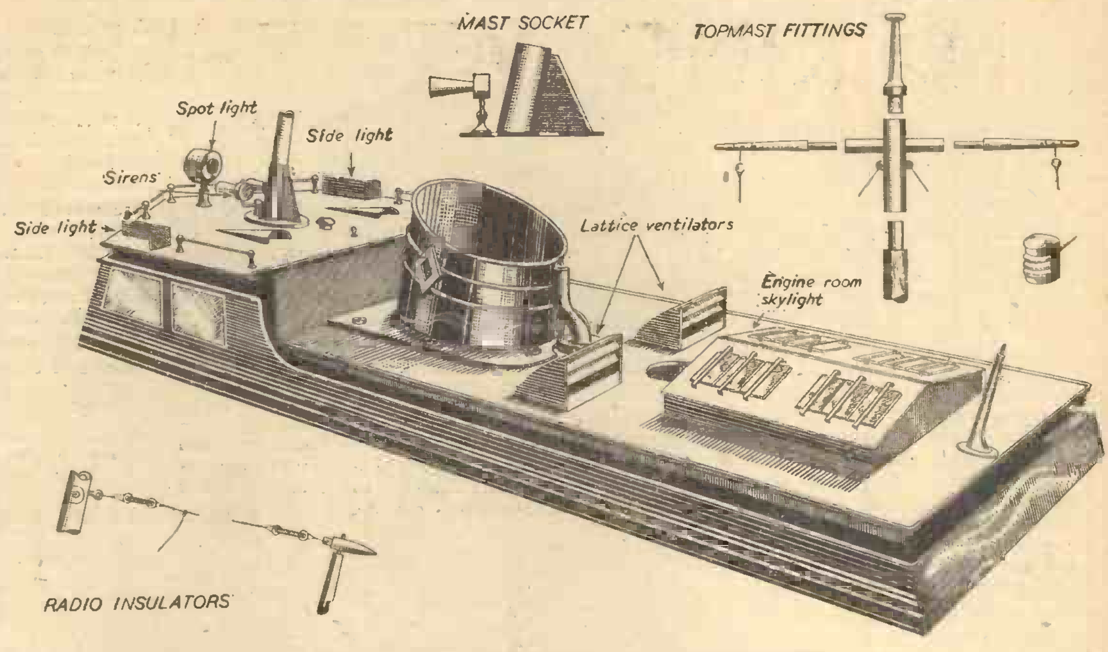


Fig. 4.—Upper deck layout prior to modification.

The skiff (shown in Fig. 3) was carved out of a piece of 2in. by 3in. white pine, and is fitted with a pair of oars, and a boat hook, fashioned from wire, and painted.

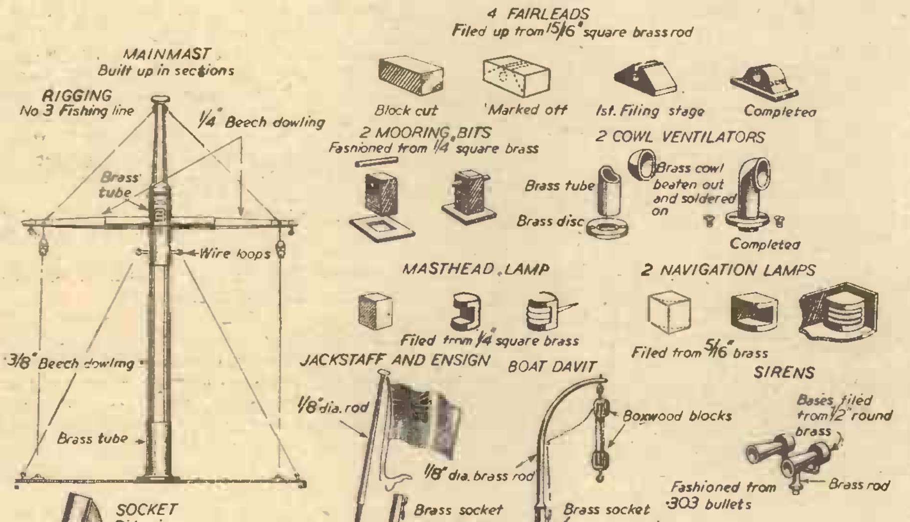


Fig. 5.—Further details of deck fittings.

Power Unit

The engine, which is a twin-cylinder, single-acting oscillating type, 2in. bore $\frac{3}{4}$in. stroke, was made completely by hand, from mostly odds and ends. The cylinders were made from $\frac{1}{2}$in. dia. brass tubing and the pistons were cut from pieces of $\frac{1}{2}$in. dia. mild steel rod. The piston rods are made from $\frac{1}{8}$in. dia. steel rod, and were sweated into the pistons, the other ends being fitted with big ends of brass.

The crankshaft was built up, the webs being sweated and riveted to the main shaft, which is of 3/16in. dia. silver steel. The main bearings are fitted with 3/16in. ball races. The fitting of these was rather a tricky job. First, two $\frac{1}{2}$in. brass washers were silver-soldered to brass plates. Then the existing holes were scraped out to enable the races to be inserted at a press fit, after which the plates were bolted into position over the main shaft holes on the engine frames. So far to date they are functioning quite well.

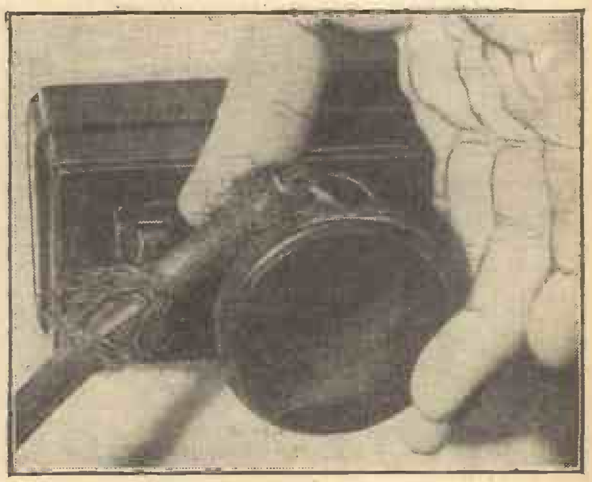
(To be concluded)

Holding wires in a plug socket with aid of matches is a common but dangerous practice.

DANGER IN THE KITCHEN

THE great increase in recent years of electrical appliances in the home has resulted in a number of tragedies due to faultily installed wiring. The Cheltenham branch of the Electricity Board are taking every opportunity to educate the public in the dangers of wrongly wired apparatus.

The accompanying illustrations show only two examples of many dangerous methods of handling domestic electrical apparatus, and the risk involved cannot be over-emphasised.



One of the demonstration pieces shows a badly frayed plug wire, which should be attended to by an electrician.

MAKING WEATHERVANES

Here are Three Weathervane Designs Which We Have Received in Response to Our Invitation in the November, 1952, Issue

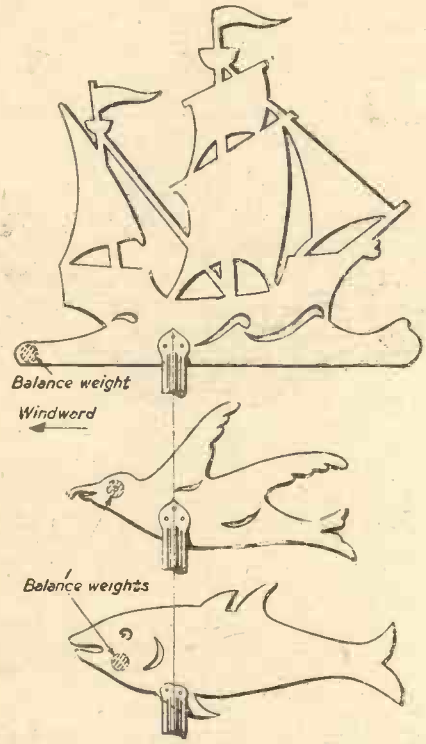


Fig. 2.—Some suggested vane designs by Mr. G. Murray.

Mr. G. Murray's Design

WEATHERVANES have always had a special fascination, and enhance the appearance of country dwellings, particularly when the choice of design is in keeping with the surroundings.

Their construction is not difficult, but some important points require to be watched, as will be seen in the following description of a type which has been found very satisfactory in practice.

The Bearing

The heart of a weathervane is its vertical bearing, which should be very easy-running and capable of remaining so for long periods exposed to the elements and without attention. This has been achieved in the construction shown in Fig. 1. The stationary axis is a ½in. diameter steel rod, drilled 3/16in. centrally at the top-end for about ½in. and slightly countersunk. The rod is fitted with two steady-rings of brass or aluminium alloy pinned on, and of a diameter such that the rings are a slack fit in the 1in. diameter aluminium tube which forms the swivelling member.

The upper part of the swivelling tube has inside it an aluminium plug, driven in at a tight watertight fit, and pinned as shown. This plug is drilled on the underside, a little under ⅜in. diameter and about ¼in. deep, and a ⅜in. ball-bearing is forced into the hole so as to bear on the edge of the axial hole in the rod. At the lower end of the tube a retaining ring is fitted as shown, and held to the tube by three set-screws in such a position as to allow a slight vertical play under the lower steady-ring on the rod.

The upper end of the tube is split and flattened so that the vane-plate can be sandwiched between the lugs and fastened with two or three aluminium rivets.

Below the tube assembly, a ball (or cylinder if preferred) is fitted over the rod and held to it by one or two set-screws. The 5/16in. rods carrying the letters N, S, E and W are screwed into the ball and are split at the outer ends to take the letters, which are cut out of 14 g. aluminium sheet.

The Vane

The vane itself, if of moderate dimensions, may also be cut from 14 g. aluminium, and may, of course, take many forms, some suggestions for which are shown in Fig. 2. The important thing about the vane, of course, is that its "centre of pressure" should be on the leeward side of the axis. This will mean that the weight will be unbalanced and, therefore, lead counterweights should be bolted to the windward side, as suggested in the illustration.

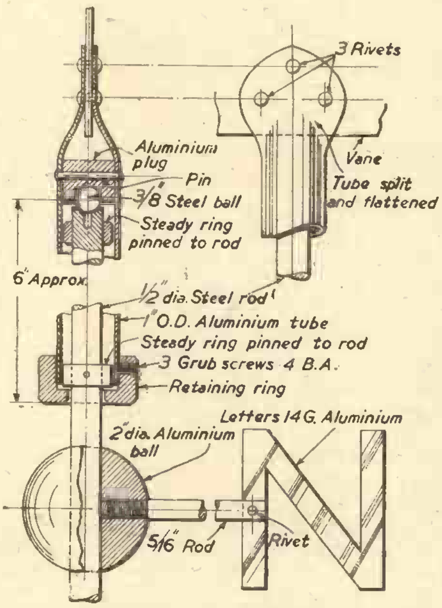


Fig. 1.—Constructional details of Mr. Murray's design.

The "centre of pressure" can be found by cutting out the pattern in cardboard and balancing it on a straight-edge placed in the direction which will be vertical when the vane is working. The distance between the centre of pressure and the axis is not important, but the greater the better for sensitivity, provided the design does not appear unduly unbalanced. It is usual to make birds, animals and fish face up-wind, but if a ship design is used it should face down-wind, as shown in Fig. 2. The design should be bold and simple, since it will be seen at a distance and in silhouette. The vane should be painted black, as otherwise it may annoy the neighbours by flashing in the sunlight.

The upper bearing should be well greased, if possible with "silicone" grease, which will not harden in cold weather or run out in hot weather. No fixed dimensions are given here since these will depend on local conditions and on the chosen design, but it is important to make the bearing (Fig. 1) fairly long, say, not less than 6in., to minimise the side pressure on the lower ring, which would increase the friction. A vane about 18in. long with letters about 2½in. high is about right for the gable of a dwelling house. The separation of the letters should be about 27in.

One little difficulty which always arises is that the letters, being visible from both sides, appear left-handed from some aspects. This is usually got over by making them appear correctly from the principal aspect—say from the front of the house. The orientation of the letters can easily be done accurately by observing the direction of the pole star at night and fixing a sighting peg in the ground or other convenient place, which can be used for sighting the direction of north in daylight.

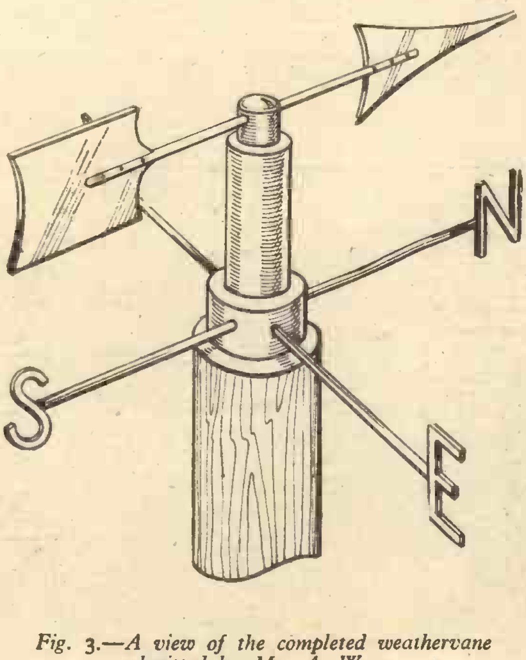


Fig. 3.—A view of the completed weathervane submitted by Mr. A. Warne.

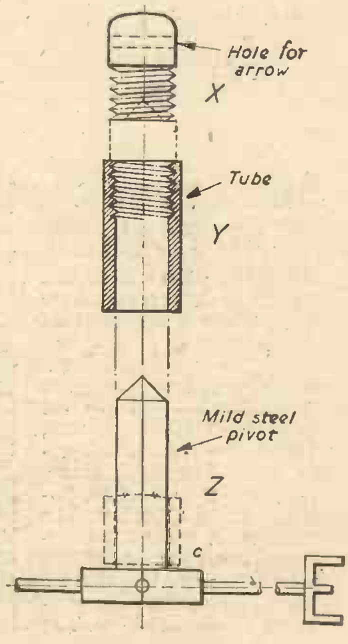


Fig. 4.—Constructional details.

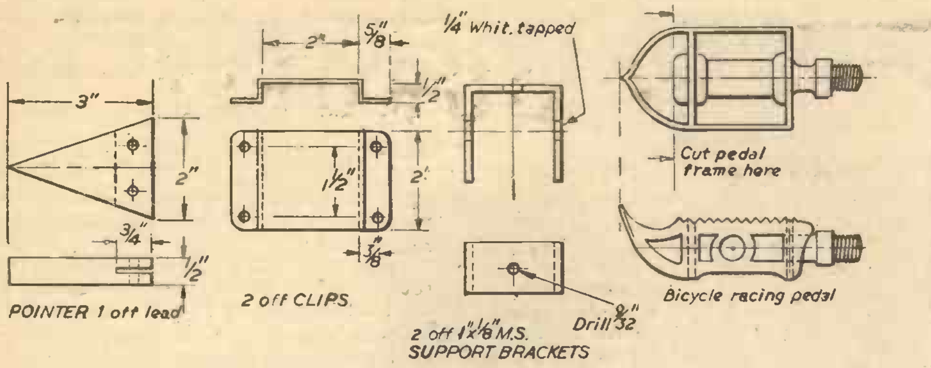


Fig. 5.—Details of some of the component parts of Mr. Dean's weathervane.

Mr. A. Warne's Design

The vane about to be described is made entirely of metal, and a glance at Fig. 3 will give readers an idea of its appearance when complete. All measurements have been omitted as these will depend entirely on material available and method of fixing to either building or post. In construction, the chief thing to remember is that the revolving arrow must be well balanced so that it does not bind.

Construction

Brass or copper would be ideal for the construction of the centre post. This is made up of three items, marked X, Y and Z (Fig. 4). X is a solid cylindrical piece, having a thread at the lower end, and at this end a tapered hole is bored to an angle of, say, 30 deg., as shown. At the top end of this piece a hole is drilled, at right-angles, equal to the thickness of the arrow rod. The rod is first pushed through this hole, after which the ends are slotted to receive the arrow head and its tail.

Item Y is a length of tube with a fairly thick wall; at one end it is threaded on the inside with the same thread as that on piece X; the two pieces are now joined by screwing X into Y.

Piece Z is made from round mild steel rod, one end of which has been turned to a point of the same angle as piece X to enable XY to revolve on Z. On assembly, XY is partly filled with grease and simply slid over piece Z. The steel rod mentioned above must, of course, be of a thickness that will enable it to slide into tube Y and revolve freely without any slackness, but must not bind.

A thick collar is now made and is welded on to the steel rod just below the end of tube Y, when its position has been found, leaving a space of, say, 1/16in. clearance (see c Fig. 4). This collar has four holes drilled into its side at equal distance; these holes take the rods which hold the four letters N, S, E and W. These letters N, S, E and W can be cut out in metal and welded to the four rods.

Fixing the Arrow

Fix the rod securely into piece X, and then saw down its centre at both ends for a short length. The head and tail (having been cut out in metal to the reader's design) are now inserted, fixed with rivets and finally cleaned up.

Mr. E. W. Dean's Design

A weathervane of this type was made and fitted 20 years ago, and apart from being repainted once it is still operating at Willerby in Yorkshire.

Construction

The base of the weathervane is an old bicycle pedal which was cleaned up inside and out and lubricated with a light grease. The pointed end of the pedal was cut off as surplus and the threaded portion of the spindle ground and filed until it could be screwed with a ¼in. Whitworth die (under the thin hard case the metal is quite soft).

The two clips were made from 16 g. mild steel sheet and bolted round the pedal with the tail and the pointer support nipped between them. The tail can be designed to any shape provided its area is at least three or four times that of the pointer, otherwise it will yaw from side to side.

The pointer is made from lead and can again be any shape or size, but it must balance the tail exactly when the whole is held in one side.

The whole assembly is supported on the two inverted ⊔ clips, which are bolted to the pedal at the top, fitted at right-angles to each other and screwed on to the top of the pole with No. 8 countersunk woodscrews (Fig. 6).

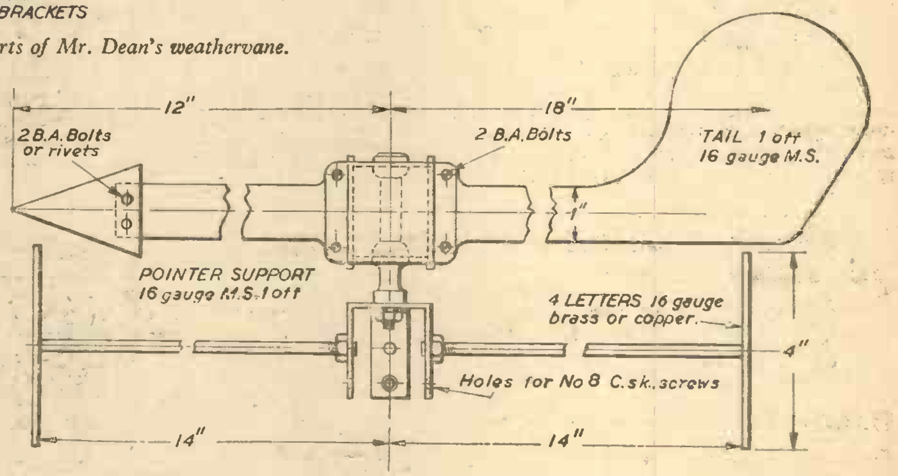
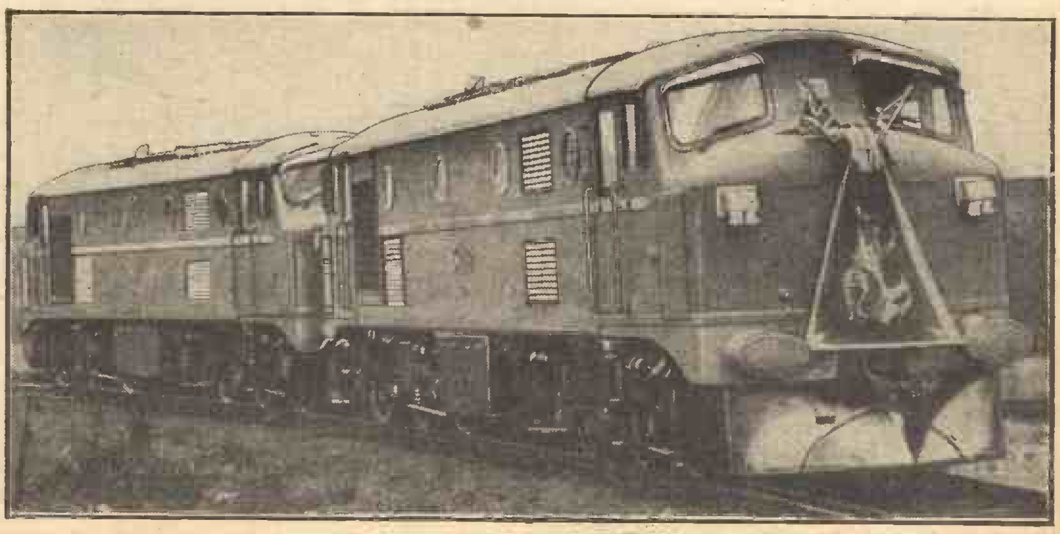


Fig. 6.—A side elevation of the completed vane with one direction indicator removed.

The indicating letters are supported on a ¼in. mild steel rod screwed into the ⊔ clips and locked with nuts. The letters themselves were cut from 16 g. copper sheet, polished and lacquered and riveted on to their supports; all the metal (mild steel) parts were painted green with good quality paint. The last thing to remember is to close the oil hole in the top cap, otherwise it will soon fill with spiders, etc.

DIESELS FOR CEYLON

Brush Bagnall Traction Co., Ltd., of Loughborough, have just completed the first of 25 diesel locomotives (constituting a £1,000,000 order) for Ceylon, and in November last it was formally handed over to the Ceylon High Commissioner, the Hon. Edwin A. P. Wijeyeratne, by Sir Ronald Matthews, chairman of the Brush Electrical Engineering Company. The locomotive is carried on six-wheeled bogie trucks, and is provided with a "cow-catcher" in front. The look-out windows are fitted with wipers. The photo shows this locomotive making a run on the track after being handed over.



The "World of MODELS"

By "MOTILUS"

Scale Model Babcock Boiler : International Railway Models

THE renowned boiler makers, Messrs. Babcock and Wilcox, Ltd., had constructed for them last year an exhibition model of their High-head Boiler. Such boilers are installed in modern power stations, where they are the dominant features. They can be up to 100ft. high and have an evaporation rate of about 400,000lb. of steam per hour. A typical modern installation of this nature is the new Uskmouth Power Station, which has 12 Babcock High-head Boilers, each of 360,000lb./hour.

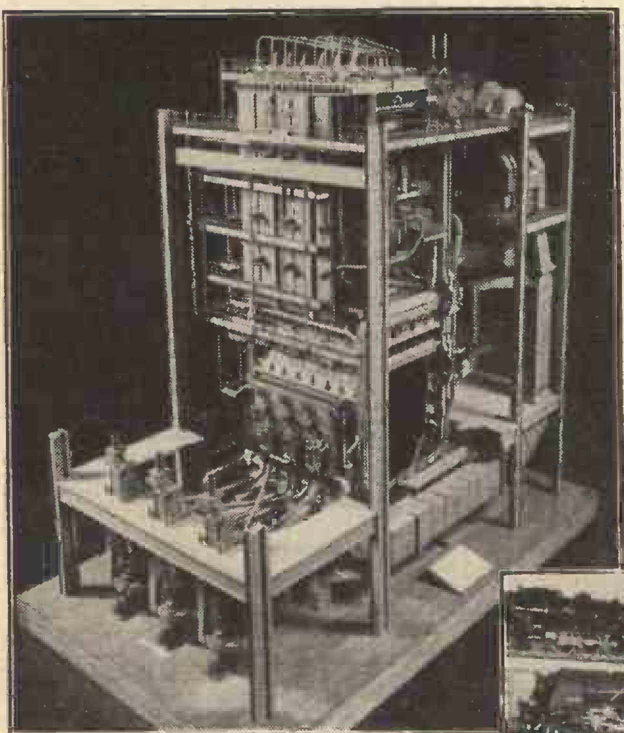


Fig. 1.—(Left) A model of a Babcock High-head Boiler, to a scale of $\frac{1}{2}$in. to 1ft. Boilers of this type are used in modern power stations.

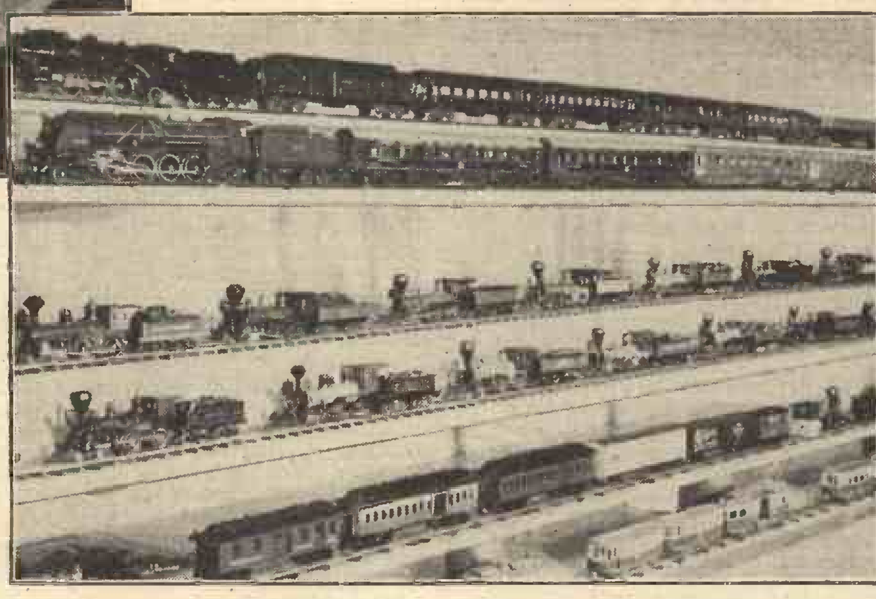


Fig. 2.—(Below) Models of modern French trains and old-time American trains, all in Gauge O. They were part of the large model railway display shown at the Zurich shop of Franz Carl Weber last October.

The largest part of the boiler is the furnace, which comprises a large, rectangular chamber, formed of steel tubes and refractory materials, equipped with stokers and pulverised-coal or oil burners. Above the furnace, and in the flow of the hot furnace gases on their way to the chimney stack, are other complex assemblies of steel tubes. Surmounting the boiler is the steam drum, a massive cylinder of thick steel, some 4ft. to 5ft. in diameter and weighing perhaps 40 tons, from which the high pressure steam passes, via the superheater (which is a component part of the boiler), to the turbines.

Model Babcock Boiler

As can be well imagined, it is never possible to obtain a complete view of a whole boiler when it is of such a size. A carefully detailed scale model, however, can present the whole project in comprehensible dimensions. The model illustrated here is to a scale of $\frac{1}{2}$in. to 1ft. and was built for Messrs. Babcock and Wilcox, Ltd., by Bassett-Lowke, Ltd., of Northampton. It shows the whole structure of furnace and boiler with one side wall removed to reveal the interior. The model is built partly in wood, with aluminium tubing. It demonstrates clearly the complicated system of air-heating and the ducts which carry the air to the pulverised fuel feeds. The mills which grind the fuel before injection into the furnace are models in themselves and can be seen on the left-hand side of the photograph, below the firing floor.

Such boilers can also be arranged for alternative methods of firing, and oil burners are incorporated in the model in addition to pulverised-coal firing equipment.

This model, along with a number of others showing the range of water tube boilers manufactured by Messrs. Babcock and Wilcox, can be seen in the company's own exhibition hall at Salisbury Square House, Fleet Street, London, E.C.4. The exhibition hall is not open for inspection by individuals but the company offer facilities for groups of engineering students to visit the hall to examine these models.

International Railway Models

In 1947 Switzerland celebrated "One Hundred Years of Swiss Railways" and in lectures, exhibitions and excursions traced the history of Swiss railways from the days of the first steam-hauled trains to present-day trains, powered chiefly by hydro-electricity. The celebrations included a tour of a full-size model of the first train of the 1847 "Spanischbroetli" Railway. This curious name for a railway originated because the train, which ran between Zurich and Baden, used every morning to bring hot "Spanischbroetli," a savoury speciality of Baden bakers, for the breakfasts of the people of Zurich.

Last year Swiss railway and model railway enthusiasts were celebrating once again : this time a Jubilee celebration for the fiftieth year of the Swiss Federal Railways, of which the Swiss are justifiably proud.

In this connection, the Swiss firm of Franz Carl Weber staged a large display of international railway models, all of Gauge O size, in their model and toy store in the main street of Zurich, the Bahnhofstrasse. The display, which was shown last October, included a group of models to mark the Swiss Federal Railway Jubilee, all the models having been built by Swiss amateur model-makers. The remainder of the exhibition comprised models of locomotives and rolling stock of railways of other countries. Among these were models of old-time American locomotives, from the collection of Mr. H. Bühlmann. I have referred to some of these lovely old-time models in previous articles, as I have seen them myself when visiting the Model Railway Club in Zurich, and they are all beautifully-made scale replicas.

LETTERS TO THE EDITOR

The Editor does not necessarily agree with the views of his correspondents.

Model Ships in Bottles

SIR,—I was especially interested in the article "Model Ships in Bottles" (November PRACTICAL MECHANICS), as I have been making this type of model for a number of years.

In 1942 I built a model of a fully rigged ship in a 150-watt clear electric light bulb and since then have used bulbs instead of bottles.

In my opinion, the finished result is more of a novelty and never fails to attract attention.

The bulb is cemented to a polished wood base which has a chock at one end to support the bayonet cap end of the bulb.

Through experience, I find it is far better to colour the putty "sea" before inserting it in the bottle (or bulb). I usually mix in engineers' blue to obtain the correct colour. This method has the advantage of securing a uniform blue colour on the under-surface, and as some of the concentrated "blue" works to the top surface, one gets the effect of different shades at "sea level." In addition, the painstaking task of painting the interior of the bottle is obviated. The white wave crests and bow waves are then added in the conventional manner.

I trust that any newcomer to this fascinating hobby will find the foregoing remarks of interest.—A. GREENWOOD (Bradford).

Organ Notes and Temperature

SIR,—Although the answer given to C. Jones in the November issue tells part of the story, it certainly needs some enlargement in order to line up with facts.

Every player of a wind instrument and most organists are well aware that a rise in air temperature causes a rise in the vibration frequency and, therefore, of pitch. The way this comes about is as follows: Take, for instance, a lead-zinc alloy pipe of approximately 13in. length, sounding the note "A" at 439 vibrations per second. The "coefficient of linear expansion" of this alloy would be 0.000027in., from which it follows that an increase of temperature from, say, 32 deg. F. to 90 deg. F. would increase its length by less than one-fiftieth of an inch, and, other things being equal, reduce the vibration rate from 439 to 438.4. The resulting change of pitch would be inappreciable to the most sensitive ear except by heterodyning with a standard frequency.

A much more important factor lies in the change of frequency resultant from a change of density in the vibrating column of air within the pipe. A 58 deg. rise of temperature, i.e., from 32 deg. to 90 deg. would increase the vibration rate by 6 per cent. to approximately 465, a rise in pitch of practically a semitone. The above applies to the "flue-work" which constitutes the major part of an organ; a small section of the reed work will vary somewhat from the above, depending on whether the sound-generating reed or the resonating pipe dominates the control of pitch.

In the case of breath-blown instruments, a rapid warming up occurs when the instrumentalists commence to play. Fortunately, means are provided for rapid and easy correction of pitch. In the case of an organ, change of pitch is due only to change in ambient temperature, and no means are provided for correction. No doubt it would be possible to provide thermostatically controlled "shading" to each pipe if this were justified by the enormous expense which would be involved.—G. E. MORTLEY (Tunbridge Wells).

Braille Printing

SIR,—In a recent issue of PRACTICAL MECHANICS I noticed a request from Mr. L. Mortimore (Pinhoe), for information regarding duplication of Braille printing. I do not know whether your correspondent has received the help he required, but if not, the following may assist him. In the printing trade "embossing" is often done by means of a powder, consisting mainly of resin, which is sprinkled over the wet printing. A certain amount of the powder sticks to the wet print and the remainder is shaken off. The print is then heated on a hot plate, or in front of an electric radiator, and the combination of printing ink and resin forms raised printing when fusion takes place. Presumably, if Mr. Mortimer cut an ordinary wax stencil on a Braille typewriter and experimented a little with ink and embossing powder (which he could get from a printing supply house) he would be able to produce copies which could be "read" by his blind friends. Possibly the use of a fairly non-absorbent paper would be necessary.—W. TEEBOON (Nelson, New Zealand).

SIR,—With regard to the letters on Braille printing, published in the July and November issues, I would suggest that duplicating of Braille could be very easily carried out by the following method.

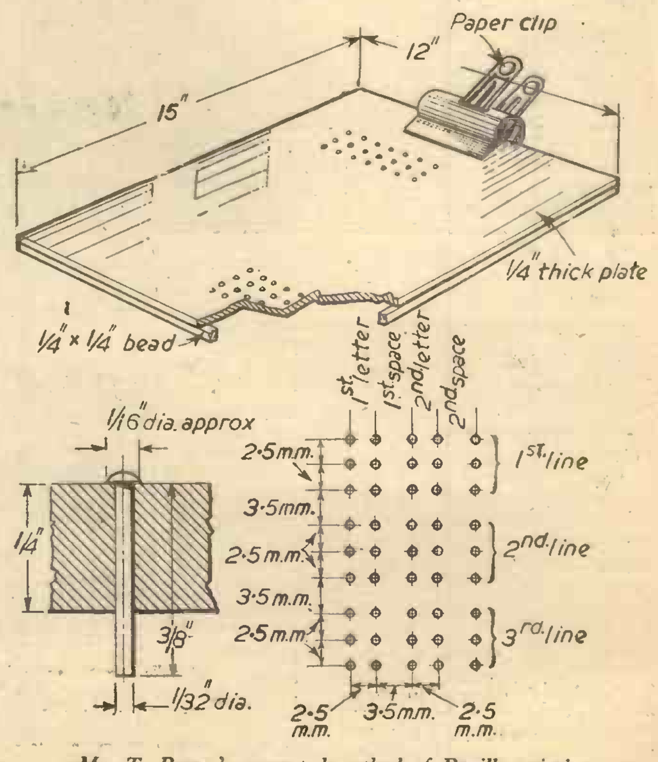
A metal plate, say aluminium, should have a complete series of holes 1/32in. dia. drilled at the correct spacing (as shown in the accompanying sketch), the plate having a paper clip secured to the top edge. The size of such a plate depends on the size of paper that is to be printed, but I am given to understand that the standard size used in the trade is 10½in. x 13½in. full size, or 10½in. x 6¾in. half-page size.

The method of forming the print is by means of the heads of 1/32in. dia. aluminium round-headed rivets, which, in setting-up the plate, are placed in the correct positions to form the characters. When the plate has been set up, complete with rivets, it would be very simple to check over before a print is taken off, thus ensuring there are no waste or faulty copies.

The procedure for printing is to secure the sheet of paper in the clip, and to go over the surface with a hard rubber roller, the protruding rivet heads in the plate forming the Braille dots in the paper.

It would probably be advantageous to have

(*Continued on page 213*)



Mr. T. Brown's suggested method of Braille printing.

WIN SUCCESS IN LIFE

Pelmanism Develops Your Latent Talents

IN this crowded world there are more good jobs looking for good people than good people looking for good jobs. For so few of us are ready for opportunity when it occurs.

Are you ready to grasp it whether it is the chance of a more interesting and more remunerative post, or a fuller and freer life in some other direction? Will you have the courage and clear-headedness to seize and use your chance?

Take up Pelmanism and prepare now for to-morrow's opportunities. You are then training, not only your mind, but your whole personality. Pelmanism rids you of handicaps which hold you back—be it self-consciousness, lack of initiative, fear or self-doubt or simply a tendency to worry about trifles.

Pelmanism also automatically develops your real self. Talents which you never knew you possessed come to the surface. For Pelmanism trains your mind and character just as physical exercise trains your body.

Remember—Everything you do is preceded by your attitude of mind.

The Pelman training for successful living has been proved by over 750,000 men and women of every type and calling. It is so clearly explained and carefully graded that anyone can follow it. It is modern psychology made practical.

Reduced fees for serving and ex-Service members of Her Majesty's Forces. (Apply for Services Enrolment Form)

The general effect of the training is to induce an attitude of mind and a personal efficiency favourable to the happy management of life.

Send for Free Book

The Pelman Course is simple and interesting and takes up very little time. You can enrol on the most convenient terms. The Course is fully explained in "*The Science of Success*," which will be sent you, gratis and post free, on application to-day to:—

PELMAN INSTITUTE,
130, Norfolk Mansions, Wigmore Street, London, W.1

Established over 50 years. Callers welcomed

POST THIS FREE COUPON TO-DAY
To the Pelman Institute, 130, Norfolk Mansions, Wigmore St., London, W.1.
"*The Science of Success*" please.

Name ....
Address ....
....
....

PELMAN (OVERSEAS) INSTITUTES. DELHI: 10, Alipore Road. MELBOURNE: 396, Flinders Lane. DURBAN: Natal Bank Chambers (P.O. Box 1489). PARIS: 176, Boulevard Haussmann. AMSTERDAM: Prinsengracht 1021.

A professional TAPE RECORDER *for only* 32 gns.

-the remarkable **BURGOYNE**

DUAL TRACK TRANSPORTABLE TAPE RECORDER

We are proud to offer today's greatest value in tape recording. Now being demonstrated at the Radio Centre.

- 64 mins. playing time from a standard 7in. reel—dual tracks.
- Fast forward and rewind ● Instantaneous braking of tape reels.
- Record Playback changeover switch with visual indication of position.
- Supplied with Ronette high-fidelity crystal microphone.
- Frequency response 30-9,000 c/s at 7½in. per second.

Three heavy duty motors to obviate use of friction drives. Erase and bias frequency 50 Kc/s. Power consumption approximately 80 watts. Output 4 watts. All controls and inputs mounted on front of cabinet on handsome escutcheon plate. Bass treble controls for cut and boost operative on both record and playback. Separate radio and microphone inputs. *All accessories by Burgoyne, Lane, Ronette, etc., available separately as advertised.*

Speaker muting switch obviating feedback between microphone and speaker. High-grade P.M. speaker. Extension speaker sockets. Switching provided for use of amplifier for high-quality reproduction. Handsome polished walnut cabinet, overall dimensions 21in. x 13in. x 13in.

We recommend high coercivity tape by Burgoyne for use in this Recorder. 1,200ft. spool, 35/-; 600ft. spool, 21/-.

PRICE 32gns

PRICE 32 Gns. with crystal microphone or H.P. terms, £11.4.0 deposit and 12 monthly payments of 42/9. Carriage and packing, 21/-

DON'T take our word for it—come and HEAR this amazing instrument.

M·O·S

MAIL ORDER SUPPLY CO., *The Radio Centre*
33 TOTTENHAM COURT Rd., LONDON, W1
Telephone MUSeum 6667

Coronation!

EMBLEMS STATUARY
PLAQUES SOUVENIRS

In gold — silver — blue — bronze and other colours and shades as required.

Cast in Karlenite.

Plastic Marble

The entirely new Karlena artificial Stone for casting Emblems, Statuary, Plaques, Souvenirs and also Bookends, Ashtrays, Wall-vases, Statuettes, etc. Sets rock hard with a scintillating crystalline structure like marble or alabaster for colour, veining, texture, density and hardness. It is enormously strong, highly resistant to heat, impervious to water. Natural "veining" can be simulated in any colour. A range of pigments is available for this purpose. Most attractive marble effect in models, plaques, statuary and Coronation designs.

Elastomold

Rubber Moulds

ELASTOMOLD is high quality synthetic rubber for making flexible moulds that faithfully reproduce the most minute details of ornamentation and surface texture. ELASTOMOLD is permanent and ideal for repetition casting or plaques, bookends, ashtrays, and art models. Moulds can be taken from any type of material including Karlenite, wood, metal, plaster, cement, stone, glass, ivory. Elastomold is incredibly simple to use and has great dimensional stability, but flexes easily for the release of cast without damage to fine detail or undercuts.

Send for full details of our Coronation supplies and services and this new, fascinating and profitable craft

KARLENA ART STONE COMPANY LTD.,
PLASTICS 2.F. DIVISION,
KARLENA HOUSE, 270-272, OXFORD ROAD, MANCHESTER, 13

WILCO ELECTRONICS

BALL BEARINGS. No. EE2. ¼in. x ⅛in., 3/-, post free.
THRUST RACES. 13/16in. x ⅜in., 1/9, post free.
GOVERNORS. Suitable for small models, 2/6 post free.
SWITCH FUSES. Ironclad Revo. D.P. 30 amp., 250 volts. Brand new, 12/6, post 1/6.
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, £5.10.0. Post 2/-.
VOLTMETERS.—0-300 A.C. Moving Iron 3½in. Flush or Surface Type, 25/-; 0-20, 2in. Flush Moving Coil, 7/6; 0-40, 2in. Flush M.C., 10/6; post 1/-.
MOVING COIL METER with 1 M/A movement, 2½in. flush, rectifier type, scaled 0/100 volts A.C. Resistance 100 k. ohms. A very useful basic meter. 30/-, post free.
PORTABLE TEST METER. Just the job for the home constructor, in neat case, 6in. x 5in. x 4in., reading 1.5, 3, 150 volts, 6 and 60 m/a. D.C., 5 k. and 25 k. ohms. 37/6, post 1/6.
THERMOSTAT.—For frost protection, on at 34 deg. F., off at 49 deg. F., 1½ amps. at 250 volts, adjustable, 4/6, post 6d.
THERMOSTAT.—Bimetal type in sealed glass tube, 2½in. x ½in. 30 deg. Cent. Ideal for Aquariums, Wax and Oil Baths, Gluepots, etc. Will control 1 amp. at 210 v., 5/-, post 6d.
THERMOSTAT.—Satchwell 12in. stem, 0/250 v. A.C./D.C., 15 amps. A.C., .1 amp. D.C., 10 to 90 deg. Cent., 35/-, post 1/6.
PRESSURE UNIT MK.23/AP.—6in. x 4in. x 3in., contains a small compressor operated by a 27 volt D.C. motor with switches, fuse, indicator lamp, 10ft. of air line and 21ft. of twin flex in a flexible tubing, etc. American made. Brand new. Only 45/-, post 2/6.
POWER MICROPHONE INSERTS.—Truvox. Diam. 2½in. x 1in. 5/-, post 6d.
THROAT MICROPHONES.—American twin-button type with strap lead and plug, 5/-, post 6d.
HEAD SET ADAPTOR.—High to low impedance, 2/6, post 6d.
CLOCKWORK MECHANISM.—Precision made movement with contacts making and breaking twice per second, can be used for switching on and off lamps, etc. Brand new in sound-proof cabinet with thermostat temperature control. Ideal for flashing signs. 17/6, post 1/6.
HEADLAMP complete with Battery Case. Fits on forehead Leaves both hands free, 10/-, post 1/-.
VEEDER COUNTER 0-9999, 1in. x ¾in. x ¾in. Very useful, 10/-, post 6d.
RESISTANCE MATS.—Make ideal heating mats for Aquariums, Photographic solutions. Print dryers, etc. Mains voltage, 150 or 620 watts. Black heat, size 10in. x 6in., 2/6, post free.
AERIAL RODS.—12in. long, ½in. diameter. Any number of sections can be fitted together, 2/6 dozen, 6/- for 3 dozen, 11/- half gross, 20/- gross, £6 per 1,000.
SLOW MOTION DIALS.—6in. Scaled 0-100, reduction 200 to 1 or direct, ideal for wavemeters, signal generators, etc. Our price, while they last, 5/6, post 1/-.
FLASHING SWITCH UNIT with 6 contacts. Full rotation 60 seconds, operated by a Sangamo Synchronous Motor. 230 volts A.C. 2 watts. In metal case, 3in. x 2½in. x 2½in. 15/-, post 1/-.
INTERESTED IN FISHING?—Then send for one of our tapered whip aerials and make yourself a fine rod worth pounds. Consists of three tubular steel, seamless copper plated sections, 4ft. long, which screw into each other and are well finished, 7/6, carriage 2/-. (Eire, 6/6).
CUTTER HEADS.—"Recording" high impedance. A bargain at 55/-, post 1/-.
CUTTER STYLII, 6/- per doz., large quantity available at special rates.
PORTABLE ELECTRIC BLOWERS.—220/230 volts, 220 watts. Completely enclosed, 8ft. flexible hose and nozzle, 7 yds. C.T.S. Flex. Many uses where clean, dry air is required. £7/10/-.
ACCUMULATOR CHARGERS, 230 v. A.C., in black crackle case with fuses and meter, 6 and 12 volts at 4 amps. Bargain Price, £4/19/6. Pkg: and carr., 5/-.
ACCUMULATOR CHARGERS. Hand generator, delivering 6 v. D.C. at 4 amps., complete with automatic cut-out, in case, 16in. x 10in. x 7½in., 45/-, carriage 5/-.
"ELF" CIRCUIT BREAKER, 220 volts, 2 amps., size 3in. round, 10/6, post 1/-.
STUART PUMPS.—230 volt A.C. motor, will lift 400 gals. per hour 15 ft., £11/15/-, carriage 7/6.
24-VOLT D.C. MOTORS with double ended shaft 2in. x 3in., 8/6, post 1/-.
TWIN FLEX, in black braided covering, approx. 25-yd. coils, 7/6, post 1/-.
INTERCOM. CABINETS.—Solid back, polished all round, 15½in. x 9½in. x 6½in., with two 4in. circular frets for speakers and cut-out for control panel, 25/-, post 3/6.
TELEPHONE HAND SETS. Brand new with cord, 15/- each, post 1/6.
INERT CELLS, 1½ volts, size 2in. x 2in. x 5in. Just add water, last for years, ideal for Electric Bells, Telephones, Models, etc. Only 2/- each, post and pkg. 1/-, or 4 for 10/-, post free.
MASTS, TELESCOPIC. Extending to 12ft. in 7 sections. 15/6, post 1/6.

These are just a few of the items in our stocks. Send 6d. in stamps for comprehensive list giving full details of Potentiometers, Condensers, Resistors, Telephone Key Switches, Rectifiers, etc.

204 LOWER ADDISCOMBE ROAD, CROYDON

LETTERS TO THE EDITOR—

(*Continued from page* 210)

two or three plates drilled at once so that one can be in use whilst the others are being set up.

Such a process would be cheap and effective since the number of copies which could be taken off one set up is unlimited.—THOS. BROWN (Pendleton).

Westminster Door Chimes

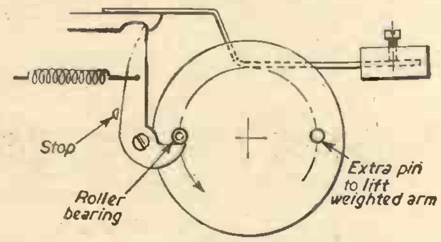
SIR,—With reference to your note on Mr. Murray's letter in the December issue. I constructed the chimes when they were first published, but only used half the chimes.

I have recently made a modification: by using a length of cycle brake cable with a push down lever on the door (in place of the bell push), I have been able to dispense with all the electrical mechanism.—H. I. LAMB (Surbiton).

SIR,—A short time after publication of the original article, I constructed these chimes. I have since placed a relay in the circuit ; which operates a buzzer some distance away. Should the chimes not be heard owing to the radio, or through the heavy counterweight being at lowest level, this buzzer can be heard in the sitting-room.—S. J. NUGENT (Forest Hill).

SIR,—In response to the note in the December issue concerning Westminster door chimes, I made a set, which has been in use about 13 months, giving no trouble.

I used a spiral spring as shown. I had great difficulty in effecting a balance between the spring and weight, etc., adjustments. I made a roller bearing to start the movement

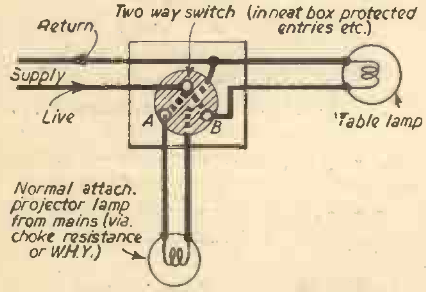


Mr. J. H. Burnie's modification to the chimes mechanism.

more easily, but this was not sufficient as the spring was too strong, so I weakened the spring, and as it did not pull the lever back in position I put an extra pin in the pulley, as shown in the sketch, to lift up the bar to allow the spring to pull the lever back in position. It now works very well.—J. H. BURNIE (Preston).

Projector Switching Device

SIR,—May I suggest an improvement in the arrangement for switching from projector to table lamp, as mentioned in answer to a querist in the December issue.



Mr. P. W. Sait's projector switching circuit.

Having built my own projector I housed the motor below the machine, so that the "base board" was really a box, the top of which gave me table surface on which I could mount a 5-amp mains, two-way switch of the *flush* mounting type. Although your reader does not require such a box he could have a small box on the table with cine, and leads between mains—projector to lamp, as called for in your two electrical diagrams. I fixed up a change-over switch, but with short leads to the table lamp (see diagram) as I provided this to illuminate the machine for film changing.

Instead of a "box" at the plug, the box is now on the table in much the same way as a remote control box for toy electric trains.—P. W. SAIT (Stratford, E.15).

Time Lag in Photo Cells

SIR,—With reference to F. Butler's letter on the above subject (December issue) the A.A.A. timekeeper who is interested in the electronic timing of races does not really require the high standard of accuracy provided by this equipment. Surely, if two runners finish within half a second of one another, they should be permitted to share the honour of winning.

The use of the photo cell in reproducing the sound track from the cinema film, proves that their is a time interval of much less than one hundred millionths of a second (100 microseconds). Therefore, we are far more concerned about the delay in the relay employed with the photo cell, since the mechanical relay cannot approach this speed of operation. Most G.P.O. type relays take at least five thousandths of a second to close after the application of the supply to the coil. Messrs. Siemens make a high speed relay with a delay of only 0.5 millisecond. The armature of the relay could be made to stop the watch escapement directly without introducing further time lags. It will, therefore, be seen that without further electronic improvement we already have a system with an accuracy better than the accuracy of the stop-watch it is operating. I cannot believe that a hand-held stop-watch, or even a temperature controlled watch, could give an accuracy of plus or minus one millisecond for the duration of a race. After all, the distance between the teeth of the escapement is greater than this.

There is an electronic clock in the Science Museum with an accuracy better than *one millisecond per day*. Its weight is about half a ton and it stands about 6ft. by 4ft. by 4ft. If the A.A.A. timekeeper would like to make one he could get details from the designer and he would need a lorry to move it about. I still think half a second is near enough, however.—C. H. BULMAN (College of Technology, Leicester).

Einstein's Theory

SIR,—Mr. C. W. Carr, of Eastbourne, seems to have chosen a very unfortunate book from which to study Einstein's Theory. The aeroplane analogy is quite sound, but the particular case suggested where the aeroplane and the wind have the same speed is ridiculous—one plane would never start, but the other could never get back! (This cannot, therefore, be the case in the Michelson-Morley experiment.)

Briefly, if "x" is the speed of the plane, "y" the speed of the wind and "a" the distance between the endpoints of the journey, then the time of flight in a direction parallel to the wind is

$$\frac{a}{x-y}+\frac{a}{x+y}=\frac{2ax}{x^2-y^2}$$

To fly a course at right-angles to the wind direction, the pilot must steer into the wind at an angle whose sine is y/x. The resultant speed along the course is then $\sqrt{x^2-y^2}$ (at this point it appears that x must be greater than y, for the journey to be possible). The total time of flight is then $\frac{2a}{\sqrt{x^2-y^2}}$ since the return speed is clearly the same as the outward speed. These two times of flight cannot be the same unless y=o, which is the deduction drawn from the Michelson-Morley experiment.

This is probably not the place to discuss the fact that the result of the Michelson-Morley experiment is not completely negative.—P. H. JACKSON (Buxton).

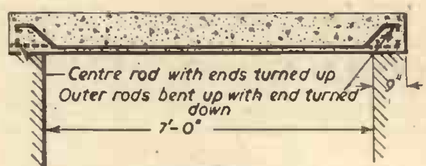
Reinforced Concrete Slab

SIR,—With reference to the reply to S. Beckett's query on page 130 (December issue), the mix of the concrete is incorrect, and the all-important quantity and positioning of the necessary reinforcement is not sufficiently clear.

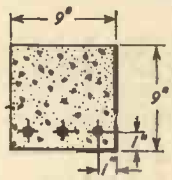
Reinforced concrete is quite suitable for spanning a 7ft. wide doorway and carrying the weight of wall and roof above.

The concrete mix should consist of one part Portland cement, two parts sand and four parts coarse aggregate (cracked stone, broken brick or similar) graded from ¼in. to ¾in. The dry materials should be completely turned over with a spade at least twice before adding enough water to make the concrete workable but not sloppy.

Three ½in. or ⅝in. mild steel rods should be used as reinforcement and bent and positioned as shown in the accompanying sketches. It is essential to well tamp the concrete around the reinforcement to ensure there are no voids in the lintel.



Elevation



The shape and position of the M/S reinforcing rods.

The formwork used to support the sides and soffit should be rigidly strutted to obviate deflection when the materials are placed inside. The formwork can be removed after 10 to 14 days, but by using a rapid-hardening cement this time can be considerably reduced. — U. J. COLE, A.R.I.C.S. (Plymouth).

SIR,—Under the heading of "Reinforced Concrete Slab," the use of ashes is suggested, which is considered bad in usual reinforced concrete work owing to the sulphur in the ashes having action on the steel or concrete. Horse hair is not necessary either, being only used in lime plaster.

A usual specification is as follows: 1 part of Portland cement, 2 parts of clean sharp pit sand free from loam or other impurities, and 4 parts of fine aggregate of clean river or pit ballast, or broken stone of a hard nature, to pass a ¾in. mesh. The proportions are measured by volume, and thoroughly mixed dry, then adding water mix again until of even colour and consistency throughout.

In this weather precautions should be taken against damage by frost.

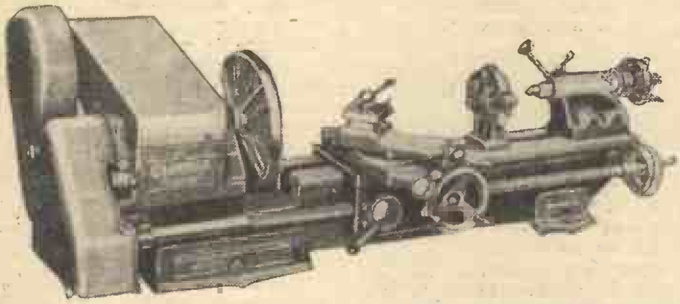
The reinforcement for concrete should be hooked at ends, and should be, for a simple beam, placed in the lower edge of the beam and have at least ¾in. cover of concrete.—A. E. HARVEY, A.R.I.B.A. (Oxford).

(*Continued on page* 214)

Trade Notes

Granville Senior 3½in. Centre Lathe

THE Burnett Machine Tool Co., Ltd., of Burnett House, Mytongate, Hull, are U.K. distributors for the Granville Senior 3½in. heavy duty centre lathe. This machine is of robust construction, having a cast iron bed, bronze headstock bearings, and most other parts of steel. All headstock gears are totally enclosed, and all movements are covered by guards, but are instantly accessible.

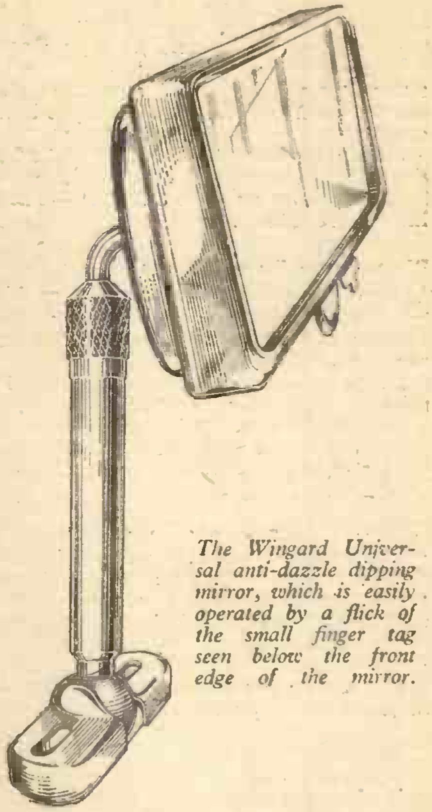


This view of the Granville Senior 3½in. heavy duty centre lathe gives a good idea of its robust construction.

A unit countershaft and drive is fitted which is compact, vibration free and simple. The bed is strongly ribbed, and is surface ground to fine limits. The wide deep gap allows a large and wide work swing. The saddle is of heavy cast iron construction, and has an 8½in. bearing surface ensuring smooth, easy action. The heavily proportioned apron is fitted with a unique method of ensuring smooth controlled movement. The leadscrew nut of ample size operates on the leadscrew by a scissor action through the ball-mounted steel cam handle on the front. The power required to drive this lathe is ½ h.p. Further particulars can be obtained from the address given above.

Wingard Anti-dazzle Mirror

THE above item is a new addition to the Wingard range of motoring accessories and one that drew considerable interest at the recent Motor Show. Several models are offered for individual types of vehicle, but the one illustrated is the universal type.



The Wingard Universal anti-dazzle dipping mirror, which is easily operated by a flick of the small finger tag seen below the front edge of the mirror.

Perfect adjustment in any position may be obtained by means of the swivelling arm and offset ball joint, and perfect rear vision may be obtained. The dipping device is operated merely by flicking the small finger tag on top of the mirror, thereby altering the plane of the glass. The mirror is set in an attractive chrome-plated mounting and is fixed to the car by means of screws.

Wingard Anti-freeze

THIS product has many points to commend it—it is non-corrosive and does not harm delicate thermostats, it is odourless, non-inflammable, non-volatile, and does not clog or rust. The anti-freeze is inhibited ethylene glycol and it is claimed that one filling lasts the whole winter. It is added to the engine's cooling system and gives protection against 35 deg. of frost; a "Do not empty" radiator safety tag is supplied free. The price is 66s. retail. The address of Wingard (M.A.) Ltd. is Chichester, Sussex.

Club Reports

The Bedford Model Engineering Society

THIS Society's Open Exhibition of Models will be held at St. Peter's Hall, St. Peter's Street, Bedford, on the 4th, 6th, and 7th April, 1953. The times are as follows: 4th—2 p.m. to 9 p.m.; 6th—10 a.m. to 9 p.m.; 7th—10 a.m. to 7 p.m. Entries: both Loan and Competition Sections by 28th February, 1953. Entry forms can be obtained from the Exhibition Secretary, Mr. G. B. Spurgeon, 61a, Goldington Road, Bedford.

K. BROWNRIDGE, Assistant Hon. Secretary, 18, Phillpotts Avenue, Bedford.

Birmingham Society of Model Engineers Ltd.

THE programme, of lecture and film shows for the second half of our winter session is as follows: February 4th—Mr. K. Williams, talk on his record-breaking hydroplane *Faro*, postponed from December 10th, 1952; February 18th—Film show, by Mr. T. Smith on T.T. Motorcycle racing and his experiences; March 4th—Mr. W. Finch, talk on Loco Design; March 18th—Annual General Meeting; April 1st—Mr. R. Phillips' talk on Plastics; April 15th—Open night. With regard to country members, this Society has great pleasure in announcing that applications can now be received from model engineers who reside outside a radius of 25 miles from the city centre, who shall be known as "Country Members." Entrance fee will be 10s., annual subscription, 10s. 6d. This entitles members to run locos at Campbell Green, use of pavilion, rolling stock, fuel, etc. Will all who are interested please write to the Hon. Secretary, R. PHILLIPS, 92, Gilbertstone Avenue, South Yardley, Birmingham, 26.

LETTERS FROM READERS

(*Continued from page* 213)

Close-up Photography

SIR,—I was very interested in F. G. Rayer's article on Close-up Photography in your October issue. He suggests any type of positive lens including the spectacle lens. I have for some time been using the latter for close-up snaps of young children. The lens used is a +1 diopter, i.e., 100 cm. focal length. I have found it admirable for the purpose, but if any reader wishes to try a spectacle lens there are one or two points to be watched if selecting the lens from old spectacles which many households possess.

Many users of spectacles have developed the careless habit of laying them lens down on the table, etc., and in many, the centre of the lens will be covered with numerous fine scratches, impairing the definition.

Another point worth noting is that spectacle lenses are also supplied for those who suffer from astigmatism. Such lenses have two different powers at right angles to one another. The simplest method of testing for this is to rule a line on paper, then holding the lens so as to magnify the centre portion of the line, to rotate the lens keeping it in the one plane. If the centre portion of the line, as seen through the lens, moves out of alignment then back, it is unsuitable for photography.

If, however, one obtains a lens of suitable strength, then it will be a very critical photographer who is not satisfied with the results.

A snap taken with the aid of a spectacle lens.

The only other reminder necessary is that the depth of focus is very limited with any attachment of this type, and accurate distancing of camera from subject is essential. The accompanying snap shows well the definition to be expected and the short depth of focus. It was taken at 24in. using a +1 diopter lens with the focusing ring set at 5ft.—G. A. MILLS (Glasgow).

When replying to advertisers' announcements please mention "Practical Mechanics"

Acclaimed by ambitious readers of PRACTICAL MECHANICS

NEWNES' Engineering Works Practice

Here is the great new technical publication which men in engineering are so enthusiastic about. They have examined and purchased it under this helpful Free Examination plan. It is just what they want—and it will help YOU, the forward-looking engineer or apprentice, to gain more knowledge and a higher position. Send to-day for Free Examination.

Basic Processes and Machines
Modern Methods and Materials
Production Engineering
Installation, Operation & Maintenance

Here is what you receive for Free Examination :

2,022 pages of invaluable information written by skilled engineers, many of them executives of world-famous engineering firms.

2,000 instructive works photographs, diagrams, perspective and working drawings, etc.

24 Unique Data Sheets, containing facts, figures, engineering drawings, special photographs, etc.

12 Instructive Wall Charts, presenting technical details in convenient form.

4 Volumes strongly bound in Rich Maroon Canvas Cloth.

1 Strong Chart Case, with pockets for Data Sheets and Wall Charts. Bound in cloth.

1 copy *Workshop Calculations, Tables and Formulæ*, a time-saving and work-saving pocket book for engineers.

2 Years' Free Technical Advisory Service.

Extracts from letters of appreciation :—

"Since I have had ENGINEERING WORKS PRACTICE I have shown a marked improvement in my work. The books are so easy to understand."
—*R. L. B. (London, N.).*

"These books are of great use to me, as I am a Maintenance Engineer, and they give me a good insight into Production Engineering of which I know very little. Thank you for the very excellent books."
—*A. S. (Staveley).*

"I am highly satisfied with the volumes of ENGINEERING WORKS PRACTICE."
—*W. J. H. (Shipley).*

JUDGE ITS VALUE TO YOU!

WITHOUT COST OR OBLIGATION

You are invited to examine ENGINEERING WORKS PRACTICE in your own home for 7 days free of charge. Fill up the coupon below and post to-day. No cost—no obligation to purchase. **HURRY !**

FREE EXAMINATION

To: GEORGE NEWNES Ltd., 66-69 Great Queen St., London, W.C.2.

YES, send me ENGINEERING WORKS PRACTICE.
It is understood that I may return the work within eight days. If I keep it I will send a first payment of 15/- eight days after delivery and 15/- monthly thereafter until the sum of £7 17s. 6d. has been paid.

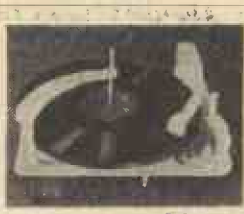
Name ....

Address ....

....

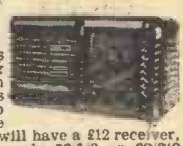
Occupation ....

Your Signature .... { HOUSEOWNER or TENANT (*Strike out one*) }
(If under 21, your Parent's Signature)
EWP1/2



AUTO RADIOGRAM UNITS

A special purchase enables us to offer a very famous manufacturer's auto gram units at little over half price.
Plays the new L.P. as well as standard records so is ideal for modernising old radiogram, size 12¼in. x 10¾in. clearance 5in. above, 3in. below deck. Modern attractive finish, capacity is 10 records mixed or same size, brand new and complete with two Decca lightweight pick-up heads. Price 11 gns., plus 7/6 carriage and insurance.



MAKE A RADIO

Using our parts in an evening you can make an all-mains 4-valve radio with bakelite case, then you will have a £12 receiver, which costs you only £6/1/6 or £2/3/0 deposit and 10 monthly payments of 10/6. Carriage and insurance, 5/-.

MAINS AMPLIFIER

Portable ideal for small dance band, singer ventriloquist, etc. Complete with hand microphone, built-in speaker, nothing else needed. 9 gns. or £3/4/0 deposit and 12 monthly payments of 13/9.

29 Gns. AUTO RADIOGRAM 29 Gns.

Full-size walnut. Console Cabinet. £11/10/0, plus 15/- carriage. Five-valve all-mains superhet radio, 3 waveband, coloured illuminated scale; fully guaranteed, £8/19/6, plus 7/6 carriage and insurance.
Auto-change unit by Collaro with pick-up for long-playing and standard records, £11/10/0, plus 7/6 carriage and insurance.
Special Offer : Three Units for 29 gns. or £10/14/0 deposit and 12 monthly payments of £2/3/0, plus £1 carriage and insurance. Booklet of photos, circuit diagrams, etc., 2/6 (returnable).

MULTI-PURPOSE MOTOR

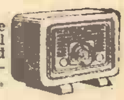
Works off A.C. D.C. mains or batteries, many speeds, many uses, including battery charging. Data given, 11/6 post and packing 2/-.

HANDY BATTERY THREE

Constructional data, showing how to make useful portable loudspeaker set (total cost 70/-, including cabinet) is available, 1/6.

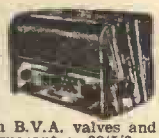
ELECTRIC CLOTHES HORSE

Warms room as it dries clothes—chrome plated rails A.C. or D.C., 650 watts, size 3ft. x 3ft. x 5in. Made to sell at 12 gns., fully guaranteed. Only £4/19/6, carriage 7/6.



CRYSTAL SET

Two waveband bakelite case, germanium crystal—gets "home" and "light" anywhere without batteries. 18/-, headphones 15/6 pair.



"ELPREQ" WOLSEY 5 VALVE A.C./D.C. SUPERHET

Long, medium and short waves, in handsome wooden cabinet, illuminated glass dial with station names. A.V.C. and usual refinements, size 11in. x 5½in. x 7in. with B.V.A. valves and built-in aerial. 12 months' guarantee, £9/5/0 or £3/2/0 deposit and 12 monthly payments of 13/6, plus 5/- carriage and insurance.

SOIL HEATER

Ideal for gardeners, helps plants along, germinates seeds, etc. Complete with wires, 47/6, plus 2/6 post.

BE PREPARED

For a cold winter by making our low cost Electric blanket. 27 yards of special heater wire and blueprint, 20/-. Blueprint only, 1/6.

ELECTRONIC PRECISION EQUIPMENT DEPT 1
42-46 WINDMILL HILL, RUISLIP, MIDDLESEX. • 152-3 FLEET ST. LONDON E.C.4

Come to Classic for All Your Tape Recording Requirements

TAPE DECKS, TAPE EQUIPMENT, COMPONENTS, AND COMPLETE TAPE RECORDERS, AVAILABLE FROM STOCK.

Agents for

	£	s.	d.		s.	d.
Wearite Tape Decks	35	0	0	Bradmatic Plate Coil ...	9	0
Bradmatic Tape Desk	42	0	0	Bradmatic M/U Screens	4	0
Truvox Tape Desk...	23	2	0	Bradmatic Guide Pillars	5	0
Lane Tape Desk ...	16	10	0	Bradmatic 6 RP Heads...	75	0
Simon 2B	60	0	0	Bradmatic 5 RP Heads	65	0
Scophony	65	0	0	Bradmatic 5E Erase Head	65	0
Ferrograph	79	10	0	Spare Spools (600ft.) ...	4	6
C.J.R. Portable ...	119	10	0	Spare Spools (1,200ft.)...	6	6
Qualtape Recorder...	16	16	0	Tapes, G.E.C.	35	0
Bradmatic Circuits...		5	0	Tapes, Scotch Boy ...	35	0
Bradmatic Osc. Coil		9	0	Tapes, E.M.I.	35	0

Hire Purchase and Credit Sales Facilities Available

CLASSIC ELECTRICAL Co., Ltd.
"The Hi-Fi Television Specialists"
364, Lower Addiscombe Road, Croydon, Surrey *ADD. 6061-6062*

QUERIES and ENQUIRIES

A stamped, addressed envelope, three penny stamps, 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.

Re-colouring an Ebonised Piano

I WISH to change the colour of the wood of my upright piano from its present ebony colour to a colour near to dark oak. What materials will I need and where can these be obtained? What is the best method? Will the ebony stain need to be removed first?—S. A. Cleare (Purley).

THE stripping and re-colouring of your ebonised piano case is not an intrinsically difficult job, although it will require care and patience.

First of all, the colour and polish must be removed completely down to the wood. Often the polish can be removed merely by scraping with the upturned edge of a copper coin. This does not injure the wood but, on the contrary, tends to burnish it. If this procedure is too slow the polish layer can be softened by means of ammonia, after which it can be scraped off. The aim, however, should be to wet the wood as little as possible in order to prevent any tendency to warp or to swell and thus alter its dimensions.

After you have got down to the bare wood the latter will require thorough sandpapering, first with coarse sandpaper, then with very fine sandpaper or glasspaper in order to get the smoothest possible surface.

You will then have to stain the wood and to re-polish it. Staining is done by dissolving a suitable stain of your choice in methylated spirit and then brushing it on to the wood. Possibly, two separate brushings may suffice, but several of the brushings may have to be undertaken before you get the precise shade which you require. As regards polishing, you may simply use an ordinary wax floor polish, this giving a dull sheen, or, alternatively, you may put a light shellac polish on and then finish off with the wax polish. If, however, you require a french polish, this is a highly-skilled job which can hardly be learned from any brief instructions which we might be able to send you. We would recommend, therefore, a light shellac polish wiped or brushed over the stained woodwork and then a wax polish. This will give a dull sheen on the pianoforte casework which will be easy to keep in good condition and NOT easy to scratch—two great advantages over the highly-polished piano cases.

When treating the "fall" or keyboard lid of the instrument, the very greatest care will have to be taken not to obliterate the maker's name which is stencilled or inlaid in a central position. Very careful scraping will be necessary here.

Your best plan would be to try out the method on an obscure part of the casework—say the inner part of the top lid. The few materials required can be obtained at any paint shop.

Fixing Locomotive Tyres

I AM interested in putting tyres on locomotives. Could you tell me what these tyres are made of, the allowance for shrinking and the various methods of locking them to the wheel centres? Could you also give me the name and author of any suitable book or literature on this subject?—William Graham (Croydon).

LOCOMOTIVE tyres are of crucible, open hearth or Bessemer steel. A disc is cut from the end of an ingot, the centre punched out and the ring thus formed is rolled to the correct section. They are then bored and machined in the lathe; the bore is of such diameter as will allow for a small amount of shrinkage. This shrinkage is usually about 1-100in. for each foot of diameter of the tyre. The tyre is then heated uniformly to black heat forced on to the wheel centre and allowed to cool by radiation; no water is used for quenching.

For security reasons, in case of tyre fracture, several fastenings of different types are used. Some designers adopt a dovetailed ring, embracing both tyre and wheel rim, whilst others use set screws passing through the rim and tapped into the tyre. In the book, "The Locomotive of To-day," published by The Locomotive Publishing Co., Ltd., 88, Horseferry Road, Westminster, S.W.1, Fig. 47 shows all of the tyre fastenings.

Silver Plating

CAN you inform me of a simple method of silver-plating or giving a silver-plated effect to brooches and small articles of jewellery, preferably without the use of a battery?—J. W. Clements (Middlesbrough).

NO true silver plating can be effected without the use of a battery. Immersion silvering (known technically as "whitening") can be effected by dipping the cleaned metal in the following solution:

Potassium bitartrate	80 parts.
Common salt	80 parts.
Silver chloride	Sufficient quantity.
Water	1,000.

In the above formula the silver chloride can be added in any amount—just sufficient to impart a silver content to the liquid. Silver nitrate may be used instead of the chloride.

The solution is used in the warm state. The deposited silver will be *white*—like that on a clock dial. It will *not* be lustrous and metallic-looking, and the deposit will be very thin and will not stand up to wear.

Silver-plating is quite easy, but the plating must be done from a silver *cyanide* solution, and, as you will be aware, all soluble cyanides are deadly poisons and are not easy to obtain. A good silver-plating formula is:

Solution 1:

Silver nitrate	2.5 grams.
Potassium cyanide	2.8 grams.
Water	50 ccs.

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.

Solution 2:

Potassium cyanide	7.5 grams.
Water	177.0 ccs.

Mix the above solutions.

Plate the work for about 3 *seconds* at 6 volts D.C. Then plate for half an hour at about 2.5 volts at a temperature of 77 deg. F. (25 deg. C.). The work to be plated must be made the cathode of the cell, and for the anode a rod or strip of silver. For this purpose *fine* silver (i.e., pure silver) is much preferable to *sterling silver* since the latter contains some copper.

Fine silver anodes may be obtained from Messrs. Wm. Canning and Co., Ltd., Great Hampton Street, Birmingham, but this, or any other firm, will not supply cyanides or cyanide solutions unless you are able to supply them with satisfactory references.

It might, we think, be easier for you to plate your small work with rhodium. This is a rare metal, but not too expensive for small working. For particulars of rhodium plating, its materials and appliances, write to Messrs. Johnson, Matthey and Co., Ltd., Hatton Garden, London, E.C.

Imitation Marble

I AM doing a small amount of plaster casting of small animals and birds, but in ordinary plaster they are not as hard as I should like them to be. Recently I came across some articles made in a plaster mixture known and resembling marble. I would like to know what the mixture consists of and the proportions required.—F. Halliwell (Blackpool).

YOU might try Keene's cement, which gives a hard set, permitting polishing with pumice. If you want to make imitation marble, complete with the "grain" in that stone, or veins, you can do this as follows:

Make the Keene's cement up to the consistency of cream in a bowl. Then put some in clean bowls and add a little colouring mineral matter to each bowl, leaving the main supply white. Dip a strand of twisted silk or other fibre into the coloured cements, and lay each coloured fibre on the inside of the mould, or if you want to make a slab, on the glass plate on which you intend to cast the marble. Add the remainder of the white cement gradually and then gently draw out the threads, which will leave coloured veins in the white. When set the resulting material will look like marble, that is if you do it properly, and can be polished.

Grease Paint Formulae

PLEASE give me some formulae for the manufacture of grease paints, for amateur theatricals.—A. E. Legg (Bristol).

AS you do not mention any specific colour of grease-paint which you wish to make, we give more or less "general" instructions, leaving the actual amounts of pigments to be decided by you after experiment.

The "base" of a grease-paint may consist, purely and simply, of mutton fat, admixed, perhaps, with a little vaseline, to soften it a little. We ourselves would prefer to use a 50-50 mixture of hard mutton fat and "benzoated lard" (i.e., a pharmaceutical preparation of lard treated with benzoic acid to prevent rancidity). The two should be melted gently together to ensure adequate mixing. Possibly a little vaseline will be needed to soften the compound sufficiently for easy application to the skin. Beware, however, of too much vaseline "softener," since this would make the paint "run" badly with the heat of the skin.

The pigments used for grease-paints must, of course, be non-poisonous ones. Yellows are obtained with yellow ochre, browns with burnt umber, very dark browns with raw umber, blacks with lampblack or ivory black (bone black) with, sometimes, a trace of blue, greens with chromium oxide, reds with rouge, blues with ultramarine, whites with zinc oxide or titanium oxide.

Usually the pigments are not admixed with the "base" at full strength. They are diluted or "extended" with a mixture of equal parts of zinc oxide and precipitated chalk to the tint required, after which they are mixed in with the base. Various colour blends may, of course, be made by mixing the various colours. The colours should be very finely ground and passed through a muslin cloth to remove all particles of grit. The colours should be free from damp before being admixed with the grease base. The "working" of the colour into the base can be done by hand, or by melting the base and stirring the colour in gradually. It is advisable to stir in, also, a few drops of perfume to overcome the fatty smell of the base. The material is finally moulded into sticks or into any other convenient form.

Toning Wallpaper

IS there any good method of staining or toning wallpaper, the pattern being imitation wood such as oak, walnut, etc.? These are usually light in colour and I should like to deepen them without losing the printed pattern of graining. If I put wood stain on, the paper just goes all one colour.—C. S. Brown (Redcar).

MAKE up a weak solution of shellac by dissolving 1 part of orange shellac in 1-3 parts of methylated spirit. Wrap a quantity of cotton wool or wadding in a bag made from a soft, fluffless fabric (similar to a french polisher's "small "rubber"). Using ordinary wood-stain, or mixtures of these, colour the shellac solution by dissolving the stains therein. Have the colour of the solution deeper than you would do ordinarily for brushing on to wood. Saturate the cotton wool in the bag with a small quantity of the dyed shellac solution. Hold the bag tightly between the fingers and gently rub it over the wallpaper firmly stretched out on a board, using a circular motion of the hand for this purpose. Continue this action until the wallpaper surface is wholly coloured to your requirements. By varying the hand pressure on the rubber and by prolonging the duration of the rubbing you will be able to get the paper to take up the shellac stain just as you desire, thereby darkening the colour in certain areas of the papers where the grain is not prominent and lightening the colour in other areas so as not to obscure the grain too greatly.

We would warn you that many of these spirit stains are anything but light-fast. The browns, particularly, fade rapidly, and almost completely decolorise on exposure to strong sunlight. The blacks, the greens and the reds are more light stable, but not infrequently all these colours gradually fade to a more or less uniform dirty-grey hue.

Glaze Finish of Plaster of Paris

I HAVE seen a number of plaster of paris articles, such as wall plaques, recently on the market which are very well finished with a hard, high gloss glaze resembling porcelain.

Can you tell me how this glaze is obtained ? My own theory is that the plaster has been dipped in plastic, but whatever the nature of the glaze, I would very much like to know the process in detail.—J. E. Booker (Ruislip).

THERE are various methods by which the glaze is put on to plaster of paris, but you have hit upon the commonest today, namely, plastic.

There are two prominent finishes, one containing "Bakelite" and the other containing a vinyl resin. The latter is widely used today for coating paper and other materials, to give them a high gloss, for covers or wrappings.

The simplest way to provide a high gloss finish with plastic is to use a plastic-based enamel, such as "Enamelit" (available at most cheap stores). No heat-treatment or curing is required.

Vinyl resins are used today for motor car body finishes and for high gloss furniture. The powdered crystals are dissolved in benzene or toluene and brushed on to the surfaces requiring finishing. One of the commonest of the vinyl resins is Polyvinyl chloride, or, as it is called in the trade, P.V.C. Plastic curtains and sheeting are usually made from P.V.C.

Cement Filling

I WISH to seal gaps between door frames and brickwork of the outside walls. Can you suggest a not-too-expensive compound ? Perhaps one I could make up myself.—R. Jarvis (Liverpool).

FOR weatherproof qualities and strength it would be difficult to beat Portland Cement. This cement tends to expand when it sets and so you should not have any shrinkage with time. For your purpose you should mix one part of cement with three parts of sand, as this will not shrink, whereas if you use too little sand there may be some shrinkage.

If you want a white filling for the door and wall, you can make this with cement, silver sand and a little whiting. Use the mixture as a stiff paste. If you want to colour the cement mixture to match the brickwork, use a little of red oxide, if the bricks are red, in place of the whiting. Barium chromate or yellow ochre will give yellow colours, while if the brickwork is between red and yellow blend some red oxide and yellow ochre before mixing into the sand.

If the gaps to be filled are small and do not call for more than a few ounces of material you should buy a tin of household cement from the ironmonger, or a proprietary plaster, of which there are various kinds which require merely water for mixing.

Installing a Damp-course

WOULD you advise me about a bungalow which I have discovered has no damp-course ? Damp rises through the cement floors to make the linoleum beneath the carpets mildewy, and ruins to varying degrees all forms of interior decoration. Would a 6ft. trench round the bungalow drain off the water which comes down from higher ground, or should I invest in a properly-laid damp-course, in spite of the expense and weakening of the structure ?—W. B. Hubbard (St. Leonards-on-Sea).

WE are afraid that your suggestion for digging a trench would not in any way cure, or even ameliorate, the uprising dampness from which your bungalow suffers in consequence of its lack of a damp-course, for the dampness would rise directly from the ground through the bricks in just the same way as it would if the trench were not made.

Troubles caused by inadequate damp-coursing are very widespread in this country. In fact, it is only within living memory that the provision of damp-coursings was made legally compulsory in all buildings.

There is no way out of your present problem other than the insertion of a damp-course. We agree that this is frequently made by builders and contractors a quite unnecessarily expensive job, but, at the same time, it is quite untrue that the insertion of a damp-course in any way weakens the building structure.

The job is one which you can do yourself if you have the available time and energy, and if you will go to the trouble of consulting one or two books on building construction previously. In principle, the provision of a damp-course is simple enough. One course of bricks is removed from the wall, at just above the ground-level of the building. There must be a complete removal of the brickwork from both the inner and the outer walls. Only a foot or so of the wall need be treated at a time. After the brickwork has been removed, a strip of good-quality bitumen felt is laid down over the top of the lower portion of the wall thus exposed and the upper bricks are inserted, and mortared up again. The next foot or so of wall is then treated similarly, and so on until the whole building has thus been treated.

If you do the job yourself, you will find that the actual material costs are very small. On the other hand, if the job is evaded in any way, the uprising damp will never be cured, no matter what methods are reverted to. If the bitumen felt strips are joined in any place, the join must be a well-overlapping one and not an edge-to-edge one, for, in the latter instance, uprising dampness would most likely penetrate through the join and give rise to damp areas in the wall, whereas with an overlapping joint this cannot possibly happen.

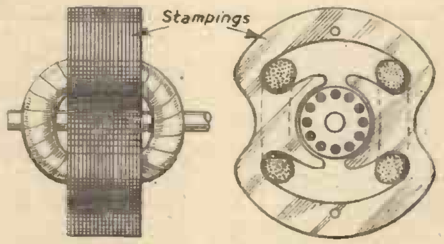
Of course, for a professional builder or contractor the job is simple and straightforward enough, and his charge for it should not be high.

Rewiring Coils of Fractional h.p. Induction Motor

I POSSESS a small rubber-bladed electric fan, domestic type, which runs on the domestic supply, 230 volts A.C. After giving good service the two coils on stator have shorted badly and require renewal. I have attempted to wind two new coils on an appropriate squarish former with 36 g. enamelled copper, but am not sure of the connection (a) between these two coils and (b) from coils to mains. I wound 800 turns on first coil, taking outer end to inner end of second coil and 800 turns on second. The remaining inner and outer ends are connected to mains through small switch on fan case. The only result was a "transformer" buzz and a general heating up of whole motor, but no rotation.

Please inform me of the correct number of turns and weight of wire per coil, the connection to bridge the gap between coils, and the connections from coils to mains, and any other points that will be useful.—A. Stringer (Manchester, 14).

WE think that you would be well advised to use more turns per coil, say about 1,400 turns per coil if these can be accommodated in the available space. The two coils should be connected in series with each other across the mains in such a way that the two poles have opposite magnetic polarity. In order to achieve this the direction of current circulation through the two coils when viewed from inside the motor must be opposite. If both the coils are wound in the same way the outer end of one coil should be connected to the inner end of the other coil, whilst the remaining inner and outer ends are fed from the mains. If your connections are correct the motor should accelerate up to 2,800 to 3,000 r.p.m. when spun round by hand before switching on.



Diagrams of Mr. Stringer's motor to be rewound.

We would point out, however, that the motor will not be self-starting when switched on unless the tips of the pole faces are specially shaped so that the air gap clearance between one part of each pole face and the rotor is greater than between the other part of the pole face and the rotor, or each pole has a copper shading band which encircles a part of the pole face. If the air gap clearance is uniform, or practically uniform, we suggest that you try winding a few turns of 22 S.W.G. bare copper wire round two diametrically opposite pole tips, the ends of the wire being twisted together to form a short-circuited loop on each pole. The loop should encircle about one-third of each pole face. Do not use any more short-circuited turns than are necessary to render the motor self-starting.

Restoring Stained Negatives

I ENCLOSE some photographic negatives, exposed some two years ago, which have reached their present stained condition owing to insufficient fixing or washing at the time of development. Could you advise me on how the negatives may be restored or, failing this, how deterioration may be arrested ?—C. H. Thomas (Nr. Huntingdon).

IT is a pity that your very excellent film negatives have become so greatly stained. In our opinion this is due to fixing the negative in an impoverished hypo bath which was probably badly contaminated with developer owing to insufficient rinsing of the negatives between development and fixing.

These negatives should be well washed in running water for half an hour. After this, they should be transferred to a freshly-made acid fixing bath for fully a quarter of an hour, and finally washed for one hour. It is possible that this procedure may remove the stain. At least, it will prevent further deterioration.

To remove the stain, if it survives the above refixing treatment, immerse the refixed and thoroughly rewashed negatives in either of the following baths:

Common alum	1 oz.
Water	20 oz.
Citric acid	½ oz.
(or hydrochloric acid, 1 dr.)	

Water	2 oz.
Hypo	2 dr.
Thiocarbamide	20 grains
Sodium bisulphite	1 dr.

The immersion may be prolonged up to half an hour. Afterwards, well wash and dry the negatives. If the stain survives this treatment, it is indelible—at least so far as any safe treatment is concerned.

Cleaning Bird Cages

HAVING a number of bird cages to clean, repair and repaint, I wondered if a bath of caustic soda would do the cleaning. The cages are made of hard-drawn steel wire and tinplate, spot welded or soldered together. What proportion of soda to water should be used and of what should the container be made ? Should the bath be used hot or cold ?—C. Chapman (Welling).

A SIMPLE and easily available method of degreasing the bird cages would be to apply, with a rubber "brush", one of the proprietary preparations sold for cleaning cooking ovens. These are usually based on caustic soda, and when applied to the cage need only be left on for an hour or so, then washed off with water. Care should be taken to see that all traces of the degreaser are removed, and systematic water washing will usually ensure that.

As you are not sure about the joints on the wire you should first of all try out the above caustic with care to see that the solder is not attacked. Such a preparation would not attack welded joints, while certain solders would also be unaffected by caustic soda.

If you do not wish to use the cooking-oven type of degreaser and cleaner you can make up a weaker solution by dissolving about 1 lb. of washing soda in about one pint of hot water. Excess soda may crystallize out when the solution gets cold.

Painting Hot-water Pipes

I WOULD be greatly obliged if you would advise me on the following problem :

I have recently had a washbasin and the usual lead outlet pipes and copper or copper alloy water pipes and brass joints installed in my bathroom. I want to paint them if practicable to match the colour scheme. I have tried aluminium paint on the copper pipes in the kitchenette, but it soon turns green. I have also tried white-lead undercoat on the lead pipes, but that flakes off. What do you advise ?—R. V. Owen (St. Albans).

A PROBLEM with pipes which may carry hot water is the expansion that takes place. If the pipe expands much differently from the paint which has been applied, the latter may tend to flake off. In general, there should be no difficulties in providing a finish on lead and copper pipes, and the green discolouration of the latter when painted with aluminium is possibly due to the formation of a copper compound which comes through the aluminium coating. It is not advisable to use aluminium paint on copper.

If you use two coats of a good quality oil-bound paint you should have no difficulty in applying an adherent finish. It is important to use the best quality paint, which forms slightly elastic compounds when dry which will permit a certain amount of stretching with the pipe when hot water passes through the latter. Rub down the copper and lead pipes well before applying the paint. Above all, do not allow hot water to run through the pipe for about 24 hours, otherwise you will dry the layer of paint next to the metal too fast and cause poor bonding and adhesion.

Calcium Chloride Humidity Control

I UNDERSTAND that calcium chloride can be effectively used in controlling humidity. I wish to apply its use in a workshop and garage to stop mould, mildew and rust, where no form of heating is available or practical.

Could you suggest how it can be applied, and whether there is some sort of apparatus involved ; also, what is the amount required per cubic foot of space ?—Alan Lewis (Yorks).

CALCIUM chloride is used to control humidity. It is a very hygroscopic substance—that is to say, it soaks up water from the air, but its use in your garage workshop will not be effective in reducing damp. To be able to use an air dryer of the chemical type like calcium chloride one must pass all air into the garage through it. There must be no other ingress.

To ensure dry air inside a building at all times it must be passed in by fan through a large container holding silica gel, which is more up to date than calcium chloride, and not corrosive to metals like the latter. This is, in effect, air-conditioning.

If, however, you want to keep things dry in a cabinet, silica gel or calcium chloride would help, provided the door of the cabinet were a good fit (not necessarily a hermetic seal).

To keep the air in a workshop dry at all times you should keep the air at slightly above the prevailing temperature outside, which means some heating device. This will eliminate dampness due to air, as opposed to leakages. This is often easier than air-conditioning with chemicals.

READERS' SALES AND WANTS

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

SITUATIONS VACANT

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, excepted from the provisions of the Notification of Vacancies Order 1952.

OPPORTUNITIES in Radio and Television Servicing.—Full-time theoretical and practical 1-year courses at E.M.I. Institutes in London. Job assured on successful completion. Next course commences April 14th. Early enrolment is advised. Free brochures giving details of these and other courses from E.M.I. Institutes, Dept. PM36, 10, Pembridge Square, London, W.2. (Tel.: BAYswater 5131/2.) (Backed by H.M.V., Marconiphone, etc.)

COLLECTORS

BECOME A POSTER STAMP Collector. Poster Stamps can be educational, instructive, informative, and always interesting. They are sometimes printed in series, cover a variety of subjects, and are mostly in beautiful colours. Send stamped addressed envelope for free sample and details to: Poster Stamp Collectors' Club, Dept. P.M.C., 177-8, Fleet Street, London, E.C.4.

PATTERN MAKING

SMALL WOOD PATTERNS made to clients' own drawings. Orders promptly executed. 26, Briton St., Glasgow, S.W.1.

INSTITUTES

EVERY APPROVED CANDIDATE graded in the Technical Engineering and Allied Classes (administrative, executive, technical) is eligible for membership of the Institute of Executive Engineers and Officers; admission fees reasonable. Give age, industry and post held for full particulars of entry to the Secretary, Executive Chambers, 241, Bristol Road, Birmingham, 5.

EDUCATIONAL

A.M.I.Mech.E., B.Sc., CITY & GUILDS, Etc. Guaranteed postal courses for all Exams. and Technical Divisions from Elementary to Degree standard. Approximately 95% successes. 144-page prospectus free on request. B.I.E.T. (Dept. 967), 17, Stratford Place, London, W.1.

FREE! Brochure giving details of courses in Mechanical and Production Engineering, Draughtsmanship, etc., for the A.M.I.Mech.E., A.M.I.P.E., City and Guilds, and other Professional examinations. Train with the Postal Training College operated by an Industrial Organisation; moderate fees. E.M.I. Institutes, Postal Division, Dept. PM30, 43, Grove Park Road, London, W.4. (Associate of H.M.V.)

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.

FOR SALE

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

TRANSFORMERS, for trains, welding, low voltage lighting, battery chargers, etc.; all transformers fitted with "earth protection" screen, "play safe." Write or phone your requirements to F. W. Whitworth, A.M.Brit.I.R.E., Model Dept., Express Winding Co., 333, London Road, Mitcham. (MIT. 2128.)

HIRE PURCHASE your new Myford or any other new machinery from Rentweld, 94, Camden Road, London, N.W.1. Also 6in. Bench Grinders, with 2 years' guarantee, £16/5/-.

ELECTRIC MOTORS: B.T.H., 230/240, ¼ h.p., 1,425 r.p.m., Electric Motors, new and unused, £5/5/- ea.; Cub Motors, 1/6th h.p., 1,420 r.p.m., 230v. A.C. flange fitting, new and unused, £4/10/- ea.; Miniature 12v., A.C. D.C. Motors, ideal for small models, etc., size 2½in. long by 2in. by 1¼in., 10/- ea.; Fluorescent Ballast Units, brand new, no starter required, with full wiring instructions, 35/-, requires lamp holders and tubes only to complete; bi pin Holders, 2/6; 40w. Tubes (callers only), 12/6; Single 40w. Ballast Units, used, but guaranteed, with wiring diagram and new starter, 19/6; Speakers, 8in. P.M., 5 ohm., ex Government, in totally enclosed cabinet with handle, 25/-; Vent Axia, 24v., 6in. fans, new, with bakelite casing, 45/-. Postage extra on all goods; s.a.e. for lists to Harringay Photographic and Electrical Supplies, Ltd., 423, Green Lanes, Harringay, London, N.4. (Telephone: Mountview 2054.)

ELECTRIC ARC WELDERS; unused surplus, from £21, complete. S.A.E. for list. Harmsworth Townley & Co., 1, Brook Road, Manchester, 14.

COMPRESSORS, ex. WD. twin cylinder, 8 cubic foot capacity, 1½in. and 3in. bore by 3in. stroke; new condition; £6/10/-; s.a.e. details. Thread Profile Gauges, 28 arms, all calibrated, in clip, 4/9. Small copper Rivets, 12 dozen, assorted, 1/3. D. M. Rogers, 2, Matlock Avenue, Southport.

MAHOGANY PLYWOOD, any parcel, £1, delivered, c.w.o.; following new, 4 at 78 x 11½ x 3/16in., 14 at 23 x 14 x 3/16in., 17 at 20 x 14 x 3/16in., 20 at 17 x 14 x 3/16in., 12 at 78 x 5½ x 3/16in., 24 at 78 x 3¼ x 3/16in., 40 at 78 x 2¼ x 3/16in., 8 at 36 x 12 x ⅛in., 10 at 60 x 6½ x ⅛in., 15 at 42 x 6½ x ⅛in., 12 at 18 x 13 x 5/16in., 10 at 60 x 5½ x ⅜in.; following one side slightly glue stained, 5 at 29 x 23 x 3/16in., 7 at 23 x 23 x 3/16in., 16 at 47 x 9 x 3/16in. M. Leader (1920), Gosford St., Middlesbrough.

EXPOSURE METER PHOTO-CELLS, 45mm. dia., 10/-; all sizes in stock; Exposure Meter Kits; s.a.e details. G. R. Products, 22, Runnymead Avenue, Bristol, 4.

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

SYNCHRONOUS CLOCK MOTORS, 230v. A.C. S/Ph 50c., 12/6 each, plus 1/-. Postage Universal Electrical, 217, City Road, London, E.C.1.

SHIPS IN BOTTLES, complete instructions, plans and unfinished parts; p/f 4/3. Gardner, 23, Wallbutton Road, Brockley, London, S.E.4.

POWDERED GUM ARABIC, 120lb. bag, £5; Leather Pouches, 9in. deep, 5½in. x 3½in., 36in. leather strap attached, 3/6 each; Bostik, 8/6 drums 5/6; Cellulose Paint, green stone, red, brown, blue, 5 gallon drums, 75/-; Metal Sheets, perforated 1/16in. and 3/16in. holes, 35in. x 24in., 7/6 sheet; Wire Mesh Sheets, 27in. x 10in., 3 square mesh per inch, 2/-, 25 for 30/-; Rubber Mats, 30in. x 40in. x ⅛in., 24in. x 36in. x 3/16in. thick, 6/- each; fabric covered Air Tubing, I/D, 10 yds., 12/6; red rubber Tubing, I/D, 100ft., 15/-; once used Carton, 12in. x 9in. x 8in., 1,000 lots, 4d. each; smaller lots, 6d. ex works. Batley & Co., Stockport.

FLUORESCENT 80w. brick Choke, 220/230v., with circuit for 5ft. tube, 17/6. 6 and 12v. Car Battery Chargers at 2-amps., complete, guaranteed, 45/-. Metal Rectifiers, 6 and 12v. at 2 amps., 8/9. Rotary Converters, 12v. or 24v., D.C. input, giving 250v. at 60m/a and 6.3v. at 2.5 amps., 8/6. Malden Transformer Supplies, 200, Cambridge Road, Kingston, Surrey. (KIN. 5501.)

NUTS, BOLTS, SCREWS, Rivets, Washers and hundreds of other items for model engineers and handymen. Send now for free list. Whiston, New Mills, Stockport.

SACRIFICE!!! 8/1 ratio enclosed Worm Reduction Gears with vee pulley, £1 each; limited number only available. Bellangers, 306, Holloway Rd., London, N.7. (North 4117.)

ANTI-RADAR Strip Dispenser Units. These comprise 2 1/20th h.p. 24v. shunt wound motors, with train of gears, both 25 and 50 to 1 reduction. The unit is mounted in an aluminium chassis and consists of over 100 gears, pinion shafts, etc., of the Meccano pattern, with variable speed switch and indicator light, bag of spares, and electrical diagram. These are all new and in original waterproof packages. They are something entirely new, and never been offered before. Price 30/- each, carr. paid. H. Middleton, 639, Abbeydale Road, Sheffield, 7.

GOING ROUND CORNERS? Of course I am; and using my Hacksaw equipped with Tyler Spiral Hacksaw Blade; 10in. Blades 4d. each. Write to Spiral Saws Ltd., Trading Estate, Slough, for full details.

C. J. EMMS LTD. for Selenium full-wave bridged Rectifiers, 6 or 12v., 1 amp, 5/6; 6 or 12v., 2 amp, 10/-; 6 or 12v., 4 amp, 15/-; 6 or 12v., 5 amp, 17/6; 6 or 12v., 7 amp, 22/6; 24v., 1 amp, 11/-; 24v., 4 amp, 30/-. 26A, Coleherne Mews, Earls Court, London, S.W.10. (FRE. 8941.)

TOY CASTING MOULDS, soldiers, sailors, airmen, animals, etc.; catalogue, 9d.; Moulds for Plaster-work, plaques, ornaments and Coronation souvenirs. Moulds from 3/6 ea.; catalogue, 9d.; s.a.e. for list. F. W. Nuthall, 69, St. Marks Road, Hanwell, London, W.7.

CYCLE ENGINES.—Britain's foremost Cycle Engine specialist, Bob Sergent, Moorfields, Liverpool. The obvious place for all the best cycle engines and accessories, Mosquito, Minimotor, Bantamota, Cyclemaster, Cucciolo, etc. Immediate delivery for cash or on terms to suit everyone; any queries answered with pleasure by experts and illustrated lists sent per return. Sole distributor for the superb "Alfa" Spring Cycle Fork; fit one now to your cycle for greater comfort and added safety, will fit any type or size of bicycle; 97/6; carriage paid. It will pay you to deal at Bob Sergent, Ltd., Liverpool. Open Saturday 6 p.m.

SHIPS IN BOTTLES.—The constructional kit that tells you how to make them; build for pleasure or for profit; kits 6/- ea. from Hobbies Ltd., and model shops. Cooper-Craft Ltd., The Bridewell, Norwich.

BARGAIN LINES.—Collaro 3-speed Autochangers, play 10 10in. or 12in. records at 33⅓ or 78 r.p.m., also 7in. at 45 r.p.m. Our price £12/8/2; Single-speed ditto, £9/17/4; P.U. Heads from 39/5; Decca 3-speed Gram. Units, complete with pick-up and autostop; price £8/8/-; Portable Record Player Cabinets, in brown rexine, 39/6; Portable Microgram Cabinets, take gram unit, amplifier and 6½in. speaker; price 62/6; "Symphony" Amplifier for A.C. mains, amazing realism, separate bass, treble and middle controls, scratch-cut, negative feedback, 5-watt model, 10gns.; 10-watt model, 15gns.; Bass Reflex Cabinet Kits, 30in. high, complete to last screw, 85/- to 107/6. Send 2½d. for full catalogue. Northern Radio Services, 16, Kings College Road, Swiss Cottage, London, N.W.3. (PRImrose 8314.)

REJUVENATE your Water Softener; New Zeolite, 2/3 lb.; 10lb., post paid. C. G. Nelson, 118, Anchorway Road, Coventry.

THE "E.W." CONVERTIBLE, 2½in. x 8in. lathe, fully convertible from plain lathe to hand traverse, brack-gear and screwcutting; price from £13/4/-. Ideal for beginner or expert; immediate delivery—credit terms. Send 2½d. stamp for fully illustrated leaflet. Wanstead Tool Supplies, 48, High Street, London, E.11.

FLEXA ELECTRIC DRILL, with 6ft. flexible shaft, new, £3/15/-; 230v. single-phase; carriage 7/6; illustration available. Wilton, 92, Toynbee Road, Wimbledon, S.W.20.

SAW BENCHES, 7in. £4/15/-, 8in. £5/10/-; Combination Lathes, £10; Planers, £9/10/-; Motors, Spindles. Send 4d. stamp for complete illustrated booklet. H.P. available. James Inns (Engineers) Marshall Street, Nottingham.

LENS WORKERS: Supplies of Abrasives. Lists available. Mason & Gantlett Limited, 3, Orford Place, Norwich.

TIMBER cut to your requirements. We cut and prepare timber to your cutting lists; Hardwood and Plywood free of licence. We carry a large stock of imported Hardwoods, Hardboard, Plywood, Plain and Pressed Mouldings, also Turned Legs and Brassware, etc.; Plywood offcuts in stock, all sizes. Timber: Austrian Oak, Jap. Oak, Beech, Mahogany, Ash, etc. Send cutting lists for quotation; s.a.e. Parcels of plywood offcuts suitable for Toys, etc., 5/- and 7/6; Oak Face Boards, 60 x 48 sheets of 4 mm. Ply at 1/6 per sq. ft.; carriage extra; we also have large sheets in stock. Mail orders promptly executed; Joinery work undertaken. Open all day Saturday—early closing Thursday. General Woodwork Supplies, 78, Stoke Newington High Street, London, N.16. (Phone: Clissold 6052.)

2IN. ASTRO. TELESCOPE KITS for simple assembly, comprising: selected 50 mm. dia. objective at 40in., focus mounted in special adaptable cell, sensitivity and correcting stop, turned eyepiece, focusing mount, 1in. focus eyepiece, magnification, 40 diameters (equivalent 1,600x area), shows lunar detail, rings of Saturn, etc.; with large explanatory drawings; price, 32/6; post, packing, 2/6; Unmounted Lens Set with drawings; price 17/6; post, 6d.; thoroughly tested.—Below.

ATOMIC KITS. Reveals actual splitting of atoms, alpha particle bombardment, etc., harmless, lasts for centuries; specially prepared micro slides with built in nuclear emitter and target screen, with 100x area microscope and instructions; 9/6, post 6d.; without microscope, for use with own; 5/6.—Below.

POLARIZING SCREENS. Adaptation to microscopes, telescopes, etc.; Laboratory grade, 2/6 pair; mounted with Experimental Specimens, 4/6; post 3d. J. K. M. Holmes, Scientific Instruments, Dept. P.M.1, "Vizcaya," Wolveleigh Tce., Gosforth, Newcastle-on-Tyne, 3.

WEAVING for pleasure or profit; 6d. for illustrated booklet, "The Hand Loom." Douglas, P.M., Andrew, Canterbury.

DUPLEX Decorative Transfers, Coronation Transfers, Trade-marking Transfers. List and samples, 6d. "P.M.," Axon Harrison, Jersey.

CASTING MOULDS for lead soldiers, animals, etc.; complete catalogue, 6d.; sample mould, 5/-. G. F. Rhead, Hartest, Suffolk.

INVALUABLE to all model makers, handymen and home mechanics! The "Britinol" Self-blowing Pocket Blow-lamp; price 7/6; post free from Bi-Metals (Britinol), 1, Balfour Mews, Bridge Road, London, N.9.

FOR SALE, brand new single phase 50 cycle 1425 r.p.m. Electric Motors with inbuilt auto reset thermal overload releases, silent sleeve bearings, resilient mountings and steel bases. Hoover 220/230 volt Capacitor type, 1/6 h.p., £4/5/- each; Hoover 200/210 volt Capacitor type, 1/6 h.p., £4 each; Crompton 230 volt split phase type, 1/6 h.p., £4 each; above are brand new in original cartons; also a few at 5/- each less than above prices, which are new but removed from cartons; also a few of 100/110 volts, 120/125 volts and 127/130 volts at £3/10/- each; also a few 100/200 volt and 110/220 volt ¼ h.p., Wagner split phase motors at £3 each. Prices include for delivery in England. W. H. Collingbourne & Co., Ltd., 1481, Stratford Road, Birmingham, 28. (Phone: Shirley 3303.)

HOBBIES

HOBBYISTS, handicraft workers, send 6d. stamps for our illustrated catalogue, "Perspex" Jewelcraft, Flowercraft, etc. Newing & Co., 96 Grove Vale, London, S.E.22.

MAKE MONEY MAKING TOYS.—We supply all the parts in best quality Plywood, all ready to assemble; list free. Elf Manufacturing Co. (Dept. P.), Mitton Mill, Stourport-on-Severn.

SPECIAL OFFER

EX-A.M. COMMUNICATION RECEIVER TYPE R.1155.—Complete with valves and despatched in wooden transit case. Tested before despatch, guaranteed in good order. £10 each, plus 10/- carriage.

POWER UNITS FOR 1155.—12 or 24 volt operation. Type 35 and 35A. Please state which voltage required. £3/19/6 each, plus 10/- carriage and packing.

POWER UNITS FOR 1154.—12 or 24 volt operation. £3/19/6 each, plus 10/- carriage and packing.

POWER UNITS FOR A.C. MAINS 200-250 FOR 1155.—£6 each, plus 10/- carriage and packing.

POWER UNITS FOR 1154 A.C. MAINS OPERATION.—£6 each, plus 10/- carriage and packing.

EX-A.M. ENGINE-DRIVEN GENERATORS.—12 and 24 volts from 500 to 2,000 watts output. Please state exact requirements. 35/- each, plus 7/6 carriage and packing.

THERMOSTATS in glass envelope with S.B.C. connection. Operate at 97 deg. F. at approx. 7½ amps. Ideal for fish tanks, temperature ovens, etc. 3/- each, plus 3d. postage and packing.

BATTERY CHARGERS by Davenset, 12 volt at 5 amps. A really good robust charger, sliding resistor, for current control, and meter incorporated. £7 each, plus 10/- carriage and packing.

DUAL WAVE CRYSTAL SET COILS complete with circuit. 2/6, plus 3d. postage and packing.

DUAL WAVE COILS, complete with circuit, for 1-, 2- or 3-valve sets. 4/- each, plus 3d. postage and packing.

SIGNALLING LAMPS, red, green and white, takes standard flat battery. Brand new and unused, ideal for Scouts, Guides, Cadets. 3/6 each, plus 9d. postage and packing.

Trade Enquiries Invited.

J. H. DAKIN
13 CHURCH ROAD · EDGBASTON
BIRMINGHAM · 15

ELECTRIC MOTORS with Gearbox attached, can be driven off 230 v. A.C./D.C. or 24 v. D.C., or if driven by power (wind or water) will generate above voltages. Motor can be adapted for many uses. Price, with comprehensive instruction sheet, 24/-, post 1/11. Sheet separately, 2½d.
B.S.R. & DECCA Gramophone Motors with turntable, but less pick-up. 230 v. A.C., 2-speed 78 r.p.m. and 33⅓ r.p.m., £3/18/6, plus postage and packing 1/11. Suitable pick-ups from 35/10. Many other 'gram units in stock, including autochangers; all brand new, not surplus stock. Send 2½d. stamp for details.
ELECTRIC BLANKET for comfort on cold nights can be made in no time with our warming unit, 200-250 v., 40 watts. Heats up in ten minutes, and is safe to leave on all night if you wish. Price 35/-, post 1/6. 2½d. stamp will bring you details.
VIEWMASTER TELEVISION FOR THE CORONATION. The Viewmaster envelope contains seven full-size working plans for easy screw-together television. Guide book gives complete price list and shopping lists for the various stages, absolutely point-to-point wiring details, and trouble spotting guide. All parts always in stock and sent C.O.D. or cash with order. State your transmitter area when ordering. NO RADIO KNOWLEDGE NECESSARY. THE VIEWMASTER ENVELOPE, 7/6, plus 3d. postage.
MAKE YOUR OWN RECORDS on plastic tape, using your gramophone for drive; records will play back thousands of times without loss of quality, or they can be erased and the tape used over and over again; tape will last for years. All parts in stock for immediate delivery. List 2½d., constructional data 1s.
SUPPRESSORS to quell noisy mains on radios, 10/- each, post 6d. Suppressors to quench interference created in vacuum cleaner, sewing machine and hairdryer motors, 11/-, post 3d.
MODEL BOATS, CARS and AEROPLANES. Send 5/- for full working plans of transmitters and receivers for controlling your models at a distance; no radio knowledge necessary. Range ½-mile for boats and cars, over 1-mile for aeroplanes. All parts in stock for immediate delivery. Send 2½d. for list, 5/6 for constructional data.
IVALEK CRYSTAL SETS, de-luxe type in white bakelite case, 21/-, need headphones at 8/9 and good aerial and earth, 5/-. Postage on set 1/-.
" ELECTRIC EARS " to stick (by sucker) on side of telephone to amplify, via amplifier, telephone conversations and record them if desired on a tape recorder. Also ideal for deaf people if connected to the hearing aid. £3/3/- each, plus 6d. postage.
VIBRATOR POWER PACKS, 6 v. D.C. input, 230 v. output; when driven off a car battery will give out 230 v. D.C. and will drive a 230 v. radio with .15 amp. current consumption valves, thus enabling a small home radio to be used as a car radio. 57/6, plus 2/6 postage.
ROTARY TRANSFORMERS for working model trains from D.C. mains. Output 12 v. at 2 amps., with 5 v. for track lights or signals, input 230 v. D.C., 37/6. Input 230 v. A.C., 47/6, postage and packing, 2/6 extra.
MINIATURE HEADPHONES, super lightweight; complete with length of flex to plug into radio's extension speaker sockets, good for grandma to listen-in. Quite safe, no risk, 17/6 per pair.
VALVES AND COMPONENTS of all types in stock and quoted for by return. Please let us have all details as shown on old part, together with make of set and year, if possible. No lists, as stock is too vast to catalogue, but all modern valves and components and many obsolete parts in stock, including parts for television. Send 2½d. stamp for reply.

PARK RADIO OF MANOR PARK
783, Romford Road, Manor Park, E.12

HERE'S VALUE!

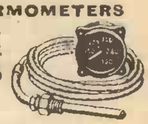
GENUINE NEW and PERFECT EX-GOVT. SIGNAL LAMPS

for day or night use. 3½in. lamp. Morse key, view finder, mirror reflector, fully wired in strong waterproof case. Swivel base, metal screw-in stand. Complete with spare parts, tin and coloured discs. Adaptable as car, motor cycle, workshop, studio spotlight.
Post and packing, 2/-. Special spare bulbs 1/3. **13/6**
Free Morse Code Leaflet given with lamp.

NEW STORAGE BATTERIES—

12 Months Guarantee **65/-**
6 volt: 7½ x 6¾ x 9¾. 8½ x 6 13/16 x 7½, 79/6; 9¾ x 6 13/16 x 7½, 95/-. *Case and Carr.* 8/-.
12 volt: 10 x 6¾ x 8, 130/-; 13½ x 6¾ x 9¾, 130/-; 15½ x 6¾ x 7½, 134/-. *Case and Carr.*, 10/-. Most other sizes.

RADIATOR THERMOMETERS

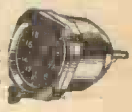


Ex-Govt. 0-100 deg. C. 2½in. with approx. 20-40ft. tubing. Suitable for WATER or OIL. **24/6** Union 2/6 extra. Post & Packing, 1/8.

VOLTMETERS
Ex-Govt. Moving Coil, 0-20v., 2in. square dial. **8/6**

AMMETERS
New Ex-Govt. 0.1 amp. 2in. round dial. Thermo-couple type. Post and packing, 1/- either. **6/6**

NEW ALTIMETERS



Ex-Govt. Single Arm 0-20,000ft. IDEAL FOR CONVERSION TO BAROMETER. Special reduction. **6/6** Post & Packing, 1/-.

Send for FREE NEW 1953 ILLUSTRATED CATALOGUE

PRIDE & CLARKE Ltd.
(Dept P.M.) STOCKWELL ROAD, LONDON, S.W.9. *BRIxton* 6251

Army Carbon Microphones with handle and switch, 5/9. Trans., 4/6.

1½in. Pulleys, take ¼in. spindle. Double groove. Cast Ali., 1/6.

M/C. Microphones with switch in handle, 7/6. Trans. to match, 5/-.

Ex.W.D. Low Resistance Phones, 8/6 pair.

Powerful Small Blower Motors, 24 v. A.C./D.C., 14/6. As used for the Hedge Trimmer.

24 v. Blower Motors, double the size of the above, 22/6.

Trans., Input 230-240. Output 50 volts 1 Amp. Tapped at 25 volt, 16/6. This is ideal for use with the 24 v. Blower Motor.

Transformers. Input 200/240 v. Sec tapped 3-4-5-6-8-9-10-12-15-18-20-24-30 volts at 2 amps., 21/6. 12 months' guarantee. This is ideal for use with the 24 v. Blower Motor.

Selenium Rectifiers F.W. 12-6 volt, 1 A., 10/6. 3 A., 14/6. 4 A., 26/-. 6 A., 30/-. 24 v. 2 A., 22/6. 250 v. 100 mA. HW., 9/-.

D.P.D.T. Relays. Operate at 200/300 volts D.C., 8/6. D.P. Make and Break, 8/6. Any combination or voltage can be supplied at varying prices.

24 v. A.C./D.C. Motors. 3½in. x 2½in., 14/-.

New Exide 2v. Accumulators 11 A.H., 7/-.

VCR97. Cathode Ray Tubes, New and Crated, 45/-. Bases, 3/6.

Multimeter Kits with 2½in. calibrated meter, reads volts 3, 30, 150, 300 and 600. MA. 0-60. Ohms 0-5,000. 24/6.

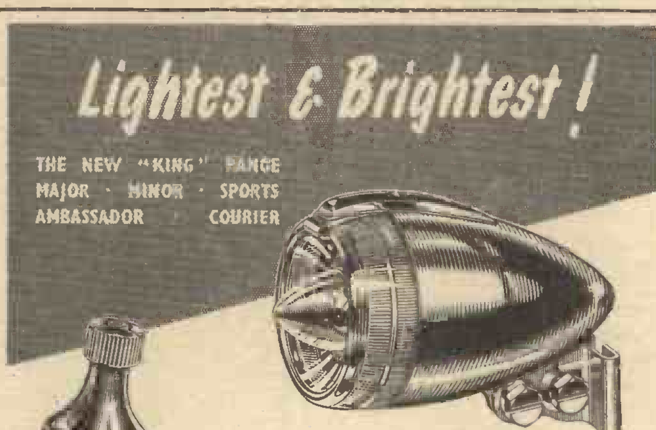
A.C. Motors. ⅛ to ¼ h.p. Write for Price List and Details.

Small Chassis with Worm Drive. Ideal for Model Cars, Railways or Boats, 4/-.

Compass Mountings each contains 4 Brass Pistons and Cylinders, 1⅛in. x 3in. Ex. Dia. ½in. Bore, 4/6.

All Carriage Paid.

THE RADIO & ELECTRICAL MART
253B, Portobello Road, London, W.11
Park 6026



"KING" MINOR

No other cycle dynamo sets have all these exclusive features:— "Light Units" modelled on the famous Lucas car lighting equipment. Silver plated brass reflectors. Twin wiring eliminates earthing troubles and push-in sleeved cable connectors allow for variable cable lengths. Powerful 6 v. 3·3 w. generator with combined universal fixing bracket and rear light. Alternative brackets available for special fixings.

Prices: 34/6 to 47/6.
(Minor illus.: 34/6.)

LUCAS *"King of the Road"*
CYCLE DYNAMO SETS

JOSEPH LUCAS (CYCLE ACCESSORIES) LTD., CHESTER STREET, BIRMINGHAM, 6

MASTER CONTACTORS. An 8/10 clockwork movement with two impulses per second suitable flasher unit. Enclosed in silence cabinet, new. Price 12/6 each, post 1/6. As per Dec. P.M. article.
LIFEBOAT S O S UNIT. Consists of 12 volt D.C. motorcoupled through train of gears to disc, periphery cut in morse to transmit SOS, disc about 5 in. wide: could be used as flasher through the two micro switches and flat disc to carry rotating display, price 20/-, post 1/6.
NAVIGATOR'S COMPASSES. Bomber Type, large size, complete with prisms, etc., alcohol fluxgate, new, in transit case, 50/- each, post 2/-.
A.C. ELECTRIC MOTORS. 200 Single Phase motors from 1/6 h.p. to 1 h.p. All famous makes; cheapest ever, some new, others reconditioned.
DRAWING COMPASSES. Ex R.A.F. School. All good condition, suitable students; sample 3/6, post 6d. 36/- doz., post 2/-.
TERMINAL BLOCKS, 2-way Ref. No A.M. 5c/430. Sample 6d. 4/- doz., post 9d. 3-way, Ref. No. 5c/432. Sample 8d., 7/6 doz., post 9d.
HOOVER 2-pin plugs, new; will fit almost any odd size socket, rubber, 1/- each, post 3d. 9/- doz., post 11d.
MILLIAMMETERS. 0-50 Milliamps, 2½in. scale, flush mounting, all good condition. 7/6 each, post 9d.
R.F. METERS. 0-6 amps, panel mounting, these are quite suitable on D.C. charging circuits if kept within 75% maximum load. Price 7/6, post 9d.
A.C. MOTORS. R.A.F.29 converted type. 2,000 r.p.m. Few only at 30/- each, carriage 3/9. Ready for use.
HOOVER SMALL BLOWER MOTORS. Mentioned in P.M. for adapting as hedge trimmers, also suitable for car heaters, 12/24 volts, price 12/6, post 1/2.
VARIABLE RHEOSTATS. Sliding contacts 0-1 ohm, suitable L.T. charging circuits. Ex-Equipment, 3/6 each, post 9d., can be connected in series with each other to any amount.
SELENIUM RECTIFIERS. 12 volt 1 amp., new, 7/6 each, suitable electric trains, trickle charging, etc.
KEY SWITCHES. P.O. type. 3-Way. Multi contact, suitable reversing switches, model railways, etc. 3/6 each, post 6d.

L. C. NORTHALL
16, Holly Road, Quinton, Birmingham, 32. 'Phone WOO 3166.
Retail Branch, 416, High Street, Smethwick, Send S.A.E. for List. Special attention to Export enquiries.