Vol. 2., No. 3

AUGUST, 1926

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# The HOMECRAFT MAGAZINE

3D EACH MONTH

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THE "MONOTROL" CRYSTAL

## THE "CRAFTSMAN" FOUR VALVE SET

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S. U. HOSKEN

# THE HOMECRAFT MAGAZINE

To fashion something —big or little— to feel its shape grow under the hands — to be able to say at the finish, "I made this" — IS TO LIVE.

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## A PRACTICAL CONSTRUCTIONAL MAGAZINE FOR THE HOBBYIST

MODEL ENGINEERING | BOOKS MAGAZINES | MECCANO FRETWORK | RADIO | PHOTOGRAPHY CHEMISTRY | PRACTICAL ELECTRICS | MODEL AEROPLANES

Vol. 2., No. 3. Melbourne, 1st August, 1926 Price 3d

## CONTENTS

### THIS ISSUE



### NEXT ISSUE

**THE RADIO SECTION**
of the next issue will be particularly interesting to those who desire interstate reception at loud-speaker strength. Full details will be published on the construction of the now world-famous Browning-Drake receiver, which, under severe test conditions in Melbourne, has been successful in receiving 5CL and 2BL while 3LO is working in the daytime. Easily handled, this set is remarkably sensitive, and readers who build this receiver will achieve their ideal. Those who wish to construct a very useful accessory should read the article on a combined wavetrap and crystal set. This instrument is so designed that it may be connected to an ordinary valve set, making it extremely selective, or, if desired, it may without alteration be used as a simple crystal set. This feature will be appreciated by readers who are content with headphone strength when listening-in alone. Radio Hints and Tips will also be numerous and interesting.

**THE MODEL ENGINEER AND FRETWORK SECTIONS**
will maintain their usual high standard, catering for hobbyists in a manner not previously attempted in Australia. Readers who are not annual subscribers are advised to forward their subscriptions immediately and save the disappointment of being informed by their newsagent that the "Homecraft" is sold out.

As a competent staff is employed to write the technical articles required for this magazine, which is not produced as a business proposition but merely as a help to our customers and readers, we do not pay for contributions. However, we are always pleased to hear from readers as to just how their difficulties have been overcome.

Advertisers are requested to note that all copy must be in hand at this office not later than the fifteenth of the month preceding the date of issue.

Remittances should be made in Postal Notes or Sixpenny Stamps; never in coin, unless registered.

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All Communications should be addressed to—
The Editor,
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211 Swanston Street,
Melbourne




Casually glancing through a bound volume of the "Homecraft," the thought occurred to me that perhaps many new readers would be interested to learn of the numerous "how to make" articles that have appeared during the last twelve months.

Numerous readers have written in praise of the Twin-Crystal Set, published in our June, 1925, issue. This set is fitted with two crystal detectors and a simple change-over switch, so that no portion of the program may be lost should the "point" be accidentally lost. The "Selective Single Valver" is the title of another splendid article, that gives full detail for making a sensitive and reliable three-coil single valve receiver.

Turning to the July issue, the reader will find another single valve set under the heading of "An Improved Three Coil Set," which may be coupled to "A Two Stage Audio Amplifier," described elsewhere in the same issue. This latter unit, being built to a standard design, is equally useful as an addition to either a crystal or single valve set, and readers who desire a complete audio unit should follow the directions given. "A Low-Loss Single" is another type of set that will interest all who wish to receive the amateurs, while those to whom electrical experiments appeal should read "The Skinderviken Microphone Button, or How to Make a Loud Speaker Crystal Set." This same class of reader should also procure the following issue, with its articles on the "Construction of an Electrolytic Rectifier" and an "Easily Constructed Voltmeter," while Radio enthusiasts who desire to make either a loud speaker or a four-valve set will find both fully described in the same number. The full list of call signs of the Australian amateur transmitters is also in this (August) issue, making it well worth the price charged.

Building a Model Electric Loco. excited quite an amount of interest, the complete article occupying the Model Engineering Section for both August and September issues.

How to use a four-element valve is fully covered in the September number, under the title of "The Negadyne Portable Receiver," while for the chap who wishes to economise on battery current the Single Valve Reflex Set on page 101 will tell him just how to assemble the finest single valve-crystal set it is possible to build.

Turning now to the October issue, articles on making a Self-registering Audibility Meter, A Three-Valve Reflex Receiver, The Adjustment of Cinema Arc Lamps, The Best Radio Receiving Set (a five-valver), Radio and Workshop Hints, The Lathe and its Accessories, Safety Valves and Model Water Gauges, and The Construction of a Flash Boiler all make interesting reading and provide a wonderful threepenny worth.

A Super Single Valver, published in November issue, has given exceptional results all over Australia, An Electrically-operated Signal, the Design for a Single Acting High Speed Engine, and an account of the Model Engineering Exhibition held in Sydney are also in the same issue.

December issue, in addition to a number of radio articles, contained the constructional details of a Twenty-watt Dynamo, hundreds of which were built throughout the Commonwealth.

Making your Set Selective and How to Make a Simple Hot-wire Ammeter were two tip-top articles in the January issue, which also gave details on making an Electric Wind Indicator and a Boiler Feed Pump.

The "Australian" Three-Valver described in February issue is a standard circuit for working either two or three valves. Hunting Trouble on a Crystal Set, Winding Basket Coils, Adding a Valve to a Crystal Set, and various radio hints were also given, in addition to Building a Sea-going Canoe, Making a Small Electric Motor and Pattern-making for Model Makers. A complete fretwork course was also commenced in this number and continued up to and including last (July) issue.

A Complete Single Valve Set for Eighty Shillings (March issue) found hundreds of builders, and innumerable letters have been received reporting all-Australian reception on this wonderful single valver. The same issue commenced the details of construction of the 0-4-0 Tank Loco., a photo of which is reproduced in the present issue. April, May and June issues contained a series of "units" so designed that the builder could make or use any number of valves from one to five, an advantage that was, judging by the letters received, appreciated by a big number of readers.

Wm. a. white

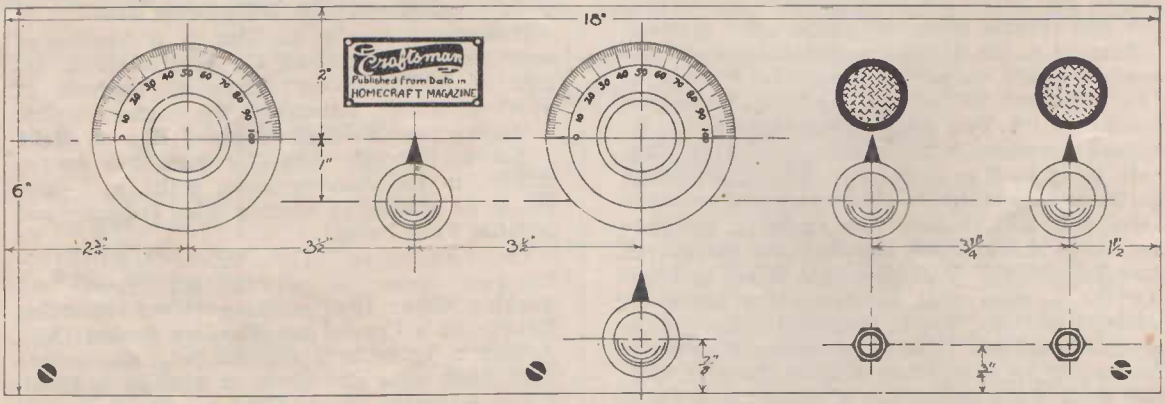
Editor

# The "Craftsman" Four

By T. H. Cragg

The four-valve set described in this article will give splendid loud speaker results on all stations within a radius of 600 miles, and when used outside a radius of 25 miles from an "A" class broadcasting station successful interstate reception is easily obtainable. The full constructional details are given below, and with the aid of the accompanying drawings no difficulty should be experienced in building the set. Fig. 1 gives all details and measurements for the laying out and drilling of the panel, Fig. 2 shows the schematic wiring diagram, whilst the theoretical circuit is shown in Fig. 3.

The first step in the construction of the set is the preparation of the panel. This consists of 3-16in. trolite, and is 18in. long by 6in. wide,




being drilled in accordance with Fig. 1. The illustration should prove self-explanatory. The aerial tuning condenser is mounted on the left of the panel (looking from the front), with the centre spindle 2¾in. from the left edge and 2in. from the top. The first rheostat is mounted 3in. from the top edge and 6¼in. from the left side; at a distance of 3½in. from the rheostat mount the second condenser, with the spindle 2in. from the top edge; immediately below this a ¼in. hole is drilled to take the shaft of a two-coil holder. Although this is shown ⅞in. up from the bottom of the panel, the actual measurement will depend on the particular make of coil holder employed. The detector rheostat is mounted at a distance of 3½in. from the second condenser, whilst the audio rheostat is 1½in. from the right edge. Immediately below the two rheostats the 'phone jacks are mounted ¾in. from the lower edge. The first jack is of the double circuit type, having four springs, whilst the second is an ordinary single circuit, with but two springs. For sake of appearance rather than utility, two "peep screens" should be mounted above the last two rheostats. In order to give the set a workmanlike appearance one of the free "Craftsman" name plates should be attached to the panel, as shown. (Free name plate coupons will be found on the front cover.) Three holes should be drilled ¼in. from the lower edge of the panel to take the screws for fixing the panel to the baseboard.

Having assembled the various components on the panel, proceed with the lay-out of the baseboard.

Good, dry wood or 7-ply board is recommended for the baseboard, which should measure 18in. x 9in. The edges should be carefully planed, and the whole sandpapered before giving a good coat of stain. The components are laid out in the manner shown in Fig. 2, which is a scale drawing, being one-third of the actual size.

It may be found that the shaft of the two-coil holder is not long enough to reach to the front of the panel. If this is so, the existing rod is quite easily removed by loosening the screw at the rear of the plug, and a piece of brass rod of the desired length may be inserted in its place, the free end being threaded to take the knob. An alternative method of extending the length of the rod is shown on page 269, February issue "H.M."

Two terminal strips are shown, one at either end of the baseboard. These are strips of 3-16in. trolite ¾in. wide, and of sufficient length to accommodate the necessary number of terminals, and are fixed to the baseboard by means of wood screws, a washer being placed over screw (between the strip and the baseboard) in order

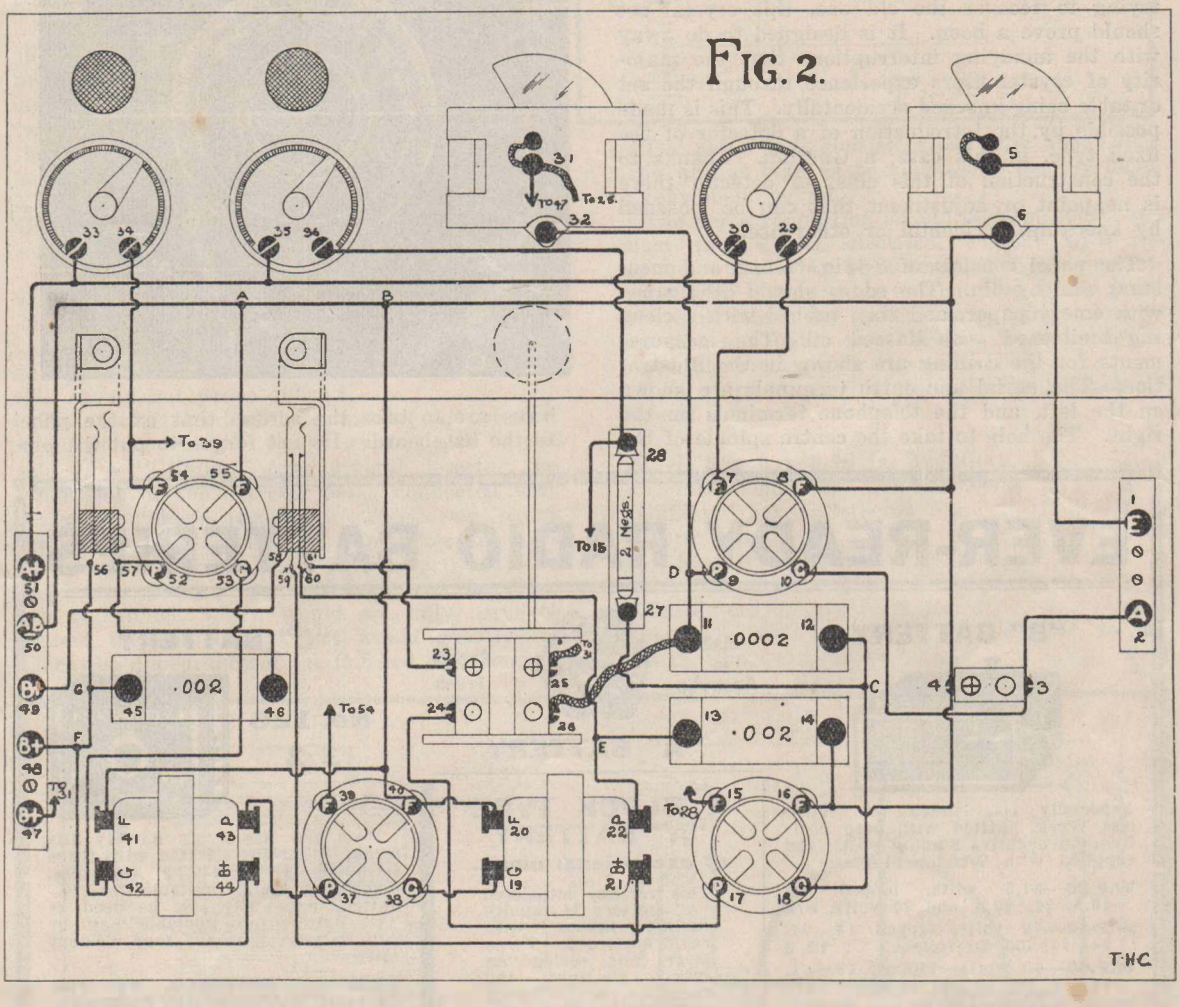
to keep the terminals clear of the wood. An ordinary single-coil holder is shown mounted on the right of the baseboard in Fig. 1; this plug holds the aerial coil whilst the two-coil holder carries anode and reaction coils. Both variable condensers should have a capacity of .0005 mf., and the rheostats a resistance of 30 ohms. The condensers and rheostats shown are of "Advance" manufacture.

Both audio transformers should have a ratio need no comment, except to mention that, like all other components, good quality is always the cheaper in the long run. Having assembled the components in their respective position, proceed with

### The Wiring.

A neat and efficient job will result if this is carried out with 16 or 18 gauge tinned copper wire. Better still, the wire may be covered with

FIG. 2.




of 3 to 1, and should be of a reliable make. It is a wise plan to use valve sockets of the standard American type, as almost any make of valve may be obtained with this particular type of base. In order to simplify the wiring see that the sockets are, in each case, mounted with the filament terminals toward the panel, also make sure that the transformers are mounted with primary terminals facing the right of the baseboard (looking from the rear). The three fixed condensers and the grid leak and mounting really the popular "spaghetti" sleeving sold for the purpose; this effectively insulates the wire, and prevents any possibility of short circuits. For those who desire to wire the set from the theoretical circuit, this is given in the conventional manner in Fig. 3.

The schematic diagram is given in Fig. 2, the numerical system being employed. If the point to point connections are followed, no mistakes can result.

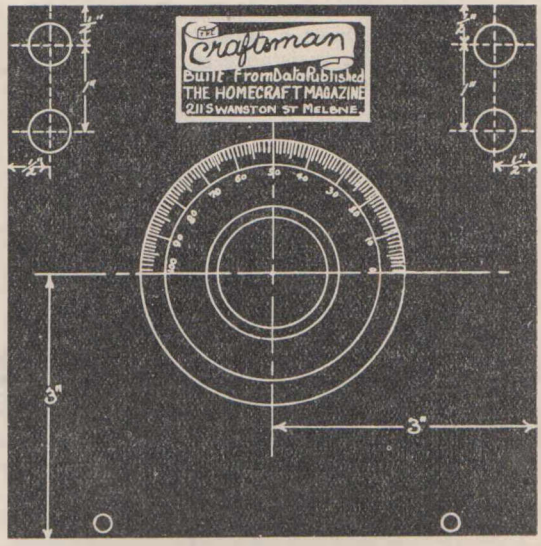
(*Continued on Page 72*)

# The "MONOTROL" CRYSTAL SET

By "Oscillator"

To those who dislike playing with the crystal detector, continually hunting for new points or trying to recover the old one, this crystal set should prove a boon. It is designed to do away with the annoying interruptions that the majority of crystal users experience through the set or table being knocked accidentally. This is made possible by the introduction of a detector of the fixed type, in this case, a Gilfillan. Thanks to the construction of this class of detector there is no point or adjustment that can be loosened by knocking, accidental or otherwise.

The panel consists of 3-16in. trolite, and measures 6in. by 6in. The edges should be cleaned with emery paper, and then rubbed with a clean rag moistened with linseed oil. The measurements for the drilling are shown in the illustration. The aerial and earth terminals are shown on the left, and the telephone terminals on the right. The hole to take the centre spindle of the variable condenser is in the centre of the panel, while two holes are drilled ¼in. from the bottom of the panel and 1in. in from the edge; these




holes are to take the screws that fix the panel to the baseboard. Do not forget to put the pro-

fessional touch to the set by attaching a "Craftsman" name plate to the panel.

When the condenser and terminals have been mounted, the panel is fixed to the baseboard, which is cut from dry wood ¾in. thick and measures 6in. square. To give the baseboard a neat finish it should be stained and polished.

The next step is the construction of the tuning inductance. This consists of 35½ turns of 18-gauge D.C.C. wire wound on a 3in. diameter cardboard former.

The tube should first be given a good coat of shellac varnish in order to render it moisture-proof. When beginning and finishing the winding, the end of the wire may be held by making two holes in each end of the tube, and passing the wire through one and then the other; if a neater finish is desired the method shown in Fig. 3, page 50, July issue "H.M." may be used; about 6in. of the wire should be left at each end for connecting purposes.

The coil is mounted on the terminals of the variable condenser, as shown in Fig. 2, the 18-g. wire being sufficiently stiff to support the coil and make the necessary connection. The set may now be wired, and by referring to Figs. 2 and 3 this should not prove difficult.

The aerial terminal is connected to one terminal of the variable condenser and also to one side of a "Gilfillan" fixed crystal detector, the other side of the detector being connected with the upper 'phone terminal. The lower 'phone terminal connects with the remaining terminal on the condenser, and also to the earth. If the builder so desires, the whole set may be fitted into a cabinet, which would not only serve to protect the components, but would greatly enhance the appearance of the finished instrument.

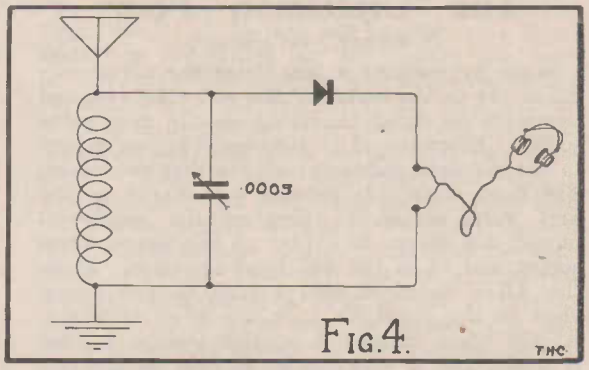


FIG. 4.

The aerial may consist of one wire about 70ft. long and as high as possible, 35ft. usually being a convenient height.

The earth connection should be kept short, and must make good electrical contact with the ground. This may be accomplished by connecting a wire to the water service pipe at the point where it enters the ground, care being taken to see that any paint or other such insulator is removed before making the connection.

List of parts required to build the "Monotrol" crystal set:—

| | s. | d. |
|---|---|---|
| Panel, 6 x 6 x 3-16 in. Trolite | 2 | 0 |
| Variable Condenser, Ormond .0005 | 8 | 9 |
| "Gilfillan" Fixed Detector | 7 | 0 |
| 4 Terminals | 1 | 0 |
| 4oz. 18-g. D.C.C. Wire | 1 | 4 |
| 100ft. Aerial Wire | 2 | 6 |
| 6 Insulators | 0 | 6 |
| 'Phones | 15/ | to 35/- |
| Earth Clip | 0 | 9 |

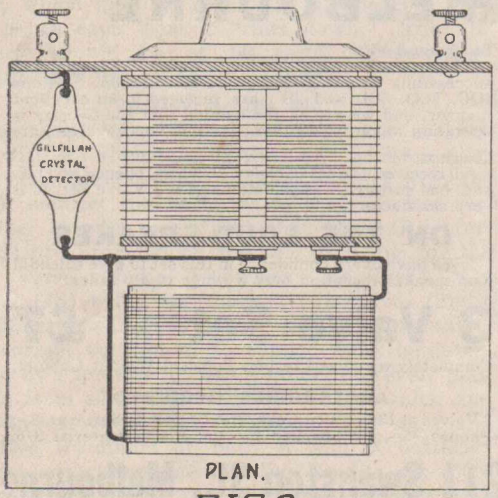


FIG. 2.

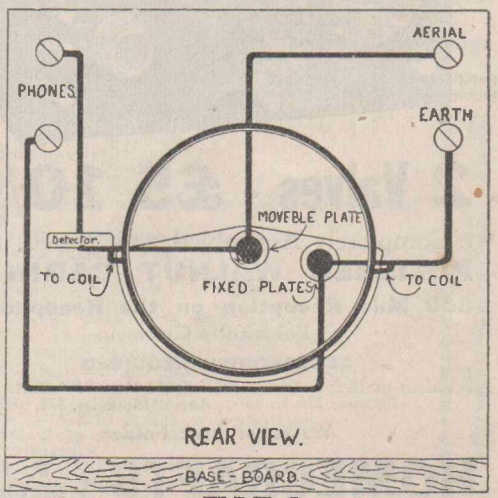


FIG. 3.

# The "Craftsman" Four

(*Continued from page 69*)

Begin by running a lead from the aerial terminal (2) to the socket of the coil plug (3), and thence to 10 (grid terminal) on the first valve socket. From the earth terminal (1) run a lead to the movable plates (5) of the first condenser. The fixed plates (6) connect with F (8) on the first valve socket, 4 (pin) on the single-coil mount, and thence to F (16) on the second valve socket, and 14 on the .002 fixed condenser. From the AB— terminal (50) a lead is run along, close to the panel, to 6 on the first condenser. At the point marked A on this lead, a T joint is made, and a wire run to F (55) on the last valve socket; another lead is taken off at B, and connected to F (40) on the third socket. This terminal (40) also joins up with 41 (F) of the second transformer, and with 20 (F) on the first transformer.

From the remaining filament terminal (39) of the third valve socket, run a lead to 54 (F) on the last socket, and thence to 34 on the last rheostat. Now run a lead, close to the panel, from A+ terminal (51) to 30 on the first rheostat, then join up 33 and 35 (second and third rheostats) with this lead. Connect 36 (second rheostat) with 28 on the grid leak holder, thence to 15 (filament terminal) of the second valve socket. Number 29 (first rheostat) is joined to F (7) on the first valve socket, and the filament circuit is complete. Number 12 on the grid condenser connects with G (18) on the second valve socket, a T joint being taken off this lead at C, and connected with 27 on the grid leak holder.

From 11 on the grid condenser take a lead to 32 (fixed plates) on the second condenser, the plate terminal (9) of the first socket being joined up with this lead at D. A length of flexible wire connects 11 (grid condenser) with 26 on the moving plug of the two-coil holder. The remaining screw (25) of the moving plug is also connected with a length of flex. to 31 (movable plates) of the second condenser. From this point (31) a lead is also taken to B+ (47) on the battery terminal strip. From P (22) on the primary side of the first audio transformer take a lead to the second spring (60) of the first jack, 13 on the .002 condenser being connected with this lead by means of a T joint at E.

The remaining terminal (21) on the primary of the first audio transformer connects with 59 (third spring) of the first jack; the first spring (61) of the jack connects with 23 on the two-coil holder, whilst the fourth spring (58) connects with 49 (B+) on the terminal strip. The remaining terminal (24) on the two-coil holder connects with P (17) on the second valve holder. The grid terminal (38) of the third valve holder

connects with 19 (G) on the secondary of the first audio transformer. The plate terminal (37) of this third socket connects with P (43) on the primary of the second transformer. From 48 (B+) on the terminal strip run a lead to 56 on the second jack, 45 on the fixed condenser being joined up with this lead at G, whilst a T connection is made at F, connecting with 44 (B+) of the second transformer.

The remaining terminal (G), 42, on the second transformer is connected with 53 (G) of the fourth valve holder; the plate terminal of this same socket connects with 57 on the second jack, and thence to 46 on the fixed condenser. The wiring is now complete, but before putting away your tools carefully go over the whole of the wiring and check it against all possible mistakes, especially the connections to the valve sockets and battery terminals, and do not pass the job as finished until you are quite confident that everything is O.K.

The type of aerial for use with this set will be governed by local conditions, but a suitable aerial system would comprise two wires, spaced 6ft. apart, and each 70ft. long, suspended 30ft. to 35ft. high. Each wire should have two insulators at either end, whilst the lead-in should be kept well away from walls, trees, or other obstacles.

The earth connection should be made by means of an earth clip securely fastened to the water main, or, better still, by burying a sheet of galvanised iron in moist earth. The connecting wire should be soldered to this sheet in several places.

The valves recommended are the dull-emitter type, Ediswan A.R.06 being very suitable. The "A" battery may consist of three dry cells connected in series, or a more economical method is the use of a small capacity four volt accumulator, which may be recharged at the cost of a few pence each time it "runs down." The "B" battery should be of 60 volts, "Ever-ready" manufacture being recommended.

### To Operate the Set.

Insert the valves in their respective sockets, and with all rheostats at the "off" position (i.e., with the slider arm not making contact with the wire), connect the batteries to their correct terminals. It will be noticed that three B+ terminals are provided on the set, 47 being for the first valve (radio frequency amplifier), the second (48) being for the last two valves (audio amplifiers), whilst 49 is for the detector valve. The correct voltage to be applied must be determined by experiment. As a guide, however, plug a lead from 47 into 50 volts, 48 into 60 volts, and 49 into 40 volts. It will be noticed that the negative terminals of both A and B batteries connect with the same terminal on the set (50), the positive pole of the "A" battery being connected to 51. Insert a 75-turn coil in the single-coil, mount a 75-turn also in the anode coil plug (moving plug), and a 50-turn in the reaction plug (fixed). A 35-turn will possibly give better results in the latter, but the correct size must be determined by experiment. After connecting the aerial to A and the earth lead to E, the set is ready to be tuned. Insert the 'phone plug into the first jack, and turn on the first two rheostats. With the coils well apart and starting with both dials at zero, turn them slowly until the desired signal is heard; when the loudest result has thus been obtained, bring the two coils closer together until the loudest and purest music is being received. The 'phones or speaker may now be plugged into the second jack, and the last rheostat turned on, thus putting the two audio amplifiers into operation.

List of parts, with approximate cost, for building the "Craftsman Four":—

| | | £ | s. | d. |
|---|---|---|---|---|
| 1 | 7-Ply Baseboard, 9 x 18 in. | 0 | 3 | 9 |
| 1 | 3-16in. Trolite Panel, 6 x 18 in. | 0 | 5 | 0 |
| 2 | .0005 "Advance" Condensers, at 12/6 | 1 | 5 | 0 |
| 2 | Dials for same | 0 | 3 | 0 |

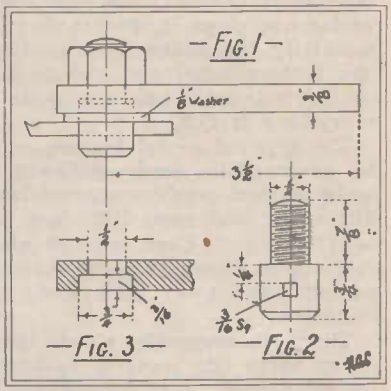


| | | £ | s. | d. |
|---|---|---|---|---|
| 3 | 30-ohm "Advance" Rheostats, at 4/6 | 0 | 13 | 6 |
| 2 | 1in. Peep Screens | 0 | 2 | 0 |
| 1 | Single-circuit Jack | 0 | 3 | 6 |
| 1 | Double-circuit Jack | 0 | 4 | 6 |
| 7 | Terminals, at 3d. | 0 | 1 | 9 |
| 4 | Standard American type Valve Sockets, at 2/6 | 0 | 10 | 0 |
| 2 | Audio Transformers, at 18/6 | 1 | 17 | 6 |
| 1 | .0002 Fixed Condenser | 0 | 2 | 0 |
| 2 | .002 Fixed Condensers | 0 | 4 | 0 |
| 1 | Single Coil Plug | 0 | 1 | 3 |
| 1 | 2-Coil Holder | 0 | 6 | 6 |
| 1 | 2-Meg. Grid Leak and Holder | 0 | 4 | 0 |
| 6 | Yds. 16-gauge Tinned Copper Wire | 0 | 1 | 0 |
| 2 | Terminal Strips | 0 | 0 | 6 |
| 4 | Ediswan A.R.06 Valves, at 13/6 | 2 | 14 | 0 |
| 1 | 60 Volt "Ever ready" Battery | 0 | 18 | 0 |
| 3 | Dry Cells, at 2/9 | 0 | 7 | 3 |
| | Or 1 4-Volt D.F.G. Accumulator | 1 | 0 | 0 |
| 100ft. | 3-20 Aerial Wire | 0 | 2 | 6 |
| 6 | Insulators | 0 | 0 | 6 |
| 1 | Lead-in Tube | 0 | 1 | 0 |
| 1 | 'Phone Plug | 0 | 2 | 6 |
| Loud Speaker, 35/- upwards. | | | | |
| 2 | 75-turn "Elroy" Coils, at 3/9 | 0 | 7 | 6 |
| 1 | 50-turn "Elroy" Coil | 0 | 3 | 3 |
| 1 | "Craftsman" Name Plate, free. | | | |

**Lathe Tool Holder.**

An old bicycle crank will suit our purpose for making the tool holder shown in Fig. 1. A ½in. hole is drilled through the end, as shown by the sectional drawing, Fig. 3, and to a depth of 3-16in.; it is enlarged to ¾in. The crank is cut off at a length of 3½in. from the centre of the hole.

The bolt is turned from ¾in. mild steel to the dimensions shown in Fig. 2. 5-16in. down from the shoulder a 3-16in. hole is drilled through the head, and then filed




square. This square hole is to hold the square turning tool which is made from 3-16in. square steel. A washer 1¼in. diameter and ¼in. thick is made with a ¾in. hole in it. This washer slips over the bolt head as shown, and comes between the crank and turning tool. By tightening the nut on the bolt, the tool is pressed between the crank and bolt head, and is so kept in place.

* * * *

Glen Waverley, Vic.

The Editor, "Homecraft."

Dear Sir,—I am writing to let you know the results of the "Tri-coil Crystal Set" in your May issue.

The first night I tried it 3LO came in very strong and after they closed down I got 5CL, Adelaide, at about the strength of 3AR. The following night I got the same result.

I only wired the set up roughly, using a wood panel. My aerial is 100ft. long and 50ft. high, and is located 15 miles east of Melbourne.—Yours, faithfully, W.H.

* * *

J.E.R., of Rochester, writes:—"It may interest R.H., J.A. and other readers to learn that on a three-valve set the same as the 'Australian Three' . . . I have picked up 3LO, 3AR, 2FC, 2BE, 2BL, 2KY, 2UE, 2JC, 2BY, 5CL, 5DN, 7ZL. Practically no interference is experienced."

## A NEW DETECTOR VALVE.

### Radiotron UX-200-A.

A new detector valve, UX-200-A, which is described as super-sensitive, non-critical, and economical in operation, and which will markedly increase the reception range of the average type of broadcast receiver, will soon make its introduction to radio set owners, experimenters, and radio fans, according to advices from Amalgamated Wireless (A'sia) Limited.

The valve may be used in an existing receiver operating on a six-volt storage battery, and it will provide vastly increased sensitivity, as well as output volume, with no changed or critical adjustments of any kind.

The UX-200-A Radiotron is the result of long and extensive study and development with the detection and rectification of radio frequency energy by the research engineers of the R.C.A.'s manufacturing associates, the General Electric Co. and the Westinghouse Co.

So far as physical dimensions and base are concerned, the new detector valve is similar to the well-known UX-200 and UX-201-A valves. However, the new detector valve has a characteristic appearance quite different from any other valve. Instead of a plain or silvered bulb, the UX-200-A has a bluish, smoky color, due to the special gas content, but incidentally serving as a means of identification,

High sensitivity has been the prime requisite in developing this new detector valve. While this has been achieved in a miraculous degree. neither the current consumption of the valve has increased nor have the adjustments been made any more critical. The filament, which is of the XL type, requires only quarter of an ampere at a potential of five volts. The B battery potential usually recommended is 45 volts, while a lower potential, as in the case of the UX-201-A, may be used with very little difference in results. A 10-ohm rheostat should be employed to regulate the filament current, which would presumably be supplied by a 6-volt storage battery. The recommended grid leak and grid condenser are 2 megohms and .00025 microfarads, respectively.

The UX-200-A valve has a greater sensitivity than any existing special detector valve. It may be used in any receiver of the storage battery type without change or special adjustment. Its internal resistance is such that it may be used with a resistance or transformer coupling. The new detector valve is absolutelv stable, and provides reliable operation at all times, with no more critical adjustments than required with standard hard valves.

The UX-200-A Radiotron answers the demand for a highly sensitive ultra-stable, storage battery detector valve, so long desired by owners of storage battery receivers who seek the utmost efficiency in broadcast reception. Actual tests with typical receivers indicate that UX-200-A provides an increase in volume nearly equal to an additional radio-frequency amplifier stage, without distortion or loss of tone quality. The sensitivity is likewise vastly increased.

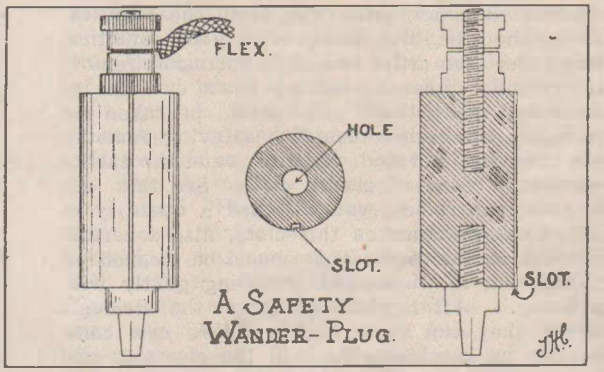
**Characteristics of UX-200-A Radiotron Detector.**

Design, same as standard UX-201-A; base, same as standard UX-201-A; filament voltage, 5; filament current, .25 amperes; plate voltage, 45 maximum; plate current, 2 milliamperes; plate impedance, 28,800 ohms; grid leak, 2 megohms; grid condenser, .00025 microfarad.

## A HIGH-TENSION BATTERY FUSE.

Many radio enthusiasts seem to lose sight of the fact that high-tension batteries cost just as much, or more, than receiving valves, and should be handled and used with the same care. A common occurrence is the accidental short-circuiting of the battery. Many do not realise that the "shorting" of a battery for 30 seconds reduces its life by about as many days.

The simple fuse described in this article will avoid such an occurrence, as immediately the battery becomes short-circuited the fuse will "blow," and no harm will result. It is not designed, however, to save the valve filaments, so do not test it by connecting the "B" battery across the valve filaments to see the fuse blow. The accompanying illustration is almost self-explanatory.




A piece of ebonite rod 2in. long by about ¼in. in diameter is threaded at one end to screw on to an ordinary wander plug, the other end being threaded, and a terminal or binding post fitted.

A shallow slot is now cut in the side of the rod, as shown, and a length of 47-gauge copper wire is laid in the slot, and connected under both terminal and wander plug. Do not forget to scrape the covering from the wire where it makes contact with the brass.

Two such wander plugs should be made, one always being ready in case a short-circuit "blows" the one in use. The plug is, of course, used in the ordinary way.

# Utilisation of "Dead" Dry Cells

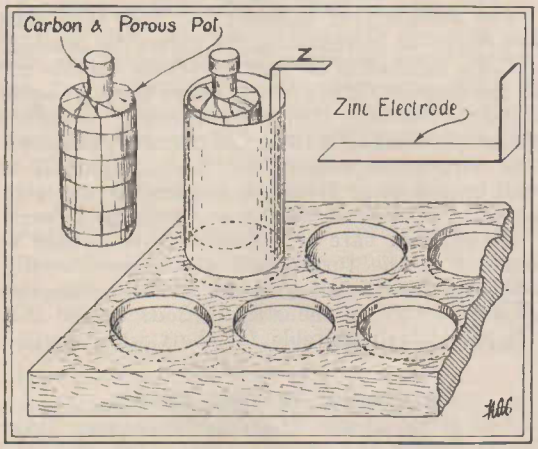
By H. M. Bird

Many amateurs using dry cells in their wireless circuits, when their A or B batteries go "dead," discard these and purchase a new set. These may be utilised as "wet" cells, and I will endeavour to give you the system I use. First remove all paper, pitch, etc., from the cells, examine the zinc, and if this is in good condition, being free from holes caused by corrosion, remove it carefully either by cutting down one side or removing the bottom; care should be taken not to injure the carbon element. Having removed the zinc, you will find wrapped round the carbon element a piece of cheese cloth. See that this is free from holes; you will find a quantity of jelly-like substance on this cloth, also a certain amount on the zinc. This should be cleaned off by soaking in water, and scrubbing gently with a brush. After cleaning, place the elements where they can drain and dry. We now come to jars or containers to hold the elements and solution. You can, at a reasonable price, obtain at your local store glass jars used to contain preserves and jams. The handiest size I find is the 3-pint "Mason," costing approximately 1/- each. This is a good size for the ordinary round dry cell. Now obtain a quantity of good quality salammoniac; this costs about 1/3 to 1/6 per lb. We will now proceed to place the elements in the cells or jars. First bend the zinc so that it will fit snugly round the inside of the jar, and solder either a lug of zinc or a loop of stout copper wire to the top of the battery zinc, care being taken, if the wire is used, to tin it thoroughly. Now place the carbon element in the centre of the jar, and while holding it in place pour in about ¾in. common sand. This should be washed free of salt if possible. When wet this sand will hold the elements in position. Now mix a solution of salammoniac in the proportion of 3oz. to 1 pint of boiled water. When cool add this solution to the cell, which is now complete, and should give 1½ volts. This method of construction will give a cell of surprisingly long life, and one that will last indefinitely. By long life, I mean a long working or discharging period.

In the event of the zinc becoming corroded,

obtain some good stout zinc sheet, and after cutting to size immerse in a bath of mercury nitrates or rub with mercury whilst wetted with a dilute solution of sulphuric acid; too much mercury should not be used, as this makes the zinc very brittle.

Having dealt with the larger type cell, I will proceed to the smaller type cell as used in making B batteries.




Proceed as for the larger type cell, using extra care with the elements, as being so small they are easily broken. For containers I suggest the bottles used for containing vaseline, etc., or those of porcelain used to contain certain foods, such as pastes, etc. If a sufficiency of these cannot be obtained, it will be necessary to use containers made of paper generously soaked in wax; ordinary wax candles will do. First obtain a smooth, round, or square mandrel, such as a wooden ruler, not less than 1in. or 1¼in. diameter, and cut strips of paper to the required width, depending on the length of the elements, and proceed to roll on the mandrel. On the first end put a drop of glue, and when finished rolling fasten down the other end, trim off neatly with a sharp knife, and remove from the mandrel. When enough of these cylinders have been made drop them into boiling wax for some time. Next prepare a board large enough to hold the cells, leaving a space of about ¼in. between. Bore holes large enough to slip the cells in easily, about ⅜in. or ½in. deep. An expansion bit is handiest for this, though care should be taken should the point of the bit penetrate right through to plug this hole, and so save wax. Now remove the cells from the wax, and insert in the holes prepared, and as each one is placed pour a little wax into it. This forms the bottom, and is water and acid proof. Place the prepared elements in the cells, and fasten with a small piece of cork soaked in wax, or cut cardboard tops for each cell, with a hole in the centre for the carbon. These tops should also be put into the boiling wax and soaked. If an extra hole, say ¼in. in diameter, is cut, the cell can be filled through this with a small funnel. If the top is put in while hot it will set itself into the wax of the cell, and so make a neat job.

The amateur who is handy with tools will no doubt be able to make a case to hold these cells; in fact, by placing a number on, say, four boards, and arranging as shelves, much space can be saved. I have quite a battery of the larger cells arranged in this way, and am rather proud of the way I have saved space.

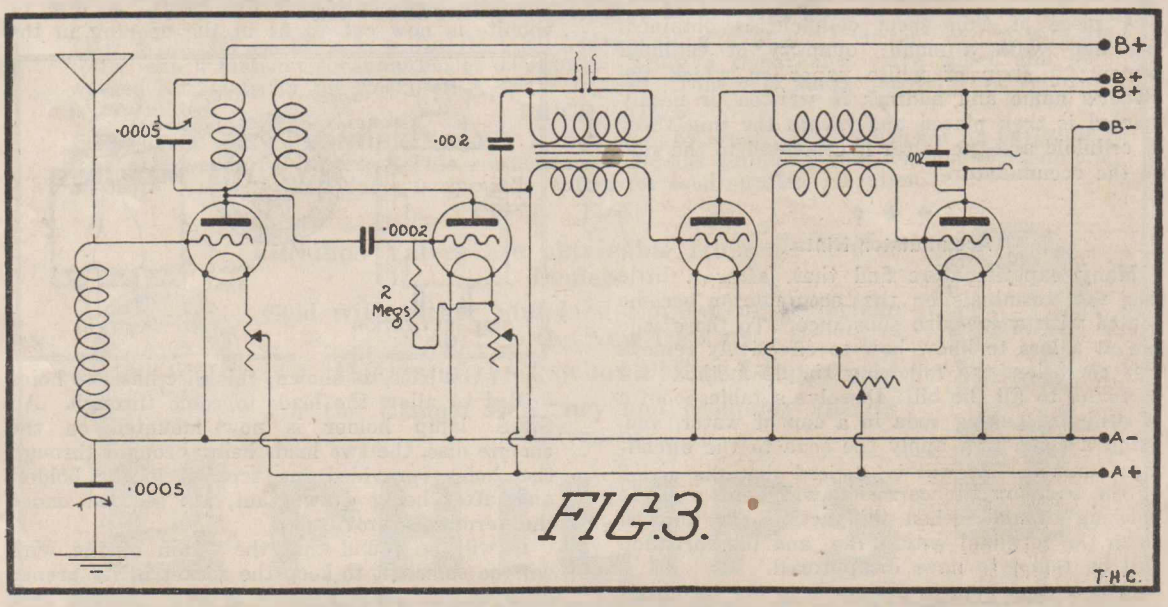


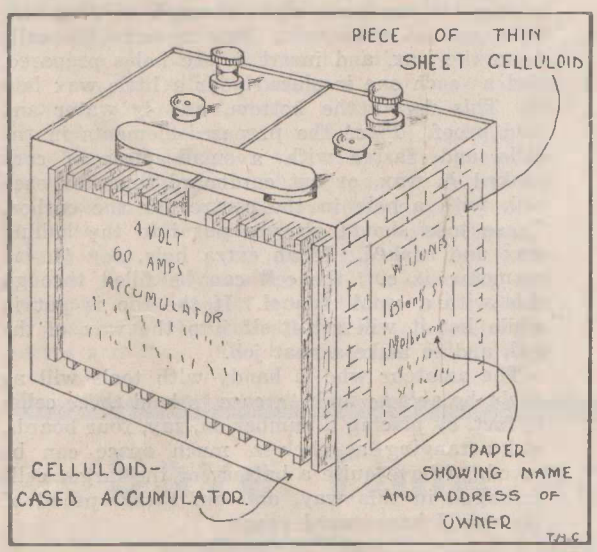

FIG.3.

Theoretical Circuit of the "Craftsman" Four described on Page 68

# Radio Hints and Tips

### IDENTIFYING THE ACCUMULATOR.

Accumulator charging stations now have so many accumulators to deal with—several of which may be of identical make and size—that some permanent method of marking one's property is almost essential.




A piece of thin sheet celluloid is obtained, together with a small quantity of celluloid cement; a strip of white paper on which the owner's name and address is written or neatly printed is then placed underneath the thin sheet of celluloid and the latter is cemented to the side of the accumulator.

✚ ✚ ✚

### Accumulator Hints.

Many experimenters find that, after a little use, the terminals on the accumulator become coated with a greenish substance. To those who are at a loss to know how to effectively remove this corrosion, the following simple method will be found to fill the bill: Dissolve a tablespoonful of ordinary baking soda in a cup of water, and, using a clean rag, apply the soda to the offending terminal. It will be noticed that the action of the soda on the corrosion will emit a slight "hissing" sound; when this action has finished clean the terminal with a rag, and the corrosion will be found to have disappeared.

It is a good plan to always keep the terminals coated with a thin film of ordinary vaseline.

### LOW LOSS COILS.

The efficiency of ordinary solenoid type coils can easily be increased in the following manner:—Cut a number of lengths of 3-16in. ebonite rod to the length of the former; space these at equal distances around the circumference, attaching them by means of a little Chatterton's compound. The wire when wound over these strips will be well spaced away from the former, and the self-capacity of the coil will consequently be reduced.

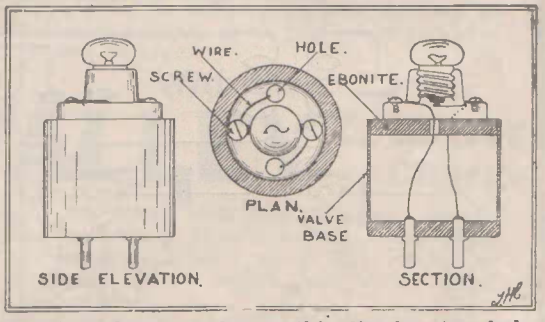
When using bare or enamelled wire, it may be found that the turns have a tendency to slip, and therefore small grooves to hold the wire should be filed in the strips. Coils spaced thus are particularly suitable for short wave work.

✚ ✚ ✚

### A USEFUL TESTING DEVICE.

The device shown in the accompanying drawing is simply and cheaply constructed, and may save many of your valves from an untimely end. If it is inserted in the valve socket before plugging in the valve, it will readily show whether the filament circuits are correctly wired, and thus avoid the possibility of placing the high-tension battery accidently across the filaments.

To make the tester secure an old valve base (either English or American type), and solder two leads to the inside ends of the filament pins (i.e., the ends inside of the base). A disc of ebonite is now cut to fit in the opening in the




top of the base, as shown; this disc has two holes drilled to allow the leads to come through. An S.E.S. lamp holder is now mounted on the ebonite disc, the two leads being brought through the holes (provided for screws) in the holder, and, after being drawn taut, are secured under the terminals provided.

It will be found that the strain of the wire will be sufficient to keep the socket in its proper position. A 3.5-volt globe is now screwed into the holder, and the tester is complete.

# Those Technical Terms

For the benefit of readers who find it hard to understand technical terms, and who, in spite of all their best efforts, cannot for the life of them see the subtle distinction between, say, a volt and a variometer, we propose to give a short list of explanations that will make everything plain sailing. This list will enable even the most crusty expert to give soft answers to the beginner's artless questions.

**Anode.**—What poets write in springtime.

**Coil.**—Used by mortals for shuffling off.

**Condenser.**—The thing that makes the squeaks when you turn its knob.

**Grid.**—Produces the frying noises. See Plate.

**Henry.**—See Ford.

**Microfarad.**—The millionth of a farad.

**Microphone.**—The millionth of a 'phone.

**Loud Speaker.**—See Wife.

**Plate.**—Serves up what is fried on the grid.

**Reaction.**—That tired feeling after a job of work.

**Super-regeneration.**—Process of submitting already amplified impulses to further distortion.

**Transformer.**—Implement designed for producing crackling noises.

**Watt.**—Electric unit of power. Power is the work done per unit of time. Understand? Splendid. Nor do I.

### Strategy.

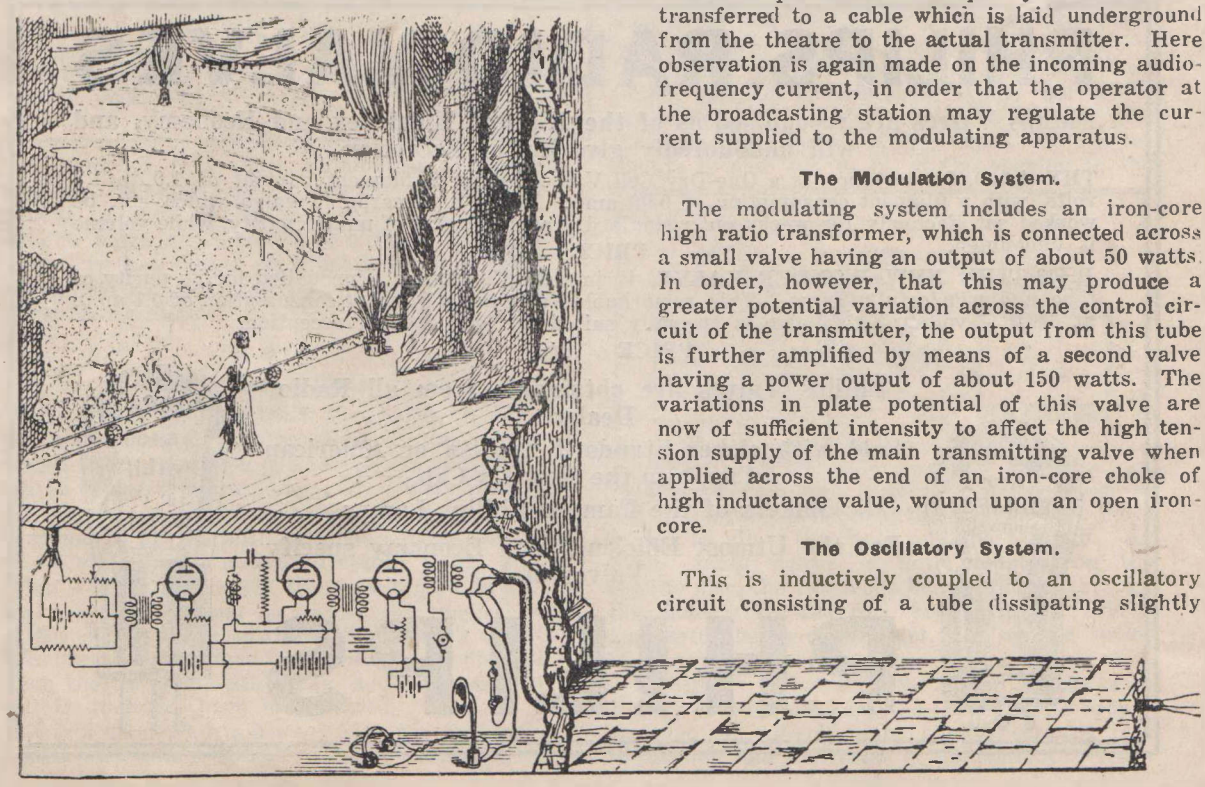
These, I think, should help would-be wireless enthusiasts towards an understanding of the great science. They must not be put off if they hear others indulging in the use of long words and unpronounceable terms. The more abstruse the flora of a wireless man's vocabulary the more profound is often his ignorance. He mugs up a whole heap of difficult words to cover his lack of knowledge. Thus, if you hear a man speaking of such things as mhos, you may feel pretty sure that he is merely trying to frighten you into silence. Attack is the only method to adopt in such cases. If you don't know any suitable words, invent 'em, and ask him what he thinks of Slopitoff's theory of superimposed bielectrons.

# Broadcasting fro

It will readily be appreciated that the microphones used for this class of transmission must be exceedingly sensitive to the smallest sound and yet comparatively insensitive to mechanical vibration. The ordinary type of microphone does not fulfil these conditions, particularly as regards sensitivity to distant sounds. The special type of microphone employed has been evolved by one of the firms responsible for the design of a certain type of broadcasting transmitter, and is remarkably sensitive to distant sounds. One or two of these microphones are mounted in suitable positions behind the footlights. Here they are so disposed as to ensure a balance of tone between singers and performers on the stage, with their relatively weak voices, and the music of the orchestra, which has considerably more volume. This particular type of microphone is sensitive to sound impinging upon it from both sides, and is eminently adapted for this class of transmission.

### The Speech Amplifier.

Whilst, however, it is exceedingly sensitive to sound, the current output from it is very small, and, in consequence, must be amplified electrically before it will be of sufficient intensity to impress speech upon the control circuits of the transmitter. A glance at the figure in the left-hand corner of the page will explain how the microphones placed behind the footlights, are connected to the speech amplifier, which is beneath the stage.



The same firm who are responsible for the design of the microphone have evolved this type of speech amplifier. It is, of course, an audio-frequency amplifier, and employs three stages of magnification.

There are novel points which will be appreciated on examination of the circuit diagram shown in the pictorial representation of the stage. Observation is made on the transmissions from this amplifier by means of either a loud speaker or a pair of telephones worn by the person in charge of the amplifier. This enables him to pass on the correct volume of speech and music to the cable which is connected to the control circuits of the transmitter. The amplifier is a piece of apparatus upon which considerable time and care has been expended, and it is without doubt the most efficient instrument of its class in existence. High amplification without distortion is ensured by the careful and correct amplification of the necessary grid voltages to ensure the valves working at the proper points on their characteristic curves.

### The Underground Cable.

The amplified audio-frequency currents are transferred to a cable which is laid underground from the theatre to the actual transmitter. Here observation is again made on the incoming audio-frequency current, in order that the operator at the broadcasting station may regulate the current supplied to the modulating apparatus.

### The Modulation System.

The modulating system includes an iron-core high ratio transformer, which is connected across a small valve having an output of about 50 watts. In order, however, that this may produce a greater potential variation across the control circuit of the transmitter, the output from this tube is further amplified by means of a second valve having a power output of about 150 watts. The variations in plate potential of this valve are now of sufficient intensity to affect the high tension supply of the main transmitting valve when applied across the end of an iron-core choke of high inductance value, wound upon an open iron-core.

### The Oscillatory System.

This is inductively coupled to an oscillatory circuit consisting of a tube dissipating slightly

# from the Stage

over 1½ kilowatts of high frequency energy. This arrangement, as a matter of fact, is really duplicated, so that two oscillatory circuits are supplying the power to a coupled circuit to which the aerial and capacity earth systems are connected. The valves throughout the transmitter are lighted from accumulator batteries. The valves of the speech amplifier at the stage are, of course, lighted from accumulator batteries. The valves A.C. to light these filaments causes an undesirable hum in the speech, and for this reason it is only of use for lighting the filaments of the rectifying valve, where it will be in phase with the rectification taking place.

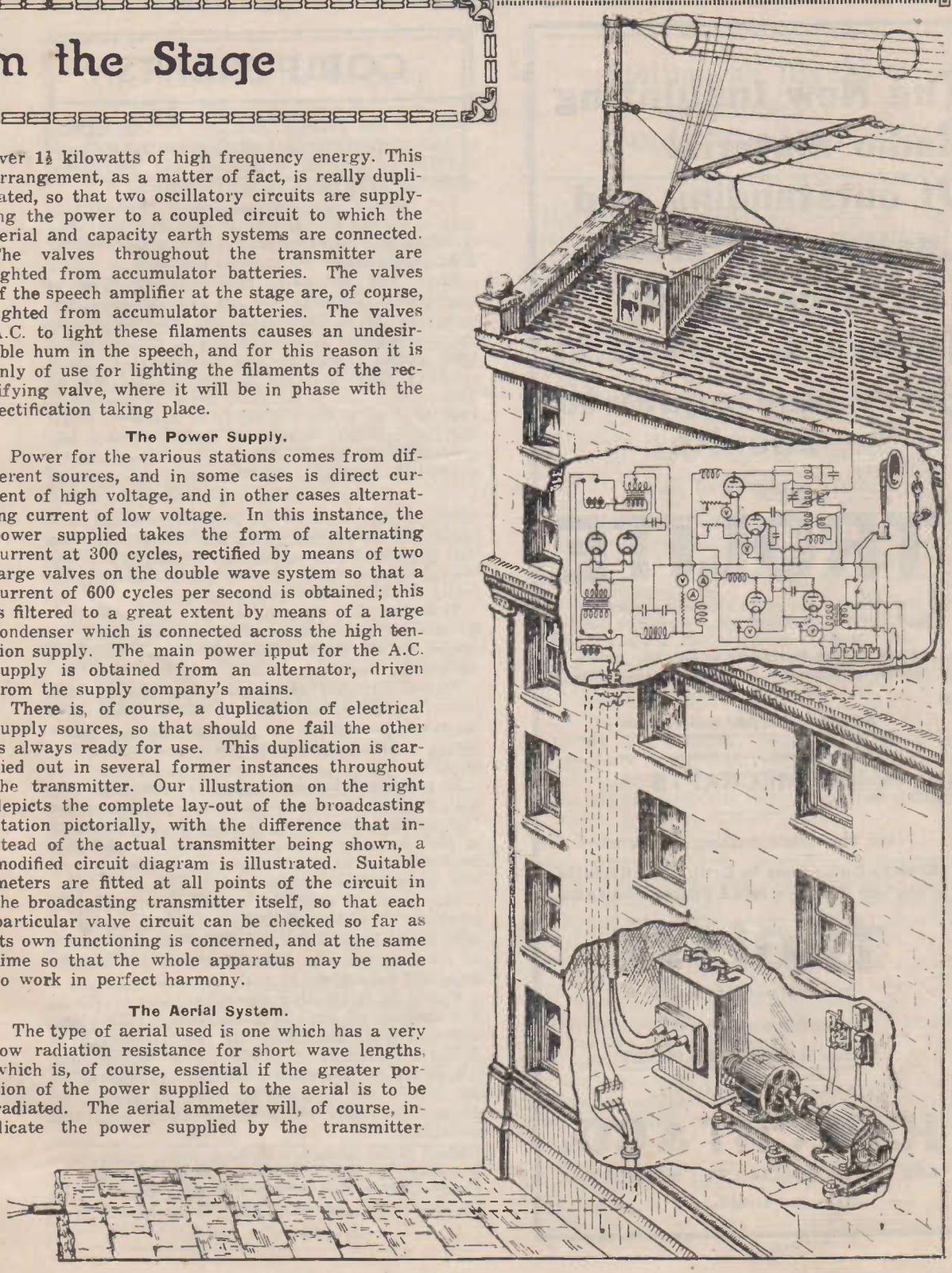
### The Power Supply.

Power for the various stations comes from different sources, and in some cases is direct current of high voltage, and in other cases alternating current of low voltage. In this instance, the power supplied takes the form of alternating current at 300 cycles, rectified by means of two large valves on the double wave system so that a current of 600 cycles per second is obtained; this is filtered to a great extent by means of a large condenser which is connected across the high tension supply. The main power ipput for the A.C. supply is obtained from an alternator, driven from the supply company's mains.

There is, of course, a duplication of electrical supply sources, so that should one fail the other is always ready for use. This duplication is carried out in several former instances throughout the transmitter. Our illustration on the right depicts the complete lay-out of the broadcasting station pictorially, with the difference that instead of the actual transmitter being shown, a modified circuit diagram is illustrated. Suitable meters are fitted at all points of the circuit in the broadcasting transmitter itself, so that each particular valve circuit can be checked so far as its own functioning is concerned, and at the same time so that the whole apparatus may be made to work in perfect harmony.

### The Aerial System.

The type of aerial used is one which has a very low radiation resistance for short wave lengths, which is, of course, essential if the greater portion of the power supplied to the aerial is to be radiated. The aerial ammeter will, of course, indicate the power supplied by the transmitter.



# COMPONENTS

One of the greatest problems in broadcasting is that of the conversion of sound as an air wave disturbance into an equivalent and undistorted electrical disturbance in the transmitter.

For ordinary commercial speech the common type of carbon microphone is excellent, but when it comes to really faithful reproduction such an arrangement fails for various reasons.

First and foremost, the ordinary type of microphone depends for its action upon the movement of a diaphragm, and this diaphragm has a resonance point. That is to say, at about 1000 cycles frequency the diaphragm is more sensitive than it is to disturbances of 200 or 3000 cycles, and is infinitely more responsive to 1000 than to 10,000. Now, it is wonderful what liberties one may take with speech without losing its "understandability," if we may coin a word; it is equally wonderful how much one has to do before one really reproduces the actual voice. Thus this resonant microphone does perfectly well for commercial purposes, but, knowing that it gives such a large predominance to certain frequencies, it is fundamentally bad for really faithful reproduction.

Thus the first line of thought indicates that the microphone, whatever form it takes, must respond to all frequencies within the range of audibility; must be, in fact, aperiodic.

Something must be moved by the sound waves impinging on it, and that something must move in exact proportion to the intensity of these waves giving predominance to no particular frequency.

In practice, what is required is something that will respond to the lowest note of the organ (somewhere about 15 cycles), up to the youngest of bat's squeaks (about 6000 a second), and give predominance to neither one nor the other, nor any other note in between.

The practical range of audibility will then be covered. It will be clear from this that a resonance somewhere about audibility will not matter as long as one can guarantee that no disturbance will take place at such frequencies.

For it is interesting to realise that if "loud" disturbances of, say, 20,000 a second, took place, although quite inaudible, still the microphone, if it had a resonance of 20 000, would respond, and one would get the control circuits over-controlled by sounds not audible, provided, of course, no precautions were taken to do away with this possibility.

Much of the sensitivity of the ordinary microphone is given by the fact of its being resonant to about 1000 cycles, which has been found to be the best resonant point for "understandability."

(*Continued on Page 94*)

# The Melbourne Society of Model and Experimental Engineers

**Election of Officers.**

Office-bearers for the next twelve months were elected at the last meeting of the Society, held in the Temperance Hall on July 7.

The retiring president (Mr. Carson) did not offer himself for re-election, so, after discussion, Mr. C. Teasdale was elected to fill the vacant position, members expressing every confidence in his ability to ably fill the presidential chair.

The secretary and treasurer (Mr. N. A. Coventry) was re-elected, and the following members chosen to serve on the executive committee:—Messrs. Wakefield, Carson, .Wallace, Milledge, Willmot and Holt.

On the conclusion of the business, Mr. Mahony not only gave an interesting lecture on the building of his Pacific Loco., but also answered the innumerable questions that were placed before him by enquiring members.

Several models were brought to the meeting, the members keenly examining the 5-inch gauge Pacific Loco. (Mr. Mahony), a fine model ½-inch scale Pullman Car (Mr. Wallace), and a ½-inch scale Model Hopper Truck (Mr. Carson).

Two counters, as used on aeroplanes for indicating the revolutions of the engine in a given time, were brought to the meeting by Mr. Willmot and excited considerable interest amongst the members, each one trying to find a suitable name for the instrument, which, so far, has had no name allotted to it.

Members quickly availed themselves of the offer by Mr. Mahony to arrange a visit to the Central Telephone Exchange, and Monday evening, July 12, was fixed as the most suitable time for members to attend.

The next general meeting will be held on Wednesday, August 4, at 8 p.m., the meeting place being the Temperance Hall, Russell Street.

All visitors are cordially invited, and full information concerning membership will be gladly supplied by the hon. secretary, Mr. N. A. Coventry, c/o "Homecraft Magazine," Melbourne.



# Melbourne Model Engineers Visit "Central"

Members of the Melbourne Society of Model Engineers were met, on Monday evening, July 12, at the Central Telephone Exchange, Melbourne, by Mr. Mahony, who had made arrangements for them to pay a visit of inspection.

Amazement was clearly registered on the faces of many of the members as the tour of inspection proceeded.

The first room into which the party was conducted was the main switch room, where the subscribers are connected one with the other, full explanations being tendered and demonstrations given of just how a subscriber to one exchange is connected to another and different exchanges.

Behind the scenes, or, in other words, behind the boards, was still more amazing, one's opinion of telephone mechanics and their easy jobs undergoing a change when confronted with the enormous number of wires, all mixed in what was, apparently, one hopeless tangle. Mr. Mahony explained in detail how a broken wire or connection behind the panel was located and repaired, and then proceeded to point out the action of the automatic apparatus which, as its name implies, automatically connects one subscriber to another.

Call recorders, or a number of devices for recording the effective "calls" which must be charged against a subscriber, were shown and proved to be interesting little instruments that, by the aid of an electric impulse passing through a coil, worked a revolution counter.

The visitors were next taken to the Trunk Room, where they were shown the carrier wave system in operation. This system, which is really wired wireless, allows the use, by four persons, of the one set of wires at the one time, all possibility of interference being entirely eliminated.

The plant where the current required for the operation of the telephone system is generated was next visited, the society members being shown the three motor generators used for charging the two big batteries of accumulators that are necessary for supplying the current at the correct voltage, i.e., 24 volts. Two of the three motor generators work from the City Council supply, the third running on power supplied by the Railways.

Members spent a very interesting evening, at the conclusion of which a hearty vote of thanks was passed to Mr. Mahony for the time and trouble that he had taken in showing and explaining the various pieces of apparatus.

# How to Make a Simple Steam Turbine

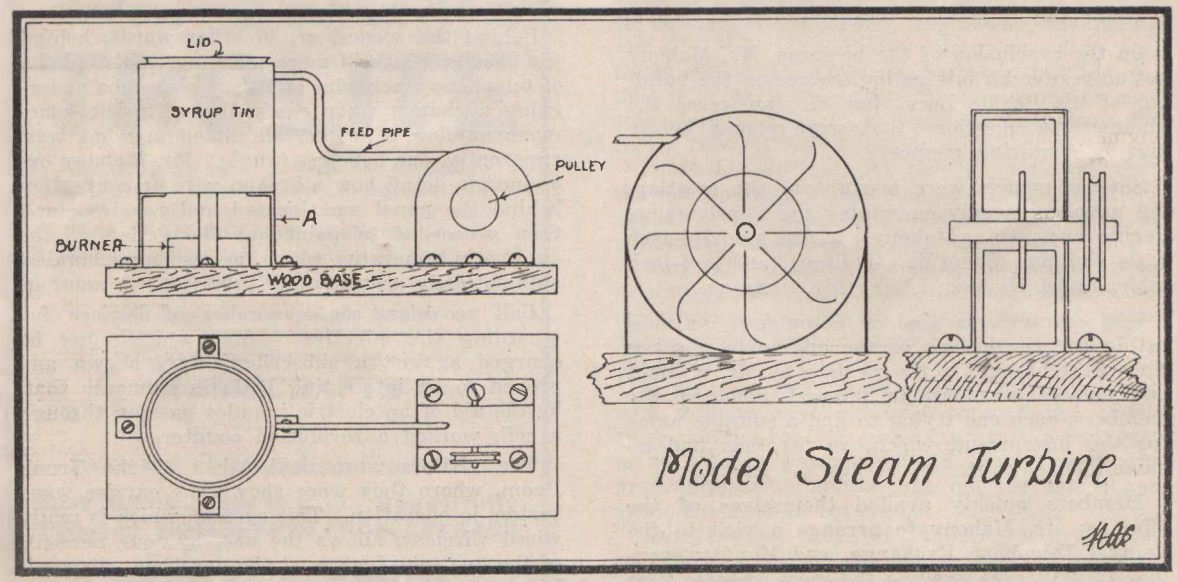
The construction and operation of the miniature steam turbine described in this article will provide many hours of interesting amusement with an entire absence of danger.

As will be seen, very few tools are required to achieve a satisfactory result, therefore, the boy who cannot gain access to a lathe need not be afraid to tackle the job.

Let us consider the boiler. This part of an engine is usually a difficult matter, but in this case the homely syrup tin may be used. Better scrape the old paper off first and then carefully examine the tin for defects, as even a tiny hole will cause a big loss of power; therefore, if you discover a small hole, heat your soldering bit and make the tin steam-tight. But do not solder the lid to the can, merely see that it is a good fit, that is to say, make sure it will fit sufficiently close to prevent the steam escaping and yet at the same time be loose enough to blow off easily should your steam pressure become too high. However, if you have any doubt on the matter, purchase a small safety valve and solder it to the lid.

As the boiler must be supported sufficiently high to place a spirit lamp underneath, it will be necessary to make four strips of heavy gauge brass to the pattern shown in the illustration. The lower ends, which serve as feet, may be drilled for the insertion of wood screws, which will serve to hold the engine in position on the baseboard. Soft or ordinary solder may be used to fasten these strips to the boiler, as owing to the presence of water in the tin even this class of solder will not reach melting point.

The burner may be made from the lid of a small tin, and filled with asbestos, inserting a piece of copper gauze of sufficient size to tightly fit the inside of the lid. When ready to use, soak the asbestos with methylated spirits and ignite. While on the job, make two of these lamps, so that the turbine may be run continuously.




**Making the Turbine.**

The illustration shows all necessary measurements, and also the various small parts required. Cut the blades from thin sheet brass, and insert one in each of the eight slots shown around the edge of the circular piece of brass that is used for the wheel. Fix in position by means of a touch of solder, taking care that only a small and equal amount is used on each.

The small brass rod which forms the spindle is also soldered to this wheel or rotor, a drop on either side holding it firmly in position.

Now cut and bend the sides as shown in the illustration, and make the circular covering (used between the sides) by bending a strip of brass

and soldering the ends together. When complete, the sides may be soldered to this strip. Don't forget the rotor must be placed in position before fixing the last side.

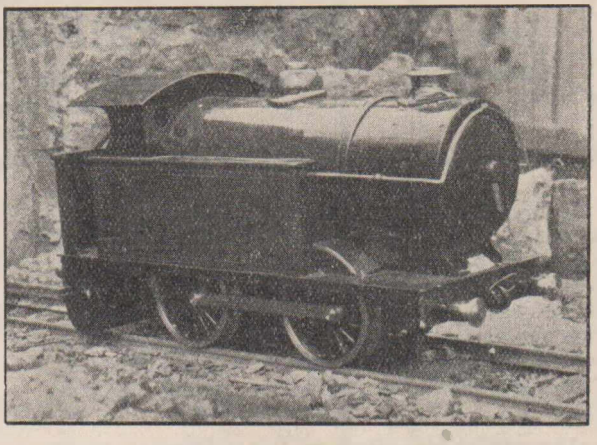
The turbine is held to the baseboard by means of the six small screws shown in the illustration, and a small pulley is fixed on the protruding end of the rotor shaft.

The feed-pipe which connects with the boiler is of brass or copper, and should be thoroughly heated before attempting to bend to the shape. If possible, procure a piece of wood the radius of which is the same as the curve to be formed, as trouble will be experienced by the pipe kinking if great care is not taken.

When bent to shape solder the pipe in position; the nozzle is shown in the cross sectional illustration of the turbine.

Even with the low pressure developed by this boiler the turbine will run at a great speed; running fast and true for minute after minute, but it should be remembered that never on any account should the boiler be allowed to become dry. Should, through neglect, this occur, the soldered joints will "spring a leak," and the boiler become useless. On the other hand, water should not be allowed to stand in the boiler when the engine is not in use, as this will cause rust, which will, eventually, eat its way through the tin. A little lubricating oil, placed in the boiler, will go far towards preventing rust.

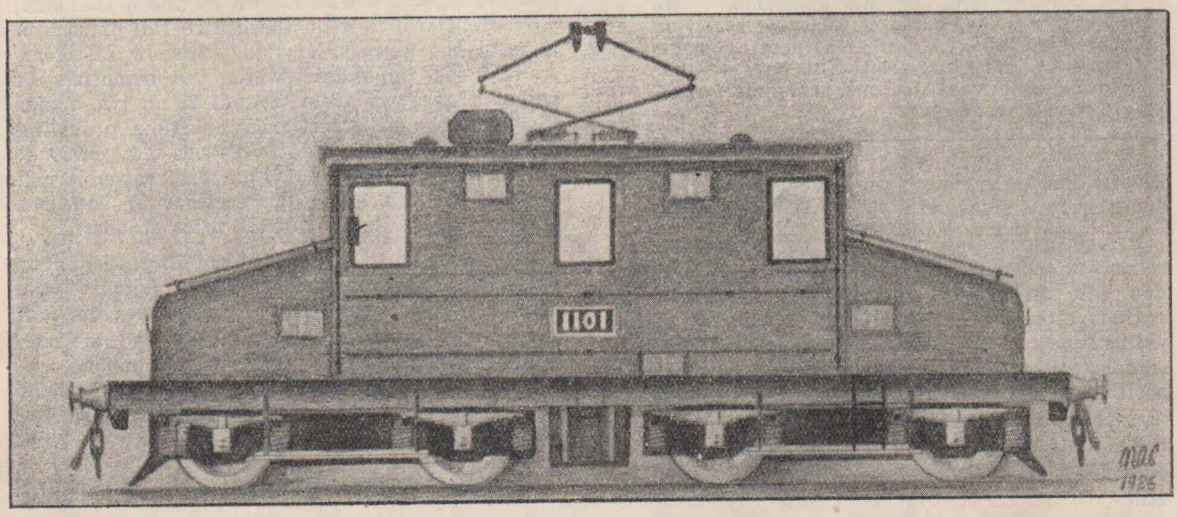
Those who desire to elaborate on this design may add a greater number of blades or increase the size of the boiler.



AN 0-4-0 TANK LOCO.

**Readers who are building the 0-4-0 model loco described in our March and April issues, will be interested in this photograph of a finished model which is seen on the track of Mr. H. M. Carson, of Brighton.**






**This pencil sketch shows an Electric Goods Locomotive, as used on the Victorian Railways. Voltage, 1500 D.C.; Drive, individual and single geared; Tractive Effort, maximum, 26,000 lbs.; Length over Buffers, 36ft. 4½in.; Length of Wheelbase, 25ft. 9in.; total weight, 49 tons 19 cwt. The steel underframes and bodies were built at the Railway Workshops, Newport, Victoria, and the electrical equipment installed at the Electric Car Shops, Jolimont.**

# Model Railway Signalling

## A System of Automatic Control of Both Signals and Locos.

By H. A. COVENTRY

In the November issue of the Homecraft, an article on the construction of an electric model signal showed readers how this useful track accessory could be made. Since then quite a number of readers have written requesting information on various phases of automatic signalling, with the result that the writer has designed the "lay-out" shown in the accompanying illustration.

The signal described in the November issue was merely controlled by means of a switch. The same design, however, is used in the construction of the signals necessary for the equipment of the automatic track circuit described in this article, but two contacts must be added as shown in Fig. 2. This is clearly shown in the illustration, the lower portion of the signal being shown enlarged.



Before proceeding with the construction, the reader should carefully trace the various circuits and gain an idea of the manner in which the various circuits are made and broken, as, providing the system is placed down as shown, the signals will automatically drop to the "go ahead" position as the train approaches. However, should there be another train on the next section ahead, the signals will not fall, thus the current will be cut off and the second train brought to a standstill.

Fig. 2 shows the contact breakers which are fitted to the armature of the signal, and it will be noticed that when the signal is at danger the armature rests on the contact screw 2, but immediately a train enters the section the armature is lifted and makes contact with the screw 1.

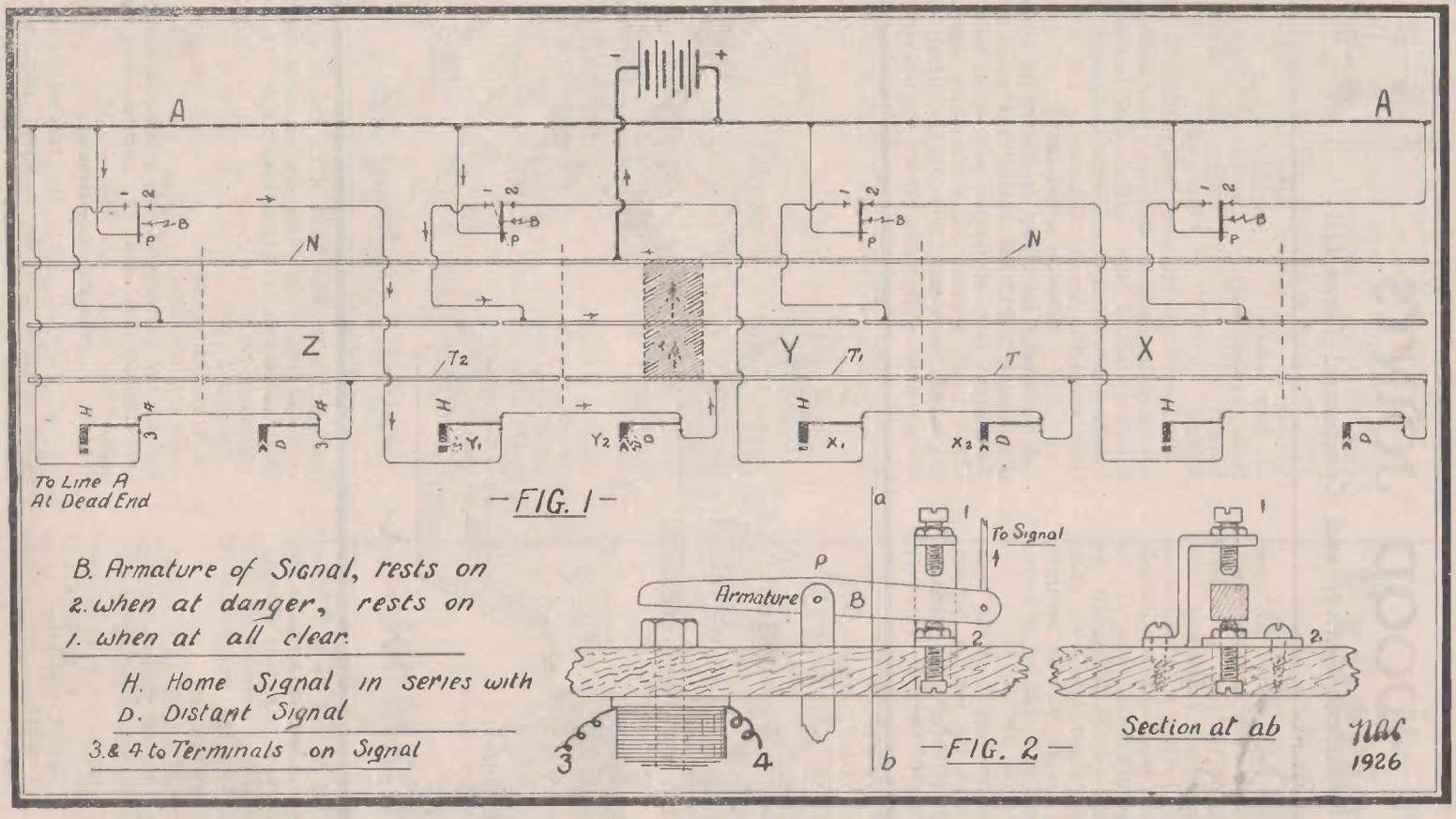
In Fig. 1 it will be noticed that the train, on entering the section X, short circuits the track circuit rail T, and the neutral rail N, the wheels and axles providing a path for the current to flow across. Following the diagram it will be seen that the current flows from A down to the pivot P, along which it travels to contact 2, and through the home and distant signals X1 and X2. The passage of the current will bring both these signals to the all-clear position, thus breaking connection with contact 2, but making connection with contact 1. This energises the centre rail of section X, and allows the train to proceed.

On reaching the next section Y, the action is repeated, and signals Y1 and Y2 are brought into the position shown in dotted line, with the armature B at rest on contact 1. Immediately the train passes from section X, the circuit between T and N is broken, and the signals X1 and X2 fall back to danger.

For example, when the train is on section Y, the train is represented by the shaded portion, and the signals are as shown by the dotted line, no current will flow on the centre rail of section X until the signals X1 and X2 show all clear. As this is impossible while the armature of signal Y is away from contact 2, no two trains can be on the same section at one time, providing the momentum of the train does not carry it across the dead section. For this reason it will be necessary to make the sections of sufficient length for the train to roll to a standstill.

All wiring must be carried out in good quality bell-wire, carefully soldering all joints. Make the sleepers of wood, and the fishplates on both centre and track circuit rails (at end of each section) of fibre. All rails must be bonded, except at the end of sections on the track circuit and centre rails. This is best done by soldering a piece of 20-gauge copper wire between each end of the rail.

Make the contact breakers from heavy brass strips bent to the shape shown, and fix to the base-board by means of wood screws. The adjusting screws should have lock nuts fitted to prevent the knocking of the armature from working them loose.




— FIG. 1 —

— FIG. 2 —

The circuit shown in this illustration should prove of great interest to the model engineer who desires to control his electric train automatically. Each signal should be similar to the one shown in our November issue, on page 182, but must be fitted with an additional contact as illustrated. By carefully tracing the flow of the current it will be seen that while a train is occupying a certain section of the track the supply to the section over which the train has just run is switched off, thus preventing any possibility of a collision. This system is, of course, not applicable to steam locos., but the signalling circuit only may be used, causing the "stick" to drop as the train approaches.

# WOOD JOINTS

## Common, Corner and Compound Dove-tail

In carpentry the term joint means the union of two or more smooth or even surfaces admitting of a close fitting or junction, as a joint between two pieces of timber. The art of making of these joints or joinery is an advanced branch of carpentry, and requires a considerable amount of skill, especially with some of the more complicated forms, as not only must the parts be shaped to the dimensions with absolute precision so that the fit will be accurate, but it is a work of precision in making or laying out.

Formerly, before the introduction of the numerous iron fittings now on the market, joinery, especially in building construction, was practiced to a greater extent than at present. However, a thorough knowledge of joinery is still indispensable to the first-class carpenter, while to the amateur a knowledge of how this class of work is carried out will help him in successfully performing the numerous jobs the handy-man is called upon to carry through.

There is a multiplicity of joints, all of which may be divided into two general classes, according to the manner in which the joining pieces are brought together, as—

(1) Plain or Butt Joints.

| | |
|---|---|
| Straight | Corner (mitre) |
| Dowell Pin | Feather |
| Corner (square) | Splice |

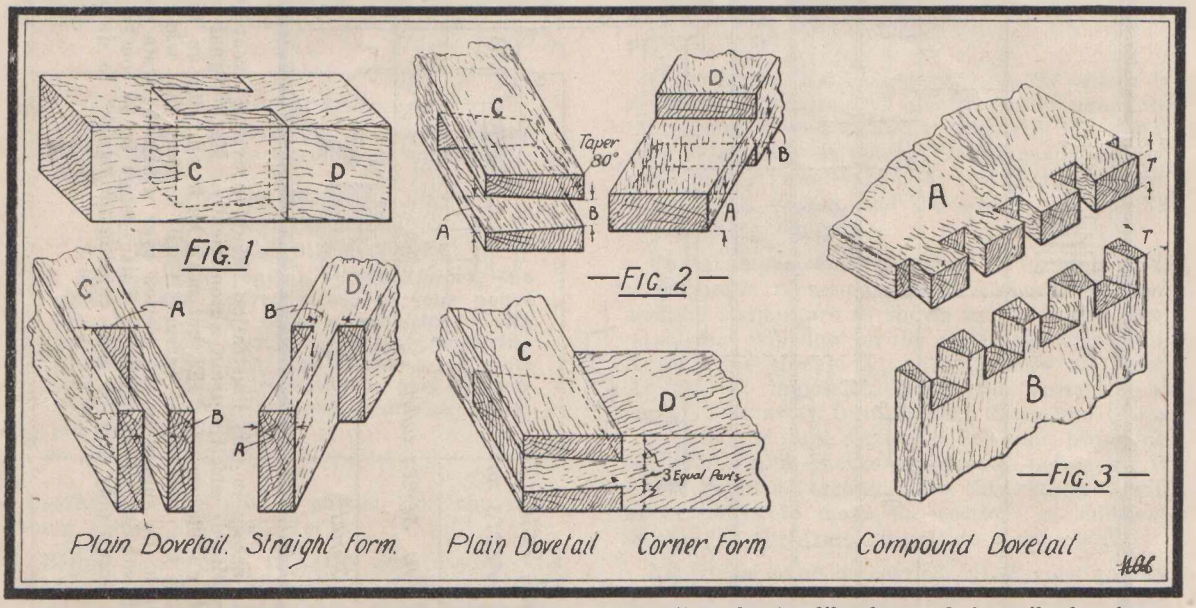
(2) Lap Joints.

| | |
|---|---|
| Dado (housed butt) | Mortise and Tenon |
| Scarf | Tongue and Groove |
| Wedge | Dove-tail |

Readers of this magazine will perhaps be more interested in the latter item, i.e., dove-tailing, as it is this class of joint which is used in the construction of wireless cabinets, tool boxes and other small but handy cabinets.

### What Is a Dovetail?

A dove-tailed joint may be defined as a partially housed TAPERED mortise and tenon joint, the tapered form of mortise and tenon forming a lock which securely holds the parts together. The word "dove-tail" is used figuratively, the tenon expanding in width toward the tip, and resembling the fan-like form of the tail of a dove.




To still further divide our list of joints we will class the various forms of dove-tail as

Common
Compound
Lap or Half-Blind
Mortise or Blind

And for the purposes of this article confine ourselves to the first two, i.e., common and compound.

### The Common Dovetail.

In all dove-tail joints the tapered tenon is called the pin, and the mortised part, which receives this joint, the socket; therefore, a com-

mon dove-tail is termed a plain or single pin joint. Where strength rather than appearance is important, this common dove-tail is always used. Fig. 1 shows the plain straight form, the lower illustrations showing the pin and socket, no great amount of study being necessary to understand how the one fits the other, thus making a solid and satisfactory joint, the keying or locking effect of being apparent.

Fig. 2 shows the corner dove-tail both assembled and unassembled, the correct proportions being indicated.

In making this joint, both edges are made true and square; a gauge line is run round one board at a distance from the end, equal to the thickness of the other one, this other board being then treated in a similar manner. Now, two methods are followed. Some mark and cut the pins first; others the sockets. In the first method the pins are carefully spaced and the angles of the tapered sides marked with a bevel. Saw down to the gauge line, and work out the spaces between with a chisel and mallet. Now put B on top of A (Fig. 3) and scribe mortise. Square over, cut down to gauge line, clean out, and fit together.

The second method is to first mark the sockets on A (sometimes on common work the marking is dispensed with, the mechanic using his eye as a guide); then run the saw down to the gauge line, put A on B and mark the pins with the front tooth of the saw; cut the pins, keeping outside the saw mark sufficiently to allow the pins fitting fairly tight; then both pieces may be cleaned out and tried together.

In cleaning out the mortises and spaces between the pins, the wood-worker must chop half way through, then turn the board over and finish from the other side, taking care to hold the chisel upright so that the work is not cut under. Another bad practice is to leave the pins long, and rivet them over with a hammer after the joint is glued.

The compound dove-tail shown in Fig. 3 is merely a repetition of the single dove-tail.

### Spacing the Work.

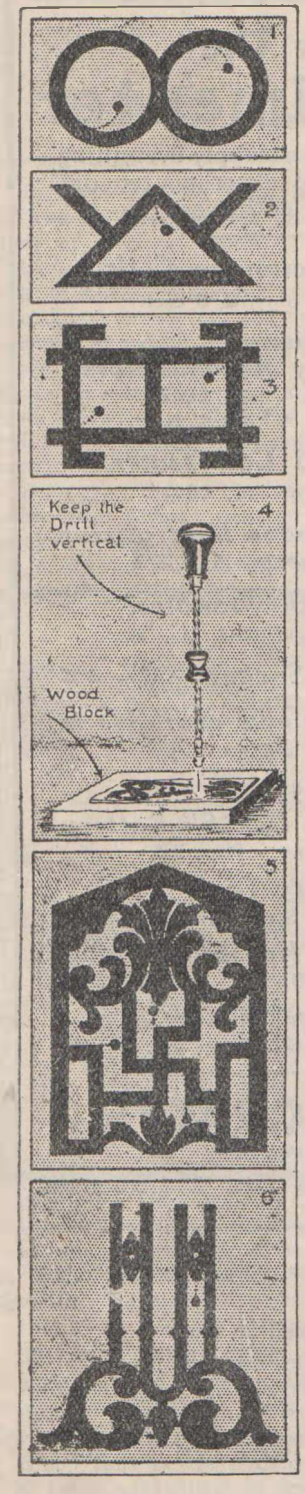
The maximum strength would be gained by having the pins and sockets equal; but this is scarcely ever done in practice, the mortise being made so that the saw will just clear at the narrow side, the space being from eight to ten times the width of the widest side. Small pins are used for the sake of appearance, but fairly large ones are preferable. The outside pin should be larger than the others, and should not be too tight, as there is a danger of it being split off.

The taper of the angle should also be slight, say, 70 deg. to 80 deg., as if made too acute, there is great danger of the pins being split when assembling.



### The Position of Pins.

When boxes are made, the pins are generally cut on the ends, the sockets being on the sides. Drawers have the pins on front and back, the rule being to have the tapered sides so that they are in opposition to the greatest stress that comes upon the piece of work to which the joint is applied.




# The Art of Fretwork

**A Special Article by "Handicrafts," London**

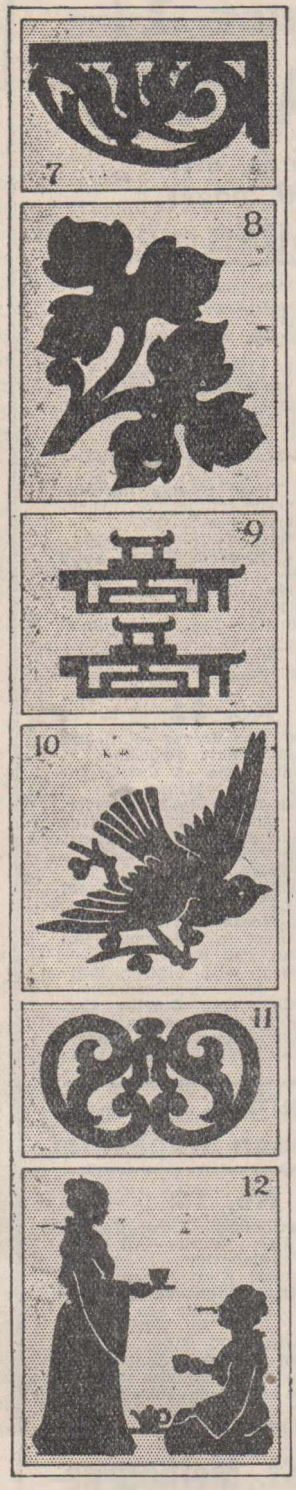
Each year sees a rapidly increasing number of fretwork enthusiasts in this country, and there is no doubt a very large number of people who are keenly interested in fretwork in Australia. Experience, however, shows that when fretwork is taken up without instruction the work is sometimes carried out in a rather indifferent manner, when with a little better knowledge of the work a much higher standard might be produced.

The following hints are intended as a guide to beginners, but many who have done fretwork for some years will, no doubt, learn useful hints by reading these notes and studying the illustrations.

When an interior opening is to be cut out a small hole has to be drilled in order to get access for the saw. Do not use a bradawl for this, or it will split the wood. Use an "archimedean" drill (as at Fig. 4). Clamp or nail the work to a waste block of wood. This will enable you to use both hands, and the waste block prevents the underside of the fretwood from splintering when the drill passess through. Keep the drill p rfectly upright; and, when withdrawing the bit, keep the bobbin moving up and down so that the point may ease itself out.

The illustrations at the left here show where holes should be drilled. In the case of circles (1) or ovals, drill near the line, and then let the saw approach it in a curve. With triangles or squares (2 and 3) drill near a corner. When, however, the opening has projecting points (as 5 and 6) drill near one of those points so that the saw may steer direct for the line it has to cut. In the openings at Figs. 5 and 6 there are several points from which to choose. When a piece of work has been drilled, the under surface of the wood should be glass-papered in order to smooth down any raggedness left by the drill.

To cut correctly and smoothly must be the first aim. Accurate cutting means following the pattern line. Bad cutting is not usually the result of inability to do anything well; it is due rather to indifference, and, if we begin by cutting carelessly, we soon get so accustomed to it that we do not realise what good work is. Then, the saw blade must, when cutting, be kept absolutely vertical. If it is allowed to lean to one side, the cut will be slightly on the bevel—not true—and the result will be an irregular and ugly edge. The secret is to begin by cutting slowly, smoothly, and with a regular upright stroke. Do not force the saw. As the teeth of the blade face downwards, the cutting is only




on the downward stroke, and there should be no pressure on the upward stroke.

When coming to a projecting corner, let the saw turn right round in the wastewood, as at X, Figs. 1 and 2 (right-hand illustrations). In this way the corner is left with a sharp edge. With a piece like Fig. 3, the tenon joint X will be noted, and care will have to be taken so that it will accurately fit the slot it has to enter. The neat cutting of constructive parts is as essential as the accurate sawing of ornament. Fig. 4 shows how "ties" are arranged so as not to interfere with the general line of the design. Fig. 5 indicates how a trellis pattern is occasionally blended with ornament. When cutting Fig. 6 it is important that the eye should constantly be kept on the line of the square so that there may be no risk of breaking the continuity.

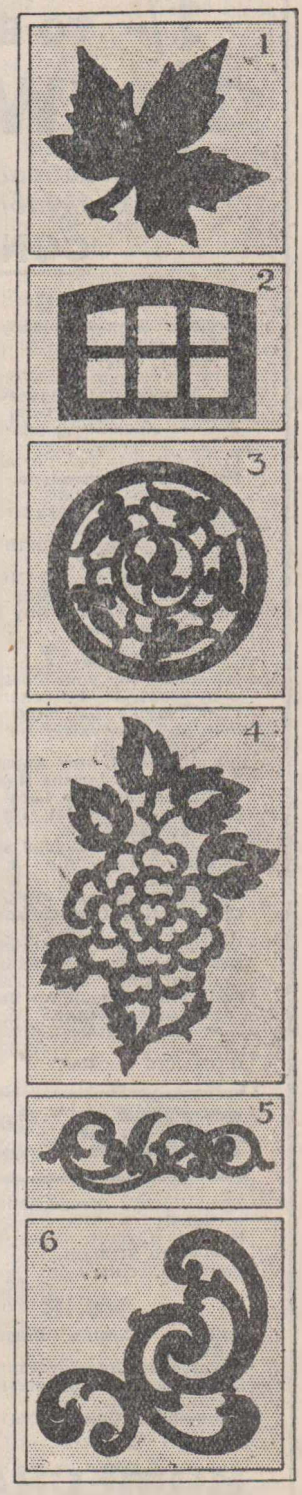
One of the first discoveries we make in fretwork is that different kinds of ornament vary in their degrees of difficulty. It is not that small openings trouble us much more than larger ones, but rather that we seem to cut certain kinds of ornament better (or worse) than others. Speaking generally, ornament is either "free" or is what we call "conventional." A natural arrangement of, say, ivy leaves (of which Fig. 1 may be one) we term "free" ornament. On the other hand, we have in Fig. 3 a design in which a leaf form is arranged according to a definite ornamental scheme. The leaf is conventionalised; it is not drawn to represent a natural leaf. The ivy leaf (Fig. 1) is easier to cut than Fig. 3, as any slight slip would hardly be noticeable. Fig. 2 again is really difficult to cut well, for the simple reason that any little error would at once be detected.

At Fig. 4 we have an example of Japanese decoration showing a very free arrangement of conventionalised forms. On the other hand, Figs. 5, 6 and 7 will usually be found difficult to cut, on account of the regularity of the curves. The more severe lines of Japanese ornament are seen at Fig. 9, and features like Fig. 11 are usually troublesome on account of their symmetry.

Before beginning to cut any design, it should be examined in order that the ornament is understood. The great thing is to grasp the SPIRIT of the ornament. In cutting it is very easy to lose the spirit. In the case of a leaf like Fig. 8, the flattening of a curve, or the rounding of a corner will rob the ornament of its effectiveness. If a design is studied the difficult parts will become obvious, and when a difficulty is understood it is more easily overcome.

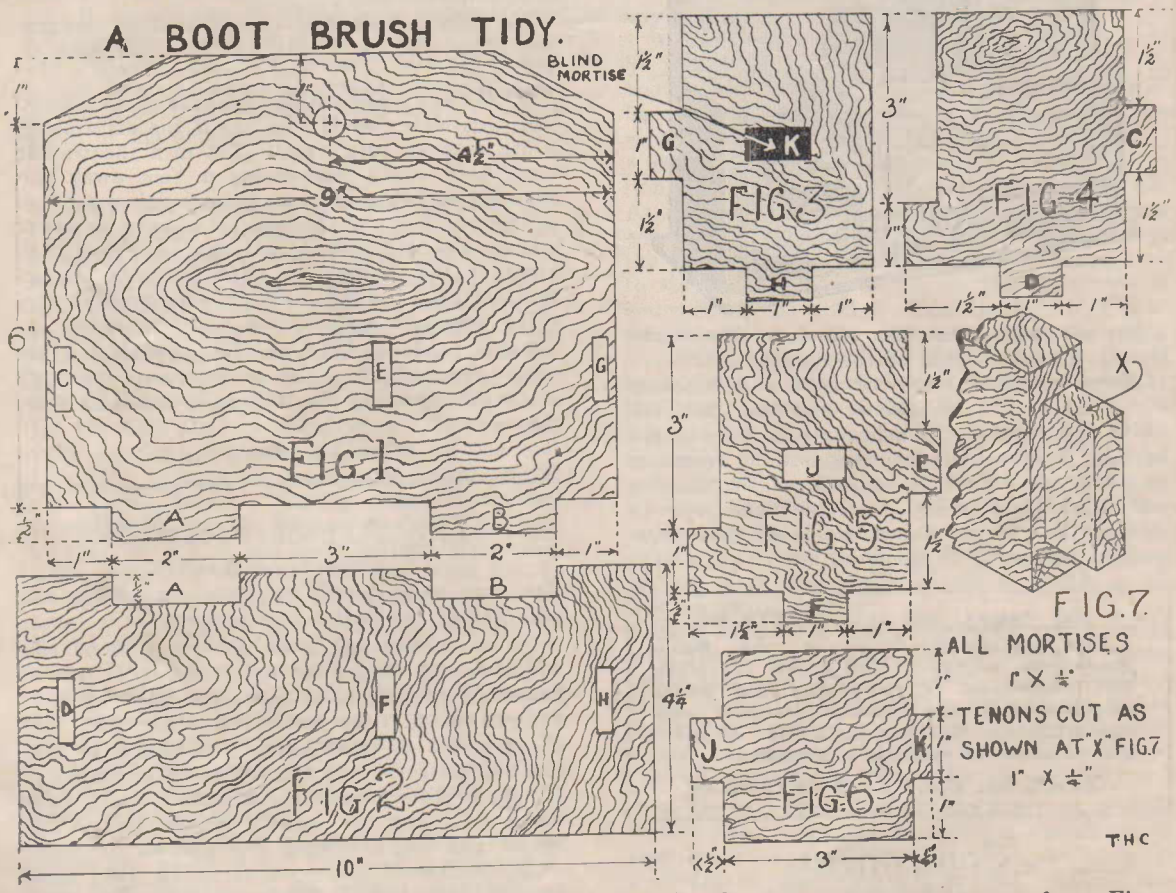
Birds, animals, and figures frequently appear on fretwork designs treated, of course, as silhouettes. It will be noticed from Figs. 10 and 12 that thin saw cuts must sometimes be introduced to suggest properly the outline. These

(*Continued on Page 94*)



# A Boot Brush Tidy

The construction of the boot-brush tidy described in this article may be considerably simplified by nailing the various pieces together. However, this course is not recommended if the maker is desirous of acquiring a working knowledge of various tools, and the reader is advised to make the mortise and tenon joints shown in the illustration. Helpful practice will thus be gained, not only in marking out the various pieces, but in the handling of the saw and chisel, which must be used accurately if workmanlike joints are to be made. The beginner can safely undertake the construction of this tidy with the sure knowledge that his work will not be wasted, as, owing to the design, a badly fitting tenon will not be noticed and a few small nails will quickly make quite a firm job should he fail on any point. On the other hand, he should not be tempted to do the work slovenly, but should strive to make each joint a better and more accurate fit than the previous one. By this means he will slowly but surely master the skill so necessary if he is to become a really first-class handyman.



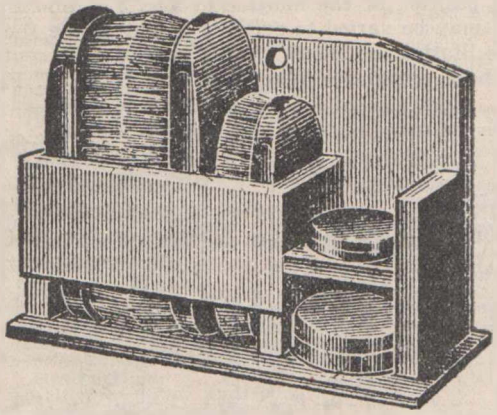

### Making the Tidy.

Choose a smooth piece of pine, ½in. in thickness, and free from knots, and lay out the various pieces shown in the illustration. The backboard, Fig. 1, measures 9in. long and 7½in. high, the latter measurement including the tenons A and B, which are left the full thickness of the timber, the correspondingly cut in Fig. 2 being made sufficiently deep to accommodate them. Tenons C. E and G in Figs. 3, 4 and 5 respectively, will give the measurements necessary for marking the mortises in Figs. 1 and 2, while the position of the mortise in Fig. 3 K and Fig. 5 J may be varied to suit the height of the shelf. The illustration shows them exactly in the centre of both uprights. When marking D. F. H. Fig. 2, take the necessary measurements from Figs. 3, 4 and 5, but remember that the 1in. mark shown between the rear edge and the tenon is not the distance from the back of the baseboard. Actually the mortises in Fig. 2 are 1½in. from the back edge of the base, but allowance must be made for the back, which, of course,

overlaps by ½in. If the back is screwed to the base-board, it will be obvious that the measurements shown in Fig. 3, 4 and 5 are correct. Before finally screwing the back and base together, chamfer the top edge of the base. Cut all the tenons as shown in Fig. 7, that is to say, each tenon should finish 1in. by ½in., the mortises being cut to correspond.

The front board is not illustrated, as it is merely cut to fit from the outside of the upright Fig. 4 to the outside of upright Fig. 5.

Mortise K (Fig. 3) is a blind or stub mortise, and is cut only half the thickness of the wood; its tenon K, Fig. 6, is shown as only ½in. long, all other tenons being half an inch.



The illustration of the complete tidy shows clearly the appearance of the finished article.

When completely cut ready for assembling the wood should be stained and wax polished, while the choice of finish may be left to the builder; a blackwood or dark walnut colour is recommended. Failing the material for staining and polishing, a good serviceable finish may be obtained by painting—chocolate being the recommended colour.



## Components

(*Continued from page 82*)

Once do away with this quality of resonance and immediately the sensitivity of the arrangement is reduced tremendously.

Thanks, however, to the use of valves, this loss of sensitivity can be made up for by the use of an amplifier.

It might at first sight then seem perfectly easy to get a microphone movement absolutely aperiodic up to, say, 10,000 a second, by relying upon having valve amplifiers and a very insensitive arrangement.

But here another trouble arises.

Every valve makes a slight hiss, and when tapped emits a "pong." Suppose, then, a 20-valve amplifier had to be used because the microphone was so insensitive (albeit perfectly aperiodic!) the result would be a broadcast of Niagara Falls, the hiss drowning all other noises. Again, the slightest jar on the valves would produce terrible spurious noises. Thus, there is an insensitivity past which one cannot safely go at the moment.

Thus ideally we require this aperiodic movement with sufficient sensitivity to allow of practical amplification.

We wish to broadcast from a theatre, and immediately the sensitivity problem presents itself.

If we have a reasonably sensitive arrangement, then this may give fair results if the disturbance is 5ft. or even 10ft. away. But in a theatre the actor may move from being a foot away and shouting to being 20ft. away and doing a stage whisper. Thus for a theatre a very sensitive microphone is required that can be placed well away in the auditorium. The difficulty, as before stated, is to get such an arrangement sensitive aperiodic and without spurious noise.

Thus fundamentally the basic problems are quite clear-cut, but obviously there are very great difficulties in the way of a practical solution.

(*Continued on Next Page*)

## The Art of Fretwork

(*Continued from Page 91*)

lines are most easily taken by a single run with one of the larger grade blades.

In all fretcutting there is one general rule which should always be borne in mind. Do not keep both eyes fixed on the waste part, which is afterwards to drop out. The mere fact that the saw has to circumscribe this seems to give it a definite form, and unconsciously the beginner is apt to concentrate his attention on a form which is being cut away. Watch, rather, the actual pattern, and keep one eye on the parts which surround the opening being cut. Good cutting, after all, is far more than mere skill. Skill means a neat and a steady hand; but to skill must be added a fair degree of intelligence; and just as we exercise our judgment in the selection of designs and wood, in fitting and in finishing, so that judgment must be used when we are handling the saw.

### NOISES IN THE SET.

High-tension batteries can be a fruitful source of trouble when they like. One of their meanest and most soul-destroying tricks consists in the "conking out" of one cell somewhere near the middle of the battery. Cracklings of wondrous variety salute your suffering ears, owing to the resistance of varying value that is set up amidships in the battery. Signals grow weaker; some horrid thing has obviously happened; but how shall one locate it?

All the usual tests indicate that nothing is amiss with the circuits. One hauls down and cleans the aerial; digs up and scrapes the earth connection. Inductance, condensers, and transformers are suspected of misbehaviour, but come through the tests with flying colors.

Growing warmer, one seizes the voltmeter, and applies it to the accumulator; warmer still, one puts it across two or three plug holes in the H.T. battery. Each of them shows a satisfactory voltage. The H.T. battery is exonerated. In fact, one may go on for hours, bamboozled all the while by that one "dud" cell lurking in the bosom of the battery.

✤ ✤ ✤

### CUTTING EBONITE WITH A CHISEL.

The ordinary woodworking chisel may be put to several uses in wireless construction, a reasonable proficiency being readily acquired with a little practice. Consider such an operation as cutting a slot in an ebonite panel. Ebonite, being quite a different substance from wood, calls for different treatment, it being necessary to proceed slowly and carefully to avoid breakage.

In the first place, a chisel should be procured which corresponds with the width of the slot to be cut. Chisels are made in standard widths from 1-16in. to 3in. Having carefully marked the outline of the slot with a steel scriber, hold the rule on one of the long scriber lines, and, taking the chisel in the right hand, with its flat side against the rule, and the cutting edge at an angle of approximately 45deg. to the ebonite, run the chisel sharply along the rule two or three times. If a little downward pressure from the hand is maintained, the result will be a V-shaped cut. The operation should be repeated in the opposite direction on the other slot, giving a W-shaped cut, and continued in this manner from one side to the other until the ebonite is cut about half-way through.

The same method is repeated upon the reverse side of the panel, which has been marked with great precision (the panel marker described on page 63, July issue, will greatly facilitate this marking). In this way the panel may be cut right through, care being taken to work inside the marking lines, as there is always a tendency to overlap. The ends are shaped with short downward cuts, and the slot is finally cleaned up with a small file.

## Components

(*Continued from page 94*)

In one type of microphone that has met with a good deal of success, the natural period of the diaphragm is made to rise above audibility. Other arrangements have been tried in which the natural period is allowed to remain in the movement, but the effect of which is overcome later by electrical means. Many other methods have been tried, some with real success. The latest type in use is remarkably efficient.

What is really wanted is a substance that is affected in its electrical conductivity by the presence of sound waves—a sort of selenium cell for sound and not for light—then nothing would have to move, and the fundamental problems of resonance would be overcome.

This is a great trouble in broadcasting, especially for theatre work.

In the theatre the microphone usually has to be placed at the footlights; place it back in the auditorium and the amplification required will be excessive, and a restive or coughing audience would predominate over the stage.

Thus the footlights are perhaps the best position, but the problem of controlling is awful. At one moment the leading lady is proclaiming her woes 5ft. from the microphone; at the next the hero whispers at the back of the stage, and to the mechanical microphone the difference is enormous. The man working the control has to sit somewhere in the dark underneath the stage, and unless he knows the play by heart, has to be a prophet, and often gets badly let down by the rapid changes of intensity.

The microphone, which is the first link in the broadcast chain, is our greatest problem, and the only solution seems to lie in the designing of a sort of sound selenium cell which alters its resistance as the sound impinges upon it. This would solve a lot of the problems of resonance, and, of course, if it was really sensitive, would be all that could be desired.

Now, suppose a really aperiodic and a fairly sensitive microphone has been achieved, a microphone that responds equally and sympathetically to all the sounds that impinge upon it, one would think that troubles would come to an end. This is not so, however, because the ear has extraordinary qualities not given by the microphone.

In the first place, the ear, to a certain extent, adjusts itself to conditions, and if a loud shout, so loud as to be uncomfortable, impinges upon it, it closes up and rejects a certain part of the sound. On the other hand, a very weak sound can be given under favourable conditions, the ear automatically sensitising itself.

The microphone has no such power, and obeys the ordinary inverse square laws to a point, so that the loud shout is too loud, and the weak sound too weak.

# Buy, Sell and Exchange

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**Wanted to Sell—Manhattan Senior Loud Speaker,** with fibre horn; stands 24in. high; extremely natural tone; guaranteed perfect order. Cost £7/10/-; **Sell £4.** C. R. McLennan, The Mia-Mia, Marnoo, Vic.

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# Your Query and Its Solution

**All Questions requiring an answer by post must be accompanied by a stamped and addressed envelope.**

**The Coupon printed on Front Cover must always be enclosed.**

### QUESTIONS AND ANSWERS.

**C.M.S. (Kalongadoo, S.A.).**—Q.: What is the maximum plate draw from "B" batteries of the small, large, and heavy duty type? Ans.: Using Hellensen's batteries of the standard (small size), the maximum withdrawal is 10 milliamps; No. 2, larger or double capacity, 15 m.a.; No. 3, treble capacity, 20 m.a.

**M.M. (Heidelberg)** asks for formula for making luminous paint without the usual firing and fusing of the chemicals. Ans.: All of our tested formulae recommend the heating of the chemicals at 2372deg. Fah. However, the makers of the "Primus" chemical sets give the following recipe:—Mix one part luminous sulphide, one calcium carbonate well together with a knife, then mix to thickness of cream in gum. If the paint is required for outside work mix in clear crystal varnish instead of gum. It absorbs light, and is luminous in the dark.

**H.C.H. (Thornbury).**—Q.: Would the "Old Folks'" receiver described in July issue "H.M." be improved by the addition of a rheostat? Ans.: Slightly improved reception may result, but providing the "A" battery merely comprises two cells we do not think any great improvement will be noticed. If it is desired to fit the rheostat, fix it to the panel, and remove the wire connecting 25 to 18. Now connect 25 to one terminal of the rheo, and 18 to the other. This rheo. will then control both valves.

**I.S.McL. (Berry, N.S.W.).**—Q.: (1) Could you please give names and addresses of A2BA, (2) and A309? (3) Have sent cards to several amateurs, but have had no replies; is this usual? Ans.: (1) We have no record of A2BA. (2) 30G is Mr. S. J. Menon, 6 Argyle street, St. Kilda, Vic. (3) The majority of transmitters receive quite a lot of cards, and do not reply to those who fail to furnish a full report or one that is helpful to them in their experiments. If the transmitters requested reports, we think you should receive replies to your cards. It will be quite obvious, however, that nearby reports of reception are useless.

**R.E.L. (Glenhuntly).**—Q.: (1) Would the two-valve reflex receiver described in June issue operate a loud speaker at Upwey, Vic. (20 miles from 3LO)? (2) What voltage batteries would be needed with Ediswan A.R.06 valves? Ans.: (1) The two-valve reflex receiver would be suitable. (2) Use three dry cells or a 4-volt accumulator for the "A" battery, and a 60-volt "B" battery.

**H.M.H. (Bellerive, Tas.).**—Q.: Have recently read an article on making high-tension accumulator from unpasted strips of lead, putting them on charge for a long time to form. (1) Would the same method be applicable to low-tension batteries of, say, 6 volts, 30 A.H., (2) Is there any method of calculating the amp.-hour capacity of such home-made accumulators? (3) What would be the rate of charge for forming the plates, compared with the total capacity? (4) While forming the plates, should the current be run in the same direction all the time, or be reversed occasionally? Ans.: (1) Yes, for positive plates, but the negative plates may give trouble for want of support. (2) Yes: approximately four ampere-hours per pound of lead per cell. (3) When forming, the charging rate is very low, and after each successive charge and discharge the rate is increased until the normal rate is eventually reached. The normal rate of charge is approximately one ampere for each 25 square inches of positive plates per cell.

**G.W.L. (Weering)** is using the Selective Single-valve Set described in "H.M." (June, 1925), and desiring to work a loud speaker, asks: (1) If I constructed the three-valve resistance-coupled amplifier described for the "Best Receiving Set" in October, 1925, issue "H.M.," and used Daniell cells, what valves would you recommend? I am using an A.R.06 valve as detector. (2) What size "B" battery would I require? Ans.: (1) The amplifier mentioned would be quite satisfactory, particularly if the valves specified in the article are used. (2) Use the largest size of "B" battery, say, the "Ever-ready" X.P.60 type which has three times the life at only double the cost of the ordinary type.

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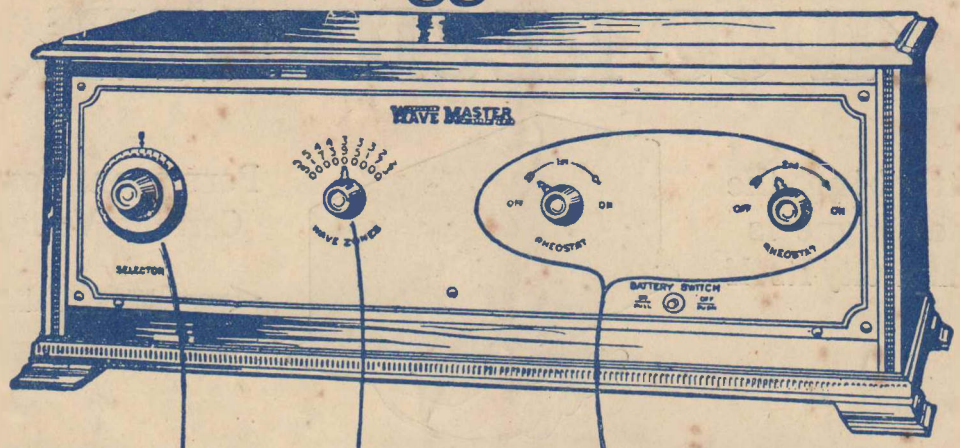


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