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# Practical 3<sup>D</sup> Wireless

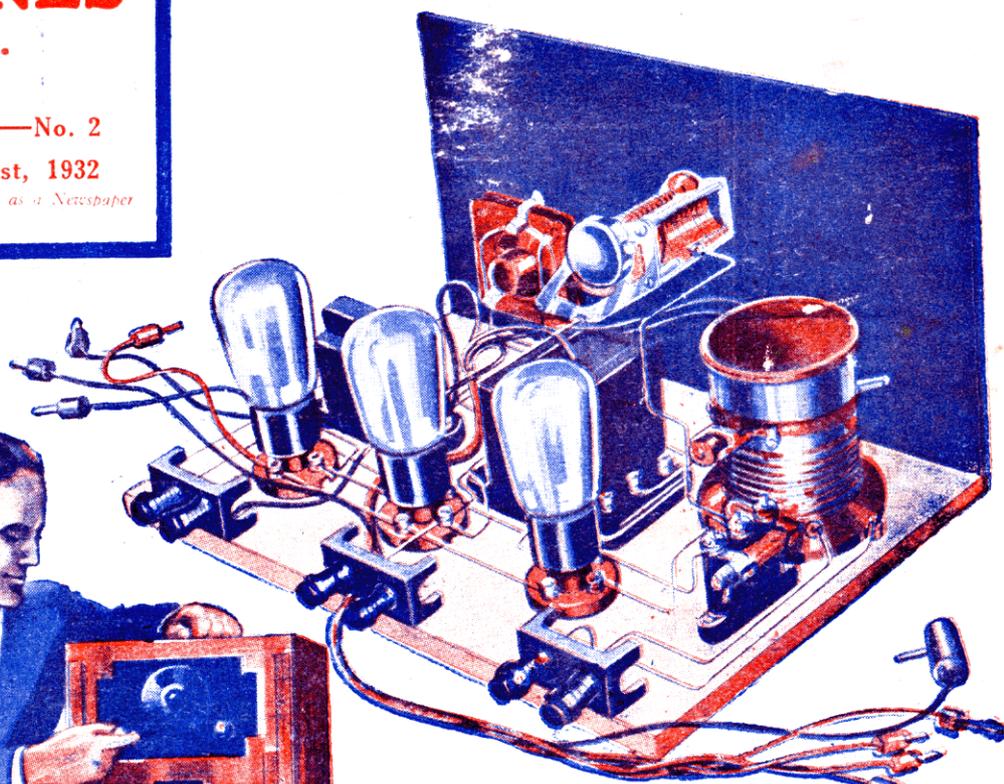
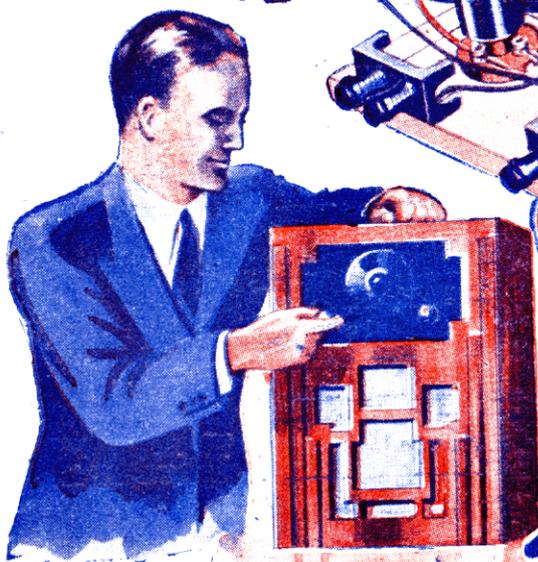
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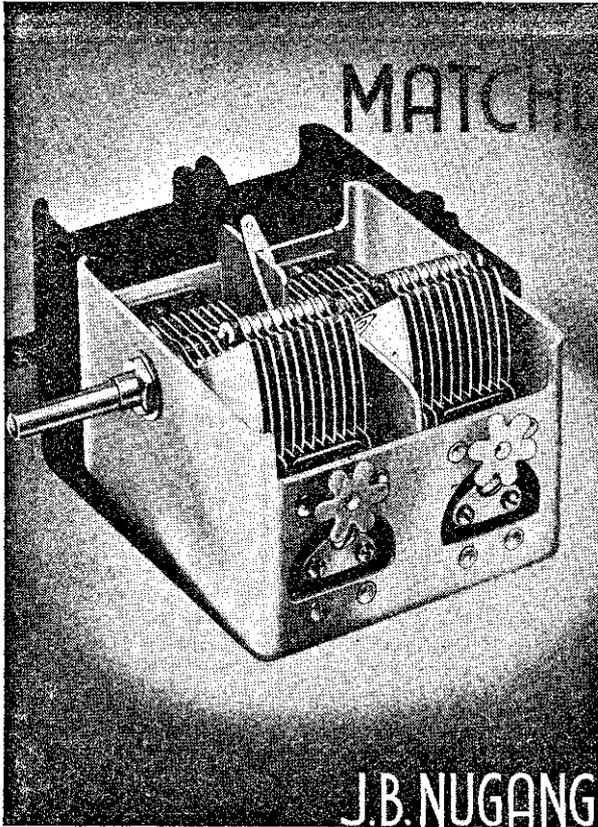


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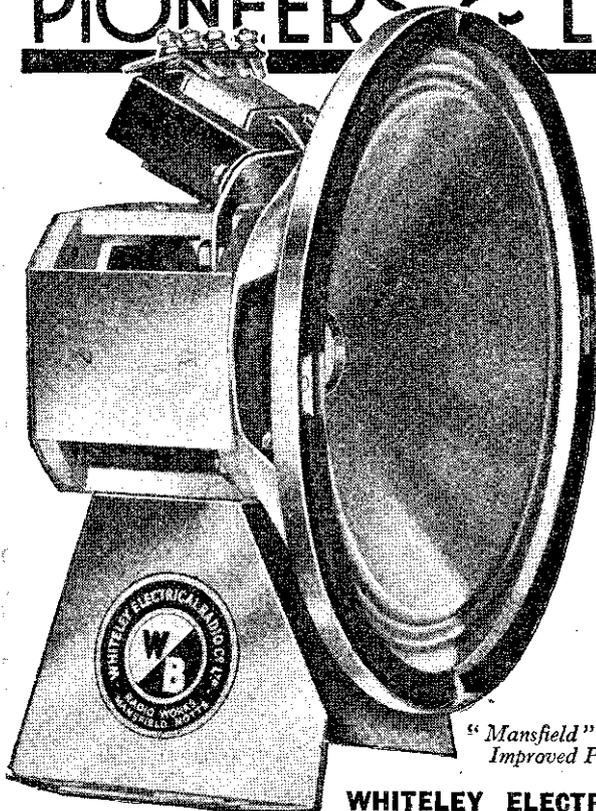
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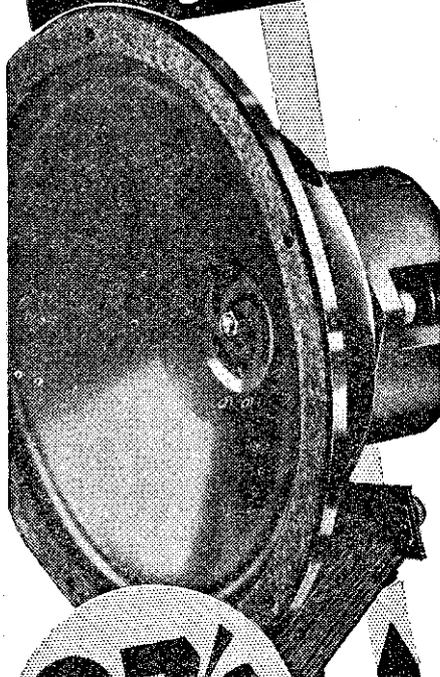
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TO-DAY.**

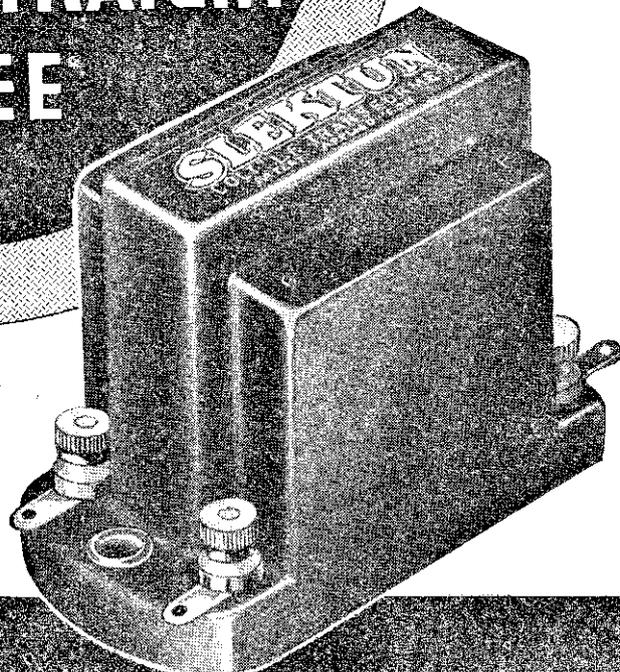
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**NEXT WEEK: THE MAINS EXPRESS THREE!**



**Practical Wireless**

EDITOR:  
Vol. 1. No. 2. || F. J. CAMM || Oct. 1st. 1932.

Technical Staff:  
H. J. Barton Chapple, Wh. Sch., B.Sc. (Hons.), A.C.G.I.,  
Frank Preston, F.R.A., W. J. Delaney, W. B. Richardson.

**ROUND THE WORLD OF WIRELESS**

**"Narrowcasting"**

THEY have a way of doing things in America that seldom occurs to people on this side (just as well, perhaps). The other day, for instance, it was the occasion of the opening of the new 50 kW WGY transmitter at the Schenectady Station of the General Electric Co. of New York, and a huge crowd of people were present at the ceremony. Even the Government co-operated in the affair, and loaned the United States Navy airship, the *Los Angeles*, to participate in a stunt piece of transmission through the new transmitter. The airship from aloft shot a beam of light on to a mirror some half a mile away, and a programme was sent over the beam that was easily followed by the audience below. This method of "narrowcasting," as they call it, was that originated by Mr. John Bellamy Taylor, this gentleman having sent the human voice over a beam of light on many occasions. In this case the transmission was particularly successful, as the programme was picked up by a sister airship, the *Akron*, many miles away over the Pacific. The beam of light is modulated by the voice, and the photo-electric tube in the receiver responds to the modulated light, affecting the electrical impulses in the amplifier, from whence it is fed to the transmitter. As a freak transmission, I suppose the system serves its purpose, but I am afraid I cannot see much future for it commercially, at any rate, particularly as a good pea-soup fog would put the whole thing out of action, I should think.

**Prague's Giant Broadcaster**

THE new radio station is situated in the geographical centre of Europe, some 35 kilometres east of Prague, in the vicinity of the small town of Cesky-Brod. This new high-power broadcasting station is rated at 200 kilowatts (C.C.I.R.), and is the most powerful broadcaster operating in the medium-wave broadcast band. During preliminary tests it was heard in many European countries, including the British Isles. The new station, which operates on a wavelength of 486.2 metres, has been designed to give very high-quality reproductions with low running and maintenance costs. Apart from its high power, the station contains a number of novel features, not the least of which is the special system

of electrical and mechanical interlocks which prevent operators not only from touching dangerous voltages, but also from receiving a shock from the discharge of a condenser. The equipment will cater initially for two studios in Prague, though provision has been made to extend service to ten studios when required.

**Unknown Listeners**

A LOT of publicity is being given to the forthcoming B.B.C. talks to "The Unknown Listener." G. B. S. comes into the limelight—is he ever out of it?—with a talk "To a Politician," and various prominent people are to give talks to other unknown listeners. It would not need a very fertile imagination to suggest scores and scores of other listeners we would like to say a few words to, but I do think the season could be very well started off with a talk—and a really good talk at that—to "An Unknown Oscillator."

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particulars.**

**Who'd Be a Manufacturer!**

A DISGRUNTLED customer wrote as follows to a certain manufacturer concerning the non-arrival of a volume control which had been on order for eight days:—

"Supposing the said volume control was made by hand, inspected by an inebriate and handed over to a half wit, I, in my innocence would have imagined that it might have been delivered by now.

"I don't want to hurry or worry you in any way, but I would be most grateful if same could be delivered before Christmas.

"If you get just one teeny weeny factory working night and day on my volume con-

trol, I should dream dreams of having my amplifier completed before the next 'Show' tells me it's out of date."

Said control had never been ordered from the manufacturer by the local dealer who had the original order. *Verb. sap.*

**New G.E.C. Conversion Unit**

OWING to the extension of the grid system throughout the country, a considerable number of D.C. areas are being switched over to A.C. This means that many thousands of owners of wireless sets who employ the mains for their source of energy find it a difficult problem to convert such sets to operate from A.C. mains. We understand that the General Electric Co., Ltd., is shortly bringing out a conversion unit which will solve this problem by giving the equivalent of the original D.C. supply at a very economical rate.

**New Italian Station**

THE new 60-kilowatt transmitter which is now being erected at Milan (Italy) will shortly carry out its initial tests. October 28th has been fixed as the date of its inauguration; it coincides with the tenth anniversary of Mussolini's Fascist rule.

**How Germany Does It**

IN Germany the listening tax is paid monthly, and its collection from set owners is made by the postman on his rounds. The annual broadcast licence costs twenty-four marks, or at to-day's rate of exchange about thirty shillings. Germany possesses roughly four and a quarter million registered listeners. Radio pirates are discovered by the municipal chimney sweeps, who, in the course of their daily duties, visit all houses, flats and apartment houses. It is their duty to notify all wireless receivers to the local authorities, thus allowing the latter to make the necessary investigations.

**One Mast Aerial**

THE 120 kilowatt Budapest (Hungary) transmitter is being erected on the island of Csepel in mid-Danube; its aerial will be of a distinctive pattern, and will consist of one pylon over 320ft. high. It is somewhat similar in construction to the one now in use at Breslau for its new station.

# Round the World of Wireless (continued)

## The Prague Cockerel

FOR its early morning transmissions, the Prague (Czechoslovakia) studio uses the crowing of a cockerel as an interval signal. As the sound could not be imitated successfully by mechanical means alone, several birds were induced to crow, and a gramophone record was made of the best farmyard rooster.

## Marconi Television

UNDER the call-letters G2BS, the Marconi Company (Chelmsford) has carried out interesting experiments in television transmission on a wavelength of 750 metres. On a recent occasion, when a demonstration of the system was made, pictures were transmitted from the Chelmsford laboratories and clearly received at St. Peter's School, York, some 150 miles away.

## More Power for Sofia

SOFIA (Rodno Radio) will shortly possess a 15-kilowatt transmitter to replace the present low-power plant. Work on its construction is being hurried forward, and the Bulgarian authorities state that there is a possibility of the station being brought into regular operation by the end of the present year.

## Saving Programme Material

IN order to economize on programme material, with the exception of two nights weekly, the German studios will close down nightly at 11.0 o'clock G.M.T. On Mondays and Thursdays, however, according to a rota, one station will broadcast a special late concert from 11.0 p.m. until 12.30 a.m. For the benefit of Germans living abroad this transmission will be relayed to Königs Wusterhausen (1,634 m.) and to Zeesen (DJA), on 31.38 m.

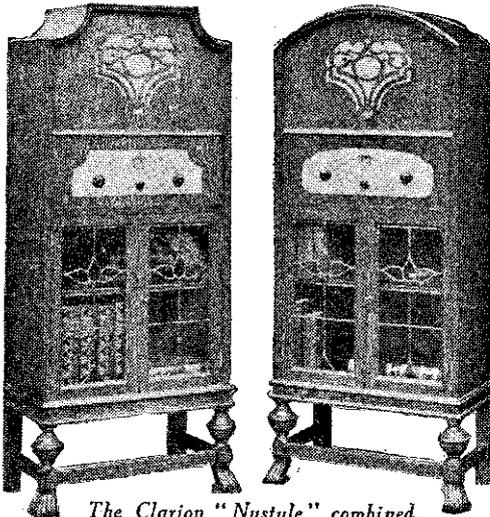
## Extensive French Scheme

THE French State Posts and Telegraphs are considering a further development of their short-wave broadcasting service with a view to bringing their overseas colonies into closer touch with the mother-country. The experimental station at Tananarive (Madagascar) is to be endowed with more powerful plant, and the authorities also contemplate taking over the working of the Chi-Hoa transmitter (Radio Saigon) in French Indo-China as, owing to lack of local financial support, the programme service was suspended some months ago. In addition, new short-wave stations are to be installed at Rabat and Casablanca (Morocco), and, to complete the system, transmitters will be erected at St. Denis (Reunion Island), Dakar (French West Africa), Brazzaville (French Congo), and at St. Pierre (Martinique). When the net is complete the authorities hope to broadcast special news bulletins and concerts from Radio Colonial (Pontoise-Paris) which, in turn, would be picked up and re-transmitted by the French overseas stations.

## Austrian Change Round

THE 100-kilowatt broadcasting station which the Ravag authorities are building at the summit of Mount Bisamberg, in the neighbourhood of Vienna, will eventually take over the duties of the Rosenzettel transmitter. The latter, in its turn, is to be dismantled and re-erected at Graz as a more powerful relay of the Austrian main programmes.

## INTERESTING AND TOPICAL PARAGRAPHS



The Clarion "Nustyle" combined bookcase and wireless cabinet. It is 57in. high, 24in. wide, and 14in. deep.

## A New Idea in Programmes

IN an endeavour to cope with unemployment amongst musicians, Radio Vitus (Paris) has inaugurated a broadcast feature by which "situations vacant and wanted" are made known to interested parties. A small charge is made for these radio ads., and all answers from employers are addressed to the studio officials.

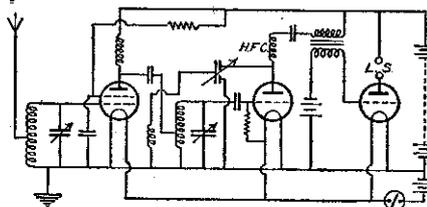
## Warsaw's Drum

FROM Warsaw, in the course of the evening programmes, you may have picked up the roll of a drum. This sound, which is produced by a gramophone record, invariably precedes certain important official communications. It has been chosen for its distinctive nature in order to attract the special attention of listeners to the ensuing announcement.

## SOLVE THIS!

"Hallo, Brown. How's the wireless set going?" Brown looked glum and, producing a grubby piece of paper, said: "Well, I re-wired my set last night. Here's the circuit. When I switched on nothing happened. The wiring agrees with this, and I can't see anything wrong, can you?"

This is the circuit, and for the first three correct solutions to this problem which are opened on October 3rd, a prize of a book will be awarded.



## ANSWER TO LAST WEEK'S PROBLEM:

As the detector valve was R.C. coupled to the next valve it already had a high value of resistance in the anode lead. The addition of a decoupling resistance of 100,000 ohms resulted in a large voltage drop, and so gave the reduction in signal strength.

## A Ship's Band Broadcast

EVERY Sunday morning, at 5.15 G.M.T., the Hamburg station relays a concert given by the ship's band of one of the transatlantic liners in dock or at Bremerhaven. This early transmission is also usually taken by Königs Wusterhausen, Breslau, Berlin, Mühlacker, Frankfurt-am-Main and Langenberg. The orchestral concert is preceded by the tolling of the St. Michael bell, the German "Big Ben."

## Double Power

CONTRARY to statements made in Continental newspapers, Poznań (Poland) is not to be the site of a new 100-kilowatt transmitter, but the power of the existing station may be doubled in the near future.

## Programmes for Prisoners

AT Malmö (Sweden) the Central Prison has been equipped with wireless loud-speakers so that the inmates may listen to the local radio programmes at fixed intervals during the day. The loud-speakers are placed in the corridors, thus enabling the prisoners to listen whilst confined in their cells. Concerts and instructional talks or lectures are permissible, but at periods when news is broadcast from Stockholm, the Chief Warden switches off the main receiver.

## Doctor Radio

ON 160 metres (1,875 kilocycles) you may pick up a call—*Elbe Weser Radio*. It originates from the German coastal station DAC, which broadcasts news bulletins to shipping in the North and Baltic seas. This channel is also used for the transmission of expert medical advice from the Cuxhaven naval hospital, and is given to shipping of all nationalities, on request, in case of sickness or accident on board.

## More Chaos

GERMAN listeners to the Heilsberg station have complained that broadcasts of their programmes are marred by interference from the Polish transmitters. As the power of the Heilsberg plant can be increased to 150 kilowatts, the German authorities propose to work on a minimum of 100 kw. in the near future. Should this not meet the case the transmitter will be used at its full capacity. Such a power would bring the Königsberg broadcasts within the reach of most set-owners in the British Isles.

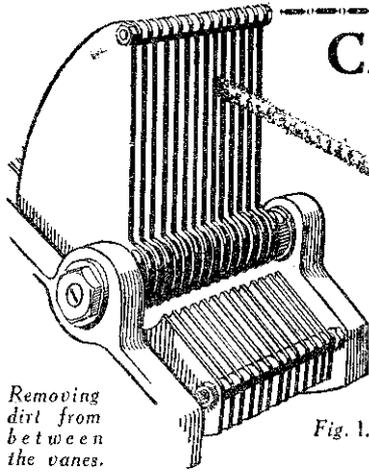
## A Lesson for Us

IN most European countries listeners to the radio programmes suffer from interference due to electrical plant in their immediate neighbourhood. The Danish authorities have passed a stringent law making such interference an indictable offence. In order to cope with the floods of complaints which have been received, the Copenhagen police compel any person who notifies the name and address of a possessor of electrical apparatus troublesome to his neighbours to deposit with them the sum of 10 kronen. If the complaint is justified and the culprit convicted the money is returned; if not, it is confiscated to defray the expenses of an unnecessary prosecution.—JACE.

# CARE AND UPKEEP

Periodic Attention to the Points Mentioned in this Article will Considerably Enhance the Performance and Life of the Set.

By GILBERT E. TWINING



Removing dirt from between the vanes.

Fig. 1.

THE life and successful operation of a wireless receiver depends upon the way it is handled and maintained. A set which is carelessly operated cannot be expected to give full satisfaction for any length of time, whilst even if it is treated with care and consideration wear will nevertheless be taking place; condensers are being strained by voltages across them, valve filaments are deteriorating and transformers, chokes and resistances are subjected to magnetic strain. Therefore, in time, some fault may develop which will need correction.

Dust and dirt are some of the worst enemies of wireless, causing weakness in signal strength, breakdowns in insulation, together with crackling. The point is that when any symptoms of trouble occur a search for the cause should be made immediately. It is of no use letting it continue, for, unless it is due to external influence, it will not right itself and will probably become worse. Where crackling noises, coupled with loss of volume and distortion are heard in a circuit, the first test must be to determine to which class the interference belongs. Remove the aerial, and, if the noise still continues, remove the earth. If the disconnection of both aerial and earth do not remove the noise, the trouble is probably due to bad contacts or faulty components. High-tension, low-tension, grid-bias and loud-speakers, grid-leaks and their holders, resistances, etc., should be looked over for loose connections.

### Faulty Switch Contacts

Switches are sometimes the cause of lost volume owing to bad contacts being made, due to the presence of dirt, or looseness. Attention should periodically be paid to all switches inside or underneath coils, panel switches for L.T., etc. Where these are

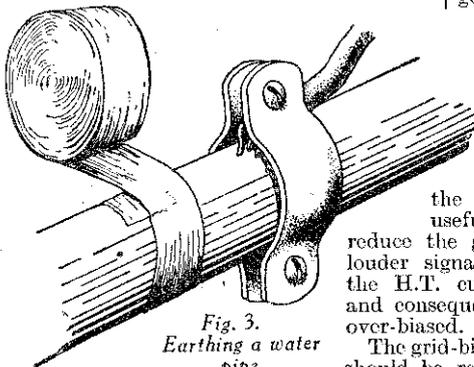


Fig. 3. Earthing a water pipe.

of the plunger type the plunger ought to be withdrawn, and the side springs cleaned and bent slightly closer together. Dirty valve pins making bad contact with the valve holders can cause crackling and loss of power, as also dirt and dust between the variable condenser vanes, especially noticeable when tuning: a pipe cleaner passed between the vanes will effectually clean these, as shown in Fig. 1. All terminals should be tested and screwed down firmly; dirty or badly-fitting wander plugs may need cleaning, and the pins opened out with a pocket knife. The spades and terminals of the L.T. accumulator, especially the negative side, become corroded by the action of the acid; these should be cleaned and a little vaseline smeared around them.

### Look to Your Accumulator

Never let an accumulator stand in an uncharged state. It should be recharged immediately, otherwise the plates will sulphate, and this can only be corrected by charging slowly at half the normal rate. If the plates are sulphated badly, however, it will probably mean renewing them. Always keep the electrolyte up to the correct level by adding distilled water. After an accumulator has been in use for some time it will be much benefited if washed out, cleaned and the cells refilled with fresh electrolyte of the correct specific gravity. This is specified on the label by the makers. With a hydrometer it is a simple matter to test the density of the acid (see Fig. 2).

When a trickle-charger is used it may be found that the L.T. battery is being undercharged. In time, the voltage will fall so low that the volume is reduced. The cells may be damaged if they are continually being used in a more or less uncharged condition, and a good charge should therefore be given at regular intervals.

### Battery Troubles

The high-tension battery is one of the chief sources of lost power and distortion, for most users are tempted to carry on with the old battery after the voltage has dropped below its useful life. A good test is to reduce the grid-bias voltage; if this gives louder signals, it proves that the H.T. current is too low, and consequently, the valve is over-biased.

The grid-bias battery deteriorates in time, and should be renewed every six or nine months:

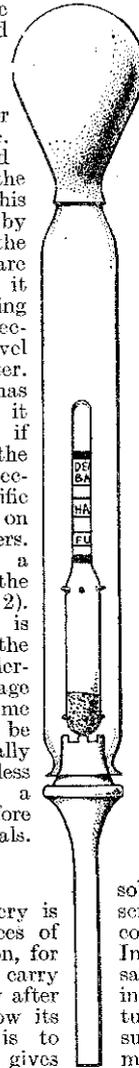


Fig. 2.—A hydrometer for testing L.T. accumulators.

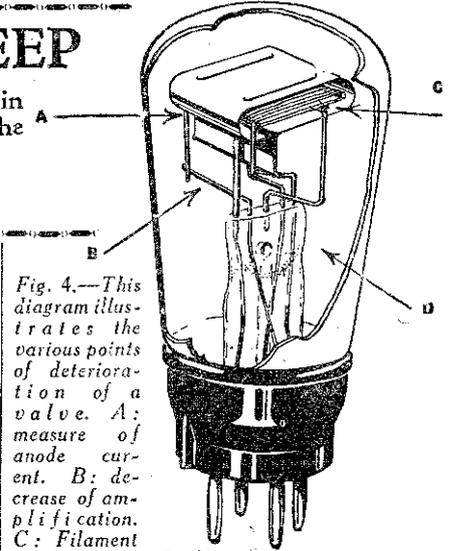


Fig. 4.—This diagram illustrates the various points of deterioration of a valve. A: measure of anode current. B: decrease of amplification. C: Filament loses emission. D: lower impedance.

it is far cheaper to look after this small battery than to spend money on large expensive H.T. batteries. The amount of G.B. given to the power valve will determine the amount of current flowing from the H.T. battery, given a certain H.T. voltage; therefore, it must follow that if the G.B. is kept constantly at 9 volts or the amount stated by the valve maker, the H.T. battery is being used as economically as possible. Too little or too much grid-bias, however, will both lead to distortion. The set must always be switched off when altering G.B. voltages: if you adjust it without doing so the bias to the valve is removed, and the plate current immediately increases. This, of course, is very detrimental to the valve, and if often repeated would, in time, ruin it. Also switch off when making other adjustments inside the set, and, as an extra precaution against short-circuits, withdraw the negative wander plug from the H.T. battery.

### Aerial and Earth

The aerial and earth system is a most important part of the set, and should receive regular and careful attention, for no matter how perfectly the set may be working, it cannot give its best reception if this is faulty. Partial short-circuiting of the aerial to earth may easily mean weak signals: the points to watch are perished lead-in tubes, broken insulators and dirty earthing switches, etc. In the case of outdoor aerials it is even advisable to fit a new wire every twelve or eighteen months, on account of corrosion due to oxidization of the metal: this process will take place much more quickly in towns than in the country, however.

The earth lead must be short and as stout as possible: 1/4 gauge stranded copper aerial wire is suitable: it should be soldered to the earth tube or sunken plate, not screwed down under a terminal. A bad earth connection leads to instability and distortion. In dry weather, or if the soil is inclined to be sandy, the earth should be kept moist by pouring water down the earth tube, the top of which tube should project about an inch above the surface of the ground. A good earth can be made by joining up to a convenient water pipe,

employing one of the usual earth-clips sold for the purpose. The pipe must first be scraped quite clean to ensure a good contact, and should be wrapped with insulating tape to protect it (Fig. 3).

(Continued on page 112)

# NEW IDEAS IN INCLUDING SOME

Mr. W. B. Richardson has investigated the Design describes in the first of two articles the Construction

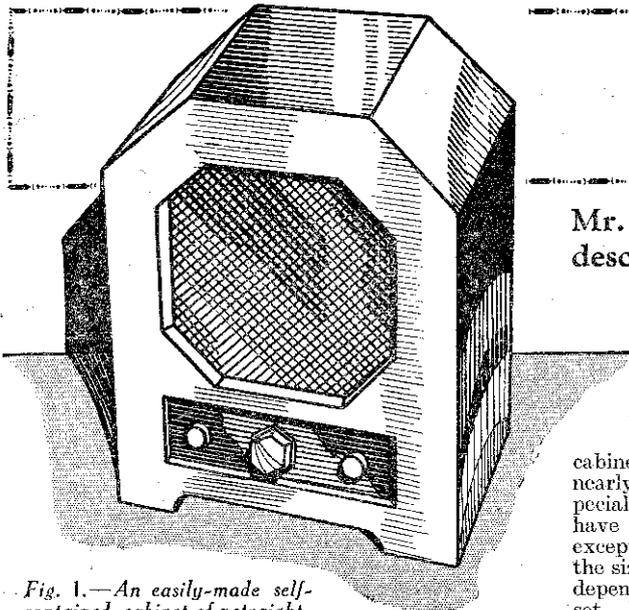
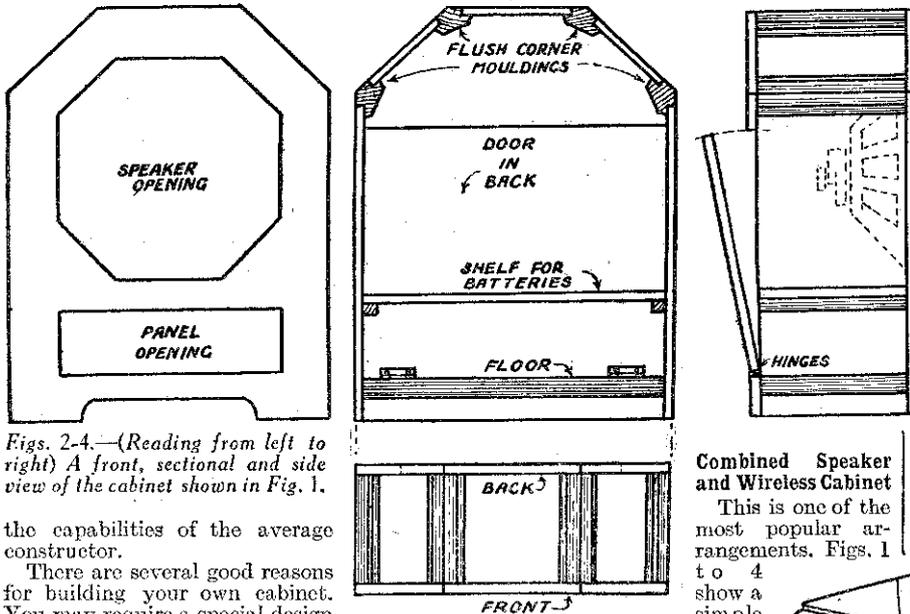


Fig. 1.—An easily-made self-contained cabinet of a straightforward design.

At one time receivers were so cumbersome and irregular in shape that anything like symmetry in the design of the case was impossible. Nowadays, however, sets are usually quite compact, and the controls are limited to one or two knobs only. This makes the task of building pleasing and distinctive cabinets much easier, and well within

one on the other. I do not hesitate to simplify my original designs if by so doing I can secure easier construction. After all, in a small piece of work such as a radio cabinet the simplest designs nearly always look best—especially if nicely finished. I have not given measurements except for certain details, as the size of the cabinet naturally depends on that of your set. Plywood, either plain or veneered, is used almost exclusively for the main parts. Any framework necessary is made up of lengths of moulding. Some shops will cut all the stuff up with a machine to your measurements. One I know of locally will do it while you wait. This is naturally a great help, as you can then be sure of everything being squared up correctly besides saving time. The rest of the work then consists merely of assembly and finishing.

has rebates  $\frac{1}{8}$  in. by  $\frac{1}{4}$  in. into which the three sections of the roof and the sides fit, as in Fig. 2. In starting to work, first determine the measurements, bearing in mind the size of your set and speaker. Then build up the roof by nailing and gluing the panels in the rebates in the mouldings. Countersink the nails and fill in the holes with plastic wood or some similar stopping. Nail and glue the two sides to the floor-board, and then secure the roof to the sides in the same way.



Figs. 2-4.—(Reading from left to right) A front, sectional and side view of the cabinet shown in Fig. 1.

the capabilities of the average constructor.

There are several good reasons for building your own cabinet. You may require a special design that is unobtainable ready-made. It may be a question of expense, or again, you may like to do it as a hobby.

### Original Designs

For the first reason, I offer here only original designs. You will find you cannot buy cabinets exactly the same in the shops. For the second and third reasons, I have kept the construction as simple as it is possible. The use of machine-cut plywood and mouldings greatly reduces the labour involved besides keeping the cost down. Of course, design and construction are to a large extent dependent

on the capabilities of the average constructor. There is no frame in the ordinary sense, the whole structure being kept rigid by the use of a stout floor-board half-an-inch thick, together with corner mouldings as the "beams" of the roof. The panels of the roof, sides and back are all of  $\frac{1}{8}$  in. plywood, but the front may well be of  $\frac{1}{4}$  in. material to avoid resonance. The pent roof is supported by four lengths of octagonal corner moulding. The particular pattern shown

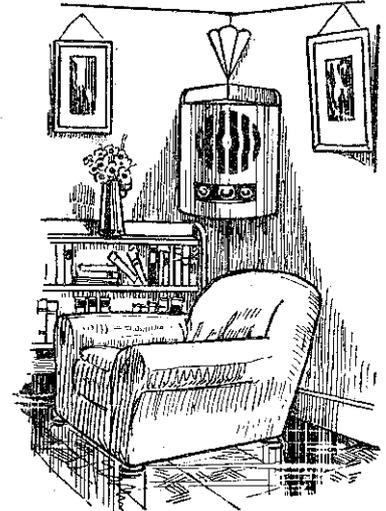


Fig. 10.—A novel and ornamental cabinet, details of which will be given next week.

Now fit the front. It should be glued in position and nails driven through into the moulding and floor-board. No other fixing should be necessary if all parts are true, but a brad or two down the sides will help if there is any tendency to bulge. Before fixing the back cover the speaker opening with a piece of gauze and fix the speaker in position. If the batteries are to be housed in the case, a

### Combined Speaker and Wireless Cabinet

This is one of the most popular arrangements. Figs. 1 to 4 show a simple but effective design.

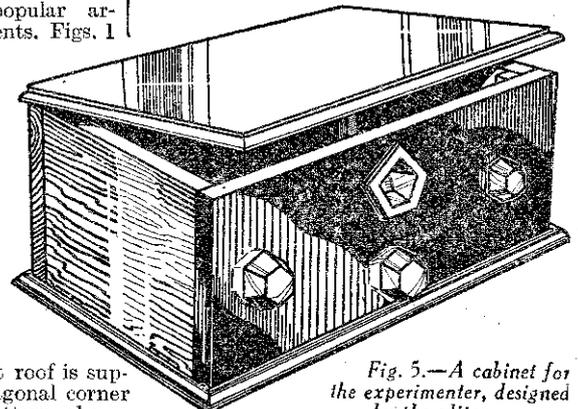
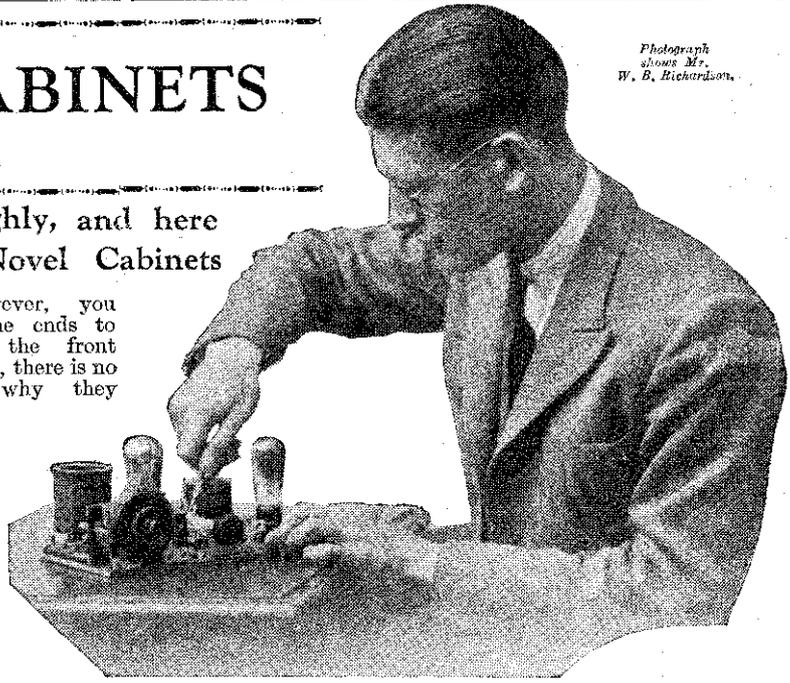


Fig. 5.—A cabinet for the experimenter, designed by the editor.

# WIRELESS CABINETS

## NOVEL DESIGNS—PART I

Photograph shows Mr. W. B. Richardson.



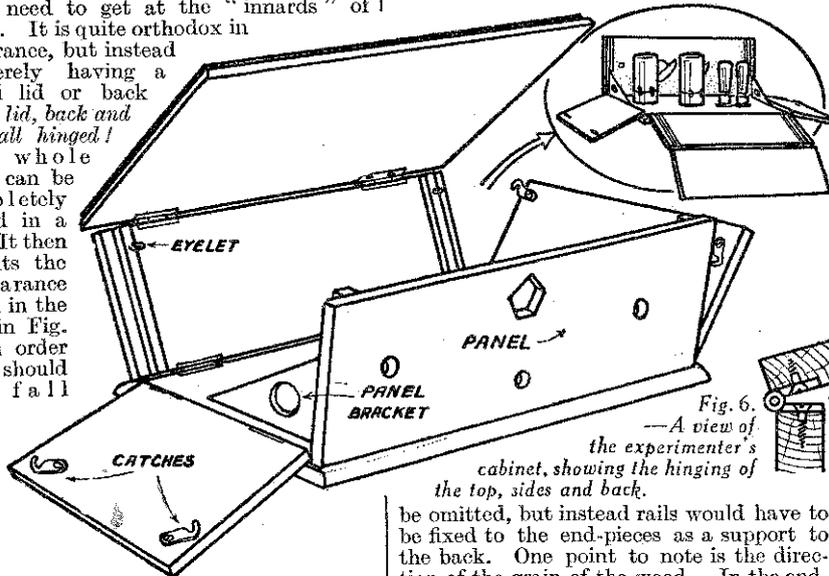
of Wireless Cabinets very thoroughly, and here of a Number of Original and Novel Cabinets

shelf should be fixed just above the set. The back is made in two parts. The upper part is fixed like the front, but the lower part is hinged to the floor-board and drops down for the insertion of the set and batteries. There is also a small strip to fill the space below the floor-board (see Fig. 4). A good idea is to drill holes in the back and cover them with gauze so as to allow the sound waves from the back of the speaker to emerge, and so prevent any "boxed-in" effect. Careful rubbing down with glasspaper until all joints are smooth and flush completes the work ready for polishing.

If, however, you prefer the ends to overlap the front and back, there is no reason why they should not. In this case the rails fitted to the front and back as stops to prevent the ends leaning in would

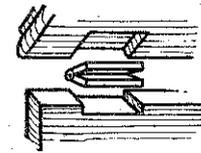
### For the Experimenter

Figs. 5, 6 and 7 give details of a novel arrangement for the man who has frequent need to get at the "innards" of his set. It is quite orthodox in appearance, but instead of merely having a hinged lid or back it has lid, back and sides all hinged! The whole thing can be completely opened in a jiffy. It then presents the appearance shown in the inset in Fig. 6. In order that it should not fall



be omitted, but instead rails would have to be fixed to the end-pieces as a support to the back. One point to note is the direction of the grain of the wood. In the end-pieces it should be horizontal, not vertical, otherwise the screws fixing the hinges to the lower edge will tend to pull out. Naturally the whole secret of success with this model lies in the fitting of the hinges.

and yet it has quite a modern note about it. I think you will find the drawings self-explanatory, but here let me say that the whole effect is dependent on the finish. The joints in the wood should be well rubbed down, and the grain should be such as to conceal rather than emphasize them. In both this and the experimenter's cabinet the height may be increased so that the set only occupies the upper part, the lower being used to house the batteries or mains-unit. In this case a deeper panel can be used extending below the base board or a wooden panel used to fill the space below the ebonite panel.



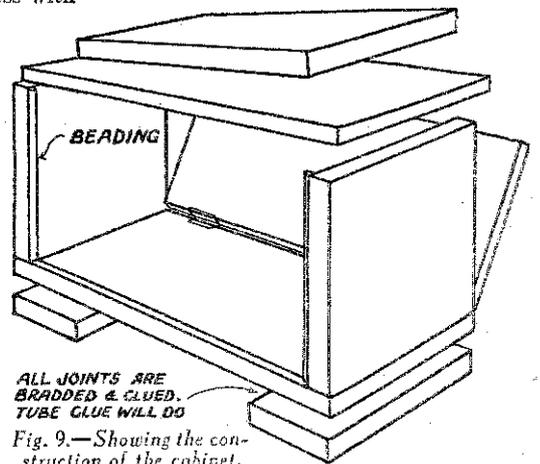
Securing a "Professional" Appearance  
So far I have not said anything about how to stain and polish the work, but I strongly advise the amateur to investigate the polishes put on the market by such firms as Hobbies Ltd., Dereham, Norfolk. They also supply all kinds of fittings, and many of the mouldings.  
(To be concluded next week.)

asunder unexpectedly, catches are fitted as shown. When these are in position the lid can still be raised as in the more usual type of cabinet. You will notice I have shown the panel extending the whole length of the front and overlapping the end-pieces;

Fig. 7, shows how they should be secured to give full movement. The axes of the hinges must be level with the edge of the wood, and the wood should be recessed just sufficiently for the hinges to be flush. If you do not recess the wood, there will be nasty gaps and the cabinet will not close properly.

### Easy to Make But Very Effective

The little cabinet shown in Figs. 8 and 9 is perhaps the easiest of any to make,



ALL JOINTS ARE BRADDED & CLUED. TUBE GLUE WILL DO

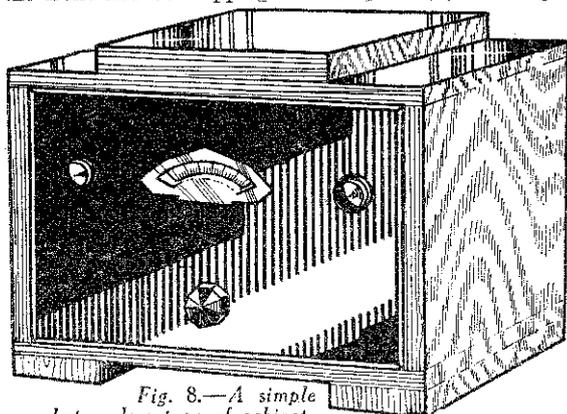


Fig. 8.—A simple but modern type of cabinet.

# THE WHY AND THE WHEREFORE—2

A Series of Weekly Articles Dealing with the Function of the Various Components of a Broadcast Receiver

WE saw last week how the energy was received by the aerial and tuning circuit of our receiver, and it would perhaps be as well to point out here that, no matter what form of tuning is employed, *i.e.* aperiodic aerial coils, band pass tuners, etc., the principle is the same. The various types of tuner abovementioned are simply incorporated in order to ensure that the receiving set shall be "selective," that is, will only deal with a narrow band of

By JACE

off a stream of electrons. Surrounding the filament, but at some distance from it, is a metal plate—the anode, which is joined to the positive side of a high-voltage battery, known as the high-tension (H.T.) battery. The negative side of this battery is joined to the filament, and this completes an electrical circuit giving a steady current through the valve. Situated between the filament and the anode is a spiral of wire known as the grid, and it is to this electrode that the received oscillations are fed. The result of this is to vary the steady current which we have just referred to, and we therefore have in the anode circuit a varying current exactly similar to that which was received by the aerial circuit, but now many times stronger.

### The Neurodyne

Unfortunately, we cannot use the ordinary three-electrode valve in this way, as owing to the small space between the electrodes, some of the energy "feeds back,"

setting will hold over a large tuning band, and therefore the arrangement was not so popular as it could have been.

### The Screen-grid Valve

These deficiencies are overcome, however, in the screen-grid valve, which is an ordinary three-electrode valve with the addition of a further grid. This extra grid is joined to a point on the positive side of the H.T. battery having a slightly lower voltage than that applied to the anode, and provided the coils in the aerial and anode circuits are adequately screened, the circuit is perfectly stable.

Instead of a tuned circuit in the anode lead, an H.F. choke may be used. This is simply a very large coil of wire, which is not tuned in any way, and it has the effect of providing a barrier to the high-frequency oscillations. They are thus prevented from passing through the H.T. battery to earth. In order to pass on the maximum signal strength it is essential that any choke used in this position should be specially designed for the job—and not one of the ordinary small reaction-type chokes. Sometimes, in order to give greater selectivity, and to obtain greater signal strength, the tuned circuit associated with the anode may be joined between the anode of the valve and earth, the H.F. choke being retained in the anode lead.

Fig 2 shows the neurodyne circuit, whilst Fig. 3 shows the complete circuit arrangement so far as we have described at present, employing an S.G. type of valve. We have now got at our disposal a strong high-frequency oscillating current, which is an exact counterpart of the transmitted signal, but before we can turn this into speech or music it must be "detected" or rectified, and we shall deal with this function next week.

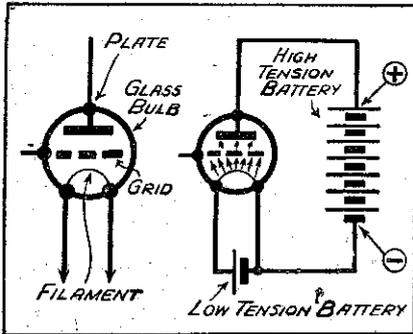


Fig. 1—The wireless valve, and a diagram of the way in which the electron stream is emitted.

frequencies at one time. For the purpose of these articles, however, we may regard them all from the same angle, namely, the reception of the high-frequency oscillations modulated by the speech or music of the transmitting station which we are desirous of hearing.

Well, then, we have got to the point where these particular oscillations are present in our tuning circuit, but unfortunately they are very weak. We must therefore treat them in the same manner as the microphone currents were treated at the broadcasting station, that is, amplify them in order to have a current sufficiently strong to be efficiently "detected" or rectified. To understand this amplification it is essential for us to know how the ordinary wireless valve works, and the following brief explanation, in conjunction with Fig. 1, should make this perfectly clear.

### The Three-electrode Valve

The ordinary type of valve contains three elements: a filament (or cathode); a grid; and a plate (or anode). These elements are known as "electrodes" and this gives us the term "three-electrode valve." The filament consists of a thin wire across which is joined a low voltage battery—known as the "low tension battery." This causes the filament to glow, and in its incandescent state it gives

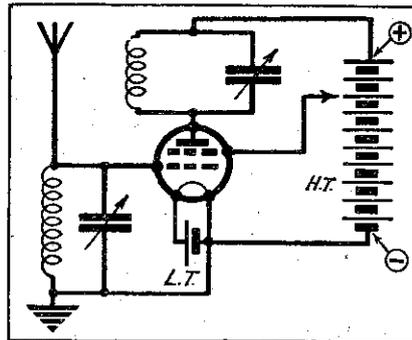


Fig. 3.—A screen-grid valve employing tuned-anode coupling.

and this results in instability. Various suggestions have been made for overcoming this trouble, and the most popular until fairly recent times was the neurodyne circuit. With this arrangement a coil is connected to the anode of the valve, and the centre of this coil is joined to the H.T. positive terminal. The other end of the coil is then joined, through a very small variable condenser, to the grid of the valve. Across the ends of the complete coil a tuning condenser is connected, giving a tuned circuit similar to that in the aerial lead. The small variable condenser, known as the neurodyne condenser, is then adjusted until the capacity of the valve is "balanced out" and stability results. The process of neutralising is rather tricky, and it is very difficult to arrange that the

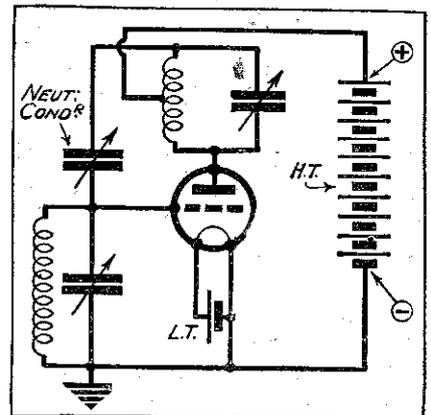


Fig. 2.—The well-known neurodyne method of H.F. coupling.

With home-made radio-grams and converted gramophones there is often a background of "chattering" which is very annoying when a record is being played. The noise emanates from the pick-up as it traverses the record, and is partly due to cabinet resonance.

### Preventing Cabinet Resonance

The trouble can be remedied very easily by lining the edges of the lid of the cabinet with a good thickness of felt.

The same trouble is often experienced

when a loud-speaker is enclosed in a square box type of cabinet. The "boomy" results often complained of with this kind of loud-speaker can be largely overcome by lining the interior of the cabinet with thick felt or packing the corners with slag wool held in thin canvas bags.

# ABOUT VARIABLE CONDENSERS

Some Valuable Information Concerning a Component which is Often Taken for Granted.

IT is really surprising how a chance remark or action will open up a train of thought the germ of which was quite outside the realm of the original subject of discussion. This was exemplified when I was talking over with two or three radio men the question of laying out a wireless receiver, the components for which were being collected together after the theoretical circuit had been finally approved.

As was to be expected, each component was being reviewed rather critically to ensure that the set's performance would fulfil adequately the aims of the designer, and when the question of suitable variable condensers arose it became necessary to choose a pair that could be accommodated easily in the somewhat limited panel space available. One of the company then passed a remark to the effect that it would have been awkward if the older type straight-line frequency condensers were the only ones available. Another of those present, being fairly new to the art of wireless, owing to his youth, asked to be enlightened on this point, and it occurred to me that there must be many other present-day wireless constructors and listeners quite unaware of the phases of development through which variable condensers have passed before reaching present-day standards. I am not concerned so much with mechanical construction, or the outcry that was made four or five years ago for "low loss" components—an era that was carried to such extremes that in many cases it defeated its prime object—but rather with the shape of the condenser plates and matters allied to this.

## Condenser Capacities

For example, it has often been said that the wavelength range of a tuned circuit—say, the familiar 200 to 600 metres—is actually altered by using different-shaped plates in a variable condenser. This is quite erroneous if each of the variable condensers employed has identical capacities at the minimum and maximum settings. The range of wavelengths covered by a coil shunted with a variable condenser is a function of the product of the inductance of the coil and the capacity of the condenser. Hence, in the case of the latter, if the measured capacity of every condenser used is the same when the fixed and moving plates are completely meshed, then obviously the shape of the plates bears no relation to the top tuning limit. The same remarks apply to the lower tuning limit when the plates are unmeshed. The important point is to make the minimum capacity as low as possible so as to extend the range, for it must not be overlooked that the actual maximum and minimum capacities of any variable condenser are in effect increased when incorporated in a wireless receiver. This is owing to the presence of stray capacities in the wiring and components, especially the self-capacity of the coil being tuned.

## Straight-line Condensers

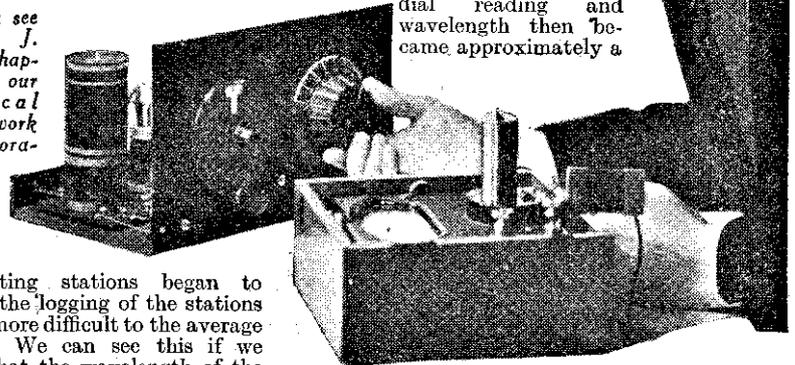
Why, then, have variable condensers been marketed having plates shaped according to certain preconceived designs? Well, first of all, when wireless began to

By H. J. BARTON CHAPPLE

Wh. Sch., B.Sc. (Hons.) A.C.G.I.,  
D.I.C., A.M.I.E.E.

make its presence felt as a hobby for all, the only type of variable condenser that enjoyed any vogue was the straight-line capacity. The condensers had semi-circular plates and the capacity of the condenser was proportional to the dial setting. That is to say, if a graph had been plotted with capacity as one ordinate and dial reading as the other, then a straight line would have resulted. As the number of

Here you see  
Mr. H. J.  
Barton Chap-  
ple, of our  
Technical  
Staff, at work  
in our labora-  
tory.



broadcasting stations began to increase the logging of the stations became more difficult to the average listener. We can see this if we realize that the wavelength of the tuned circuit is proportional to the square root of the capacity in that tuned circuit. To double a wavelength, therefore—that is, jump from a 200-metre station to a 400-metre one—meant an increase in dial reading of four times with straight-line capacity condensers, and this was apt to be disconcerting and not proper logic to the listener whose arithmetic was none too brilliant.

## Square-law Condensers

This type of condenser was, therefore, superseded by the straight-line wavelength condenser, or as it was more popularly termed, the square-law condenser. The plates were not semi-circular but shaped more like a heart cut in two so that the

## DO YOU KNOW?

- That a larger value of grid leak than usual is often found advantageous on the short waves. Values as high as 5 megohms may be tried.
- That the valves should be shielded from the sound waves from the speaker if very loud signals are obtained, in order to avoid micro-phonous troubles.
- That all leads carrying H.F. currents should be kept as short as possible.
- That all metal used for screening should be "earthed" if it is to act as a screen.
- That reaction control is smoother if a small condenser is connected between the anode of the detector valve and earth.
- That all by-pass condensers in a screen-grid stage should be of the non-inductive type to ensure stability and assist in greater stage gain.
- That in mains-operated sets all leads carrying alternating current should consist of twisted flex (of the ordinary electric lighting variety) to reduce the risk of induced hum.
- That where possible all controls should be at earth potential to avoid hand-capacity effects.

condenser capacity increased more rapidly towards the end of the dial reading than it did at the beginning. The graphical relation between dial reading and wavelength then became approximately a

straight line, and everyone was happy for a time. I say approximately because of the allowance that still had to be made for stray external capacities introduced by the wiring and components. With wireless increasing in popularity, however, and more and more transmitting stations of high power being erected, the heads of the various national broadcasting concerns found it necessary to get together and suggest a solution to avoid chaos as a result of stations overlapping one another.

Finally a definite frequency separation was decided upon between the various stations at home and abroad. When this scheme was put into operation it was noticed by listeners that there was a certain crowding of the stations logged at the bottom end of the condenser tuning dial. The explanation was simple, for with a given frequency difference the wavelength difference is less on the shorter wavelengths than it is on the longer wavelengths, hence the crowding.

## Straight-line Frequency Condensers

Condenser manufacturers bowed to popular demand for a cure of this new trouble by introducing the straight-line frequency condenser with long narrow plates somewhat like an elongated heart cut in halves. There was only a very small capacity increase per degree reading at the lower end of the scale, and in consequence calibrations were frequently upset by the increased relative importance of the stray capacities to which we have alluded previously. Furthermore, when unmeshed, the distance between the ends of the fixed and moving plates was large compared to the other types and in consequence necessitated greater panel space when working, while to crown the woes of the manufac-

(Continued on page 108.)

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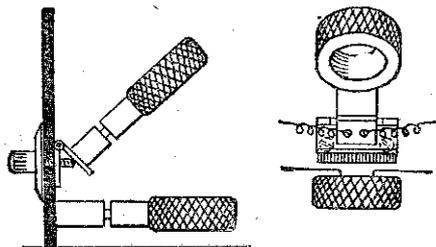


# Radio Wrinkles FROM READERS

## Converting Plug-in Coils

MANY enthusiasts are converting their wireless sets into more modern sets, and those wishing to economise may find this idea useful.

With the exception of a brass hinge, ebonite knob, and a screw of suitable



Converting plug-in coils to panel mounting with a fine adjustment.

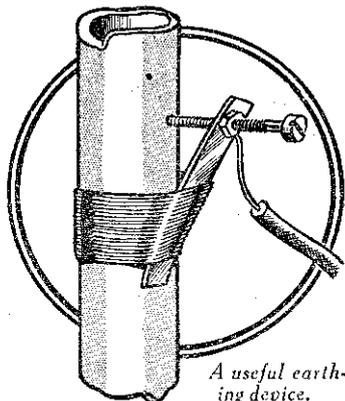
length, no other parts are required. One plug holder is fixed to the panel while the other is attached to the panel with a brass hinge, as shown. A tapping hole is drilled in one leaf of the hinge which is nearest to the panel. The screw passes through a clear hole in the panel to the tapped hole, and the weight of the coil keeps it in close contact with the end of the adjusting screw. An excellent adjustment of reaction is also possible.

## Curing a Microphonic Valve

ONE of the common troubles a listener has to contend with is a noisy background, and this is sometimes caused by a microphonic detector valve. The noise is in the form of a howl which may start at any time during reception, or only when a certain note is reproduced by the loud-speaker, the sound waves from which interact on the bulb of the offending valve. A thick felt or rubber ring placed round the valve will often cure the trouble.

## A Simple Earth for Your Wireless

A SOUND earth connection is essential for good reception, and most wireless enthusiasts will find that quite a good earth can be obtained from a wire run from an ordinary cold water pipe. A section of the pipe should first be scraped clean, after which a short length of metal should



A useful earthing device.

## THAT DODGE OF YOURS!

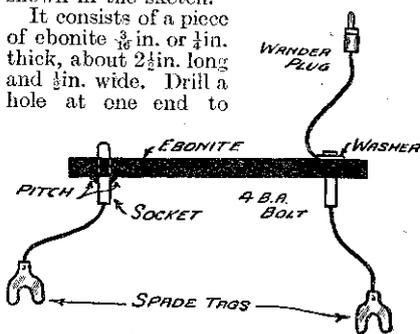
Every reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? For every item published on this page we will pay half a guinea. The items this week have been contributed, but in future we want readers of this paper to supply the items. Turn that idea of yours to account by sending it in to us, addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, W.C.2. Put your name and address on every item. Please note that every notion sent in must be original.

be attached to the pipe by means of copper wire, as shown in the sketch. A hole is then drilled in one end of the metal strip and an ordinary bolt is inserted with nuts on either side. By screwing in the bolt the strip acts as a lever and the wires are pulled tight against the pipe. The earth wire is then connected as shown.

## A Testing Hint

THE majority of milliammeters have two terminals for connecting purposes, and it is a job when one wishes to measure the anode current of a set to connect wander plugs on to pieces of wire, etc. To overcome this make up the simple device shown in the sketch.

It consists of a piece of ebonite  $\frac{3}{8}$  in. or  $\frac{1}{2}$  in. thick, about  $2\frac{1}{2}$  in. long and  $\frac{1}{4}$  in. wide. Drill a hole at one end to



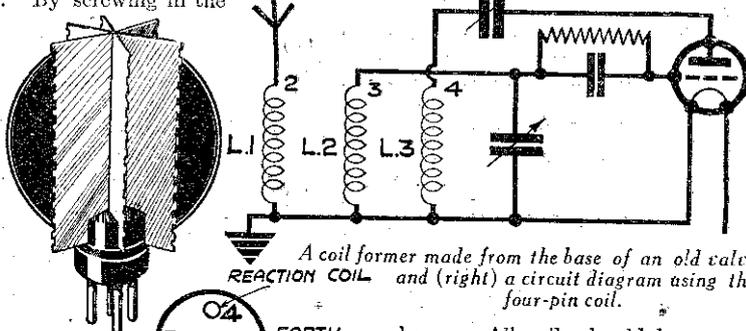
A handy testing device.

take a 4 B.A. bolt, and drill a clearance hole in the other end to take a brass socket which can be obtained from an old H.T. battery. Pitch should then be poured round the hole and allowed to set. Before inserting the socket into the strip, however, a piece of flex, about 2 in. long and carrying a spade end tag at one end, is soldered on the bottom of the socket. A similarly equipped piece of flex of the same length is secured under the 4 B.A. bolt, and also under this bolt is fastened a 9 in. length of wire carrying a wander plug. To use the device the milliammeter is connected to the spade ends, the

H.T. lead on the set extracted from the H.T. battery and inserted in the socket, and the wander plug on the strip is inserted into the H.T. on the battery.

## A Handy Coil Former and Base

A USEFUL coil former and base can be made from an old valve-holder and the bottom of a discarded valve. The coil former can be made of cardboard which has previously been painted with shellac, and mounted on the valve base by cutting slots down each side of the latter as shown in the diagram. The required number of cuts to be made can be determined by the type of coil made. The above method will be found to function equally as well as the commercial type of six-pin coil and former. A circuit using the four-pin coil is also

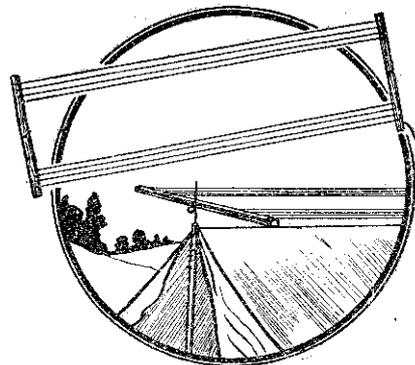


A coil former made from the base of an old valve REACTION COIL and (right) a circuit diagram using the four-pin coil.

shown. All coils should be wound in the same direction, starting from earth. If oscillation cannot be obtained, try reversing the ends of the reaction coil.

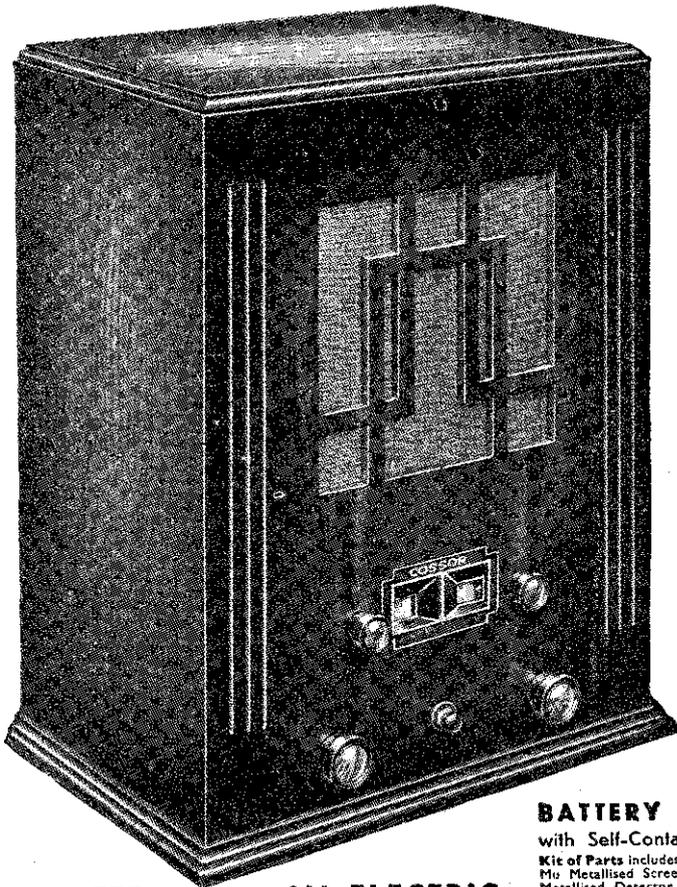
## A Handy Aerial for the Camper

THE aerial shown in the diagram will prove very useful to campers, as it can be carried in a very small space. It consists of two pieces of wood, 15 in. by  $\frac{1}{2}$  in. by  $\frac{1}{4}$  in. Four holes are bored at each end of the wood about an inch apart. Twist a piece of thick wire round each tent pole at the top, so that a piece extends upwards above the top of the tent. Bend the wires half-way up so that the bars do not slip down (see sketch). Thread the aerial wire through the holes in the two pieces of wood and the spare end can be used as a lead-in to the set.



An aerial for the camper.

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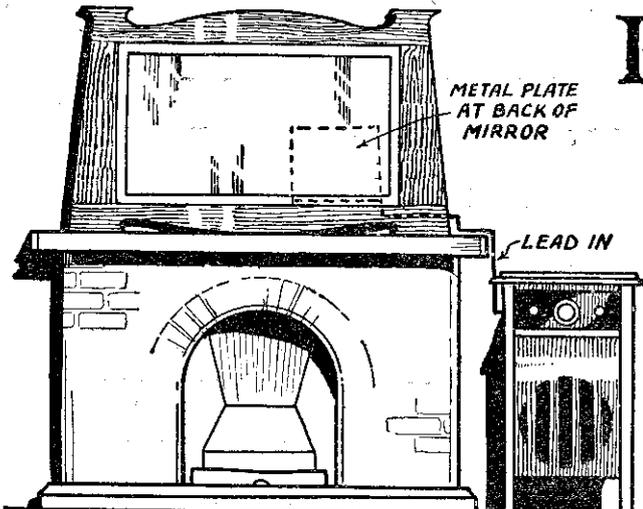
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# PRACTICAL INDOOR AERIALS

This Article will Interest All Readers who for Any Reason Cannot Avail Themselves of an Outdoor Aerial. The Author Describes Many Novel Forms of the Indoor Type, Some of which are Not Generally Known



METAL PLATE AT BACK OF MIRROR

LEAD IN

**A** PART from those listeners who object to an outdoor aerial on the score of appearance, there are countless others who are so situated that they are unable to erect one for purely practical reasons. To these the choice of a suitable indoor substitute is of vital importance. The type chosen will naturally depend on the facilities available. Probably the most efficient type is a replica of an outdoor aerial erected in the loft. However, it is often the case that the listener who has access to a loft can also arrange an outdoor aerial. On the other hand, where an outdoor aerial is out of the question the indoor facilities are also rather limited. For this reason I shall confine remarks to a description of some of the more practical arrangements of the type likely to be available to the flat-dweller and those living under similar conditions.

### Indoor Aerials and Mains Operation

Before going into details of particular types, I want to make a few general remarks. In the first place, most sets nowadays have a small condenser in series with the aerial to increase the selectivity and in some cases to act as a volume control. With an indoor aerial this condenser is usually a disadvantage, since it cuts down signal strength con-

Fig. 3.—The metal backing of an ordinary mirror as an aerial.

siderably, also the selectivity with a small aerial is already far better than with the longer outdoor type. First of all, then, "short" this condenser with piece of wire, if possible. This applies to all receivers except those operated from D.C. mains. D.C. sets should have a good condenser of about .01 mfd. in series with the aerial besides the condenser which is already included in the earth lead and is usually incorporated in the mains unit. I say first of all short the aerial condenser for the reasons I have just given, but naturally, if you find that the tuning is not sharp enough, you must include

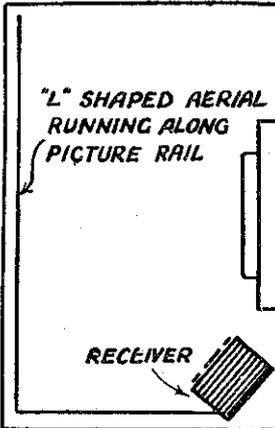


Fig. 1.—A picture-rail aerial.

it. If it has too much effect, try one a little larger. If you have a band-pass set alteration of the aerial condenser may necessitate slight re-adjustment of the first trimmer condenser. Now as to the aerial itself.

### Using the Picture-rail

The piece of wire draped along the picture-rail is so well known as to need no introduction. When properly arranged it is very efficient and costs next to nothing. All that is needed is a length of single bell wire, of a colour to blend with that of the walls, and one or two drawing-pins. Pin the wire at intervals of about four feet in the recess at the top of the rail. Carry it along two sides of the room only, so as to form an "L," as in Fig. 1.

With the question of the earth comes that of the earth. Fig. 2 shows a neat and effective arrangement where a gas bracket is handy. The earth is joined to the bracket by scraping the metal clean near the wall and twisting the bared end of the earth wire round it. Soldering the joint is better still. Where no gas bracket is available, there is

sometimes a "point" for a gas fire which will work equally well. Failing that, you must resort to a length of wire concealed under the carpet and extending to the bathroom or kitchen water tap. A connection to an iron fireplace or even a brass fender is better than no earth at all, but in this case the aerial should be a good one to make up for the poor earth, otherwise results are likely to be disappointing.

While on the subject of "earths," here is a tip worth trying. Change over the connections to the "aerial" and "earth" terminals of your set—that is, join the aerial to the earth terminal and the earth to the aerial terminal. You may get better results!

### The Use of Mirrors

It was during a thunderstorm that the idea of using a mirror as a "pick up" of radio energy first occurred to me. I was thinking what a nice large surface of metal there was in a mirror opposite to me, and wondering if it had a sufficient charge on it to make a spark to earth if I connected a wire to it, and also what sort of a mess would result if a chunk of lightning chose a path to earth that way. Well, after the storm was over, I tried out the looking glass as an aerial by making careful connection to the quicksilver at the back. It certainly

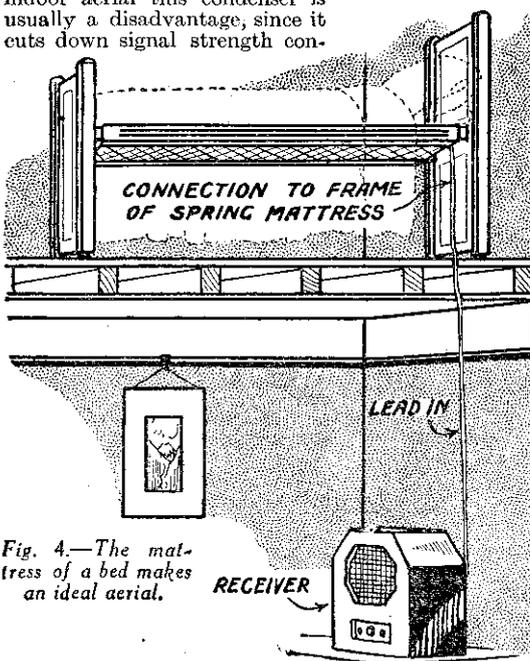


Fig. 4.—The mattress of a bed makes an ideal aerial.

RECEIVER

LEAD IN

CONNECTION TO FRAME OF SPRING MATTRESS

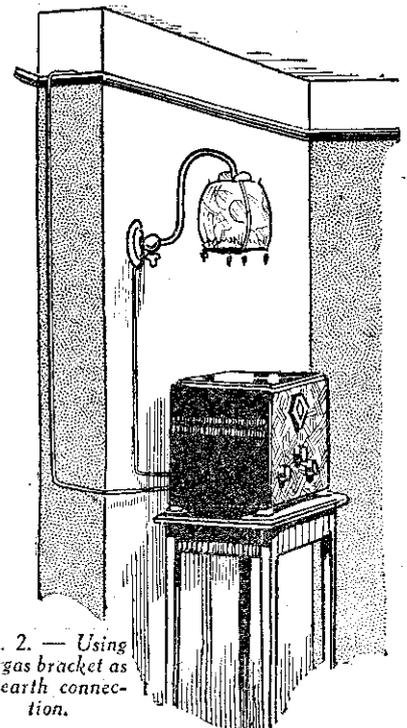


Fig. 2.—Using the gas bracket as an earth connection.

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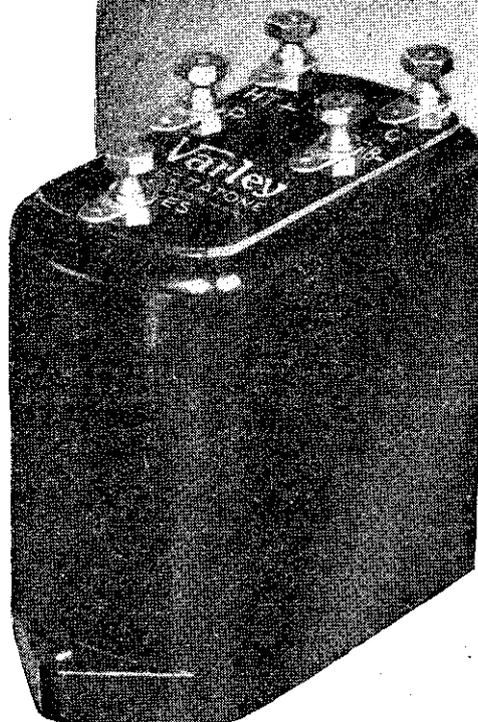
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### Practical Indoor Aerials (Continued from page 84)

worked, and brought in the radio with the inevitable atmospherics. The only difficulty was in the method of connection, which was too uncertain for universal use, so I did away with direct connection and placed a sheet of copper foil against the back of the mirror itself and replaced the wooden back. The mirror and the foil formed a condenser, and connection to the set was made via a wire soldered to the foil. The arrangement is shown in Fig. 3 if you care to try it. It is quite simple, and zinc or aluminium may be used in place of copper.

#### The Bedstead Aerial

Here is an arrangement that is so old that it has been almost forgotten. I don't quite know why it should be, unless it is because constructors nowadays do not have their sets in their bedrooms, as did some of the amateurs in the old days, when they sat up all night listening in while their fond mamas thought they were fast asleep. Anyway, a spring mattress forms quite a good indoor aerial, and you will see how to fix it from Fig. 4. Of course, if the set is in the room below, you will have to take the lead-in through the ceiling. That is perhaps why it is not very popular, as it means drilling a small hole in the plaster, and it is difficult to conceal the wire. With the receiver in the bedroom the job is simple enough.

#### A Picture-frame Aerial

Quite an effective frame aerial can be wound on the back of a large picture. Details are given in Figs. 5, 6 and 7. Of course, it has no advantage over the orthodox type apart from the appearance, but, as with most of these schemes, it is intended to make the aerial as inconspicuous as possible, and that is its recommendation. If the wooden cross-pieces are no thicker than 1/2 in., and do not extend quite to the corners of the picture, they will not cause it to stick out from the wall. The little pegs on which the wire is wound are short pieces of matchstick stuck in at an angle. The number of turns of wire must be found by experiment. About ten turns of 28 gauge D.C.C. wire will be suitable for the medium waves with a picture 3ft. by 2ft. As with all frame aerials, the receiver must be placed immediately underneath, as long leads reduce the efficiency. There is one drawback with the picture-frame aerial, and that is that it is strongly directional. If most stations lie east and west of you, it should hang on a wall running east and west, but if you depend chiefly on programmes coming from a northerly or southerly

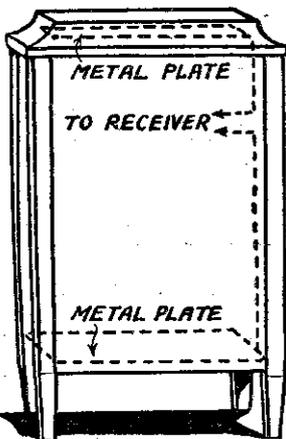


Fig. 8.—A radio-gram cabinet containing aerial and earth plates.

direction, then hang the picture on a wall at right angles to the first.

#### A Radio-gram Aerial

When constructing a radio-gram, the arrangement shown in Fig. 8 is worth trying if there is no room for a frame aerial. It consists of a metal plate in the lid and another in the floor of the cabinet. They are connected respectively to the aerial and earth terminals of the set. Fig. 9 shows how to make an adaptor to plug into a lamp socket, and so use the mains wiring as an aerial. Two small condensers are held together with a rubber band and connected as shown. Various values round about 0.1 mfd. may be tried. An alternative arrangement with one condenser is also shown. With this pattern the plug should be inserted first one way round and then the other to ascertain which way it works best. With both patterns it is also best to try them with the lightning switch first in the "On" and then in the "Off" position.

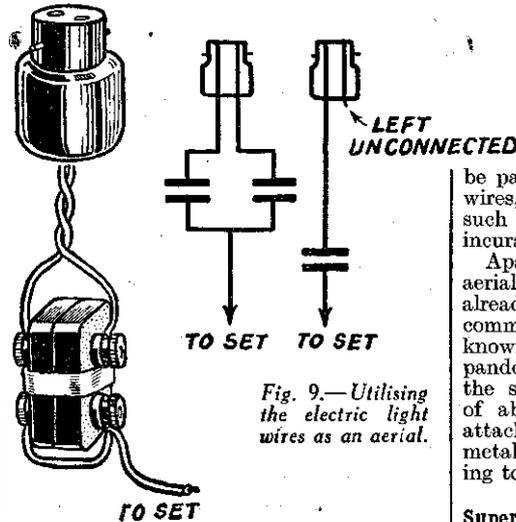
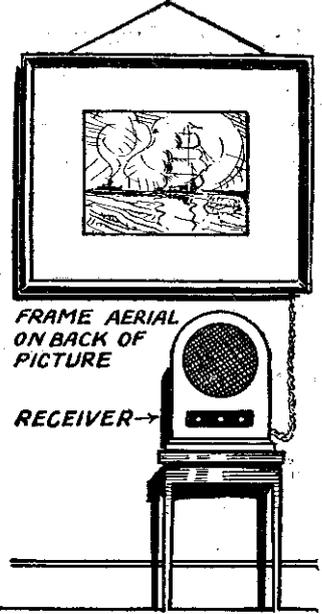
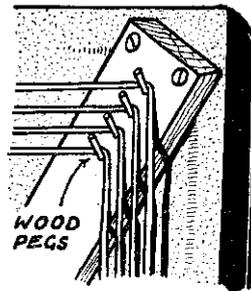
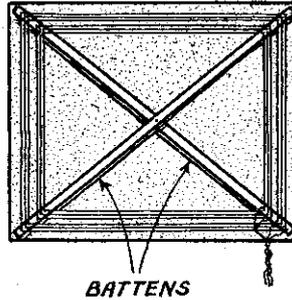


Fig. 9.—Utilising the electric light wires as an aerial.

Only good condensers which will stand the voltage of the mains should be used. Needless to say, no current is consumed. When the adaptor is completed, wind it round with insulation tape to protect the terminals from accidental short-circuiting.

#### Convenience Considered

Finally, let me repeat that the various forms of aerial given here are designed with a view to convenience and inconspicuousness before everything else. They are not all equally efficient, but each has certain merits relative to the circumstances governing its use. If efficiency comes before convenience, then the loft aerial shown in Fig. 10 needs a lot of beating. If the loft is long, then one wire will be sufficient, but if it is very small then two



Figs. 5, 6 and 7.—A picture frame can be easily adapted to accommodate an aerial.

or three wires are better. A small insulator should be used at each end.

There are, of course, certain important details which must be attended to where efficiency is the main consideration. As with an outdoor aerial, the wire should be kept as far from earthed bodies as possible, a good rule to observe being that no part of the indoor aerial should be allowed to run closer than 12 ins. to walls, ceilings, etc. Attention should also be paid to the disposition of electric light wires, as an aerial running parallel with such wires may result in hum, which is incurable by all ordinary methods.

Apart from the types of home-made aerial above-mentioned, there are, of course, already on the market various types of commercial aerials. There is the well-known spring-type, which has to be expanded and attached to opposite walls; the small "cage-type" aerial, consisting of about a dozen strands of thin wire attached to cardboard discs; and the sheet metal aerials which are intended for attaching to the outer walls, chimney-stacks, etc.

#### Super-het. Aerial

Those readers who own, or intend to make a super-heterodyne receiver, should remember that it is very desirable to use an indoor aerial in connection with them, and as short an indoor aerial as possible, too; otherwise, much of the selectivity associated with this type of receiver will be lost. Another point is that on an outdoor aerial, considerable interference with neighbouring reception is likely to accrue.

Best results may be obtained when the super-het. is used with a frame aerial.

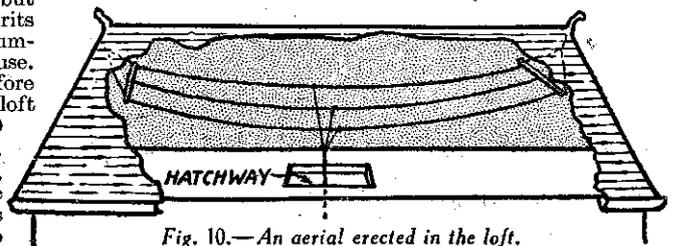


Fig. 10.—An aerial erected in the loft.

ALL ABOUT

# VARIABLE MU VALVES—1

By PERCY RAY

Their advantages and the correct method of using them

A FEW months ago the variable mu took the listening public by storm; everybody asked everyone else if they had fitted one, and those who knew little about it felt that they were years behind the times.

Following the usual fate of a new valve, the variable mu is looked upon with suspicion, as a fair percentage of screen-grid users have replaced their old valves with this new wonder and are keenly disappointed with the results.

The great mistake is to assume that this is a new form of S.G. valve that requires no alteration to the receiver and merely has to be plugged in. Such a line of action will usually result in a loss of selectivity and range.

In order to avoid any doubts as to the writer's opinion of this type of valve, let it be quite clear that the variable mu will improve the selectivity of any screen-grid receiving set and give range at least equal to the original type if, and only if, the essential simple alterations are carried out.

### How the Variable Mu Works

The selectivity of a screen-grid receiver is often ruined by what is called cross-modulation, which is a freak effect of the valve that will shift a programme from one wavelength to another; thus, if two stations are applied to the grid, it may pass on to the next valve the carrier wave of one plus the two programmes. The strange point is that, when suffering from this form of jamming, the troublesome stations disappear when the wanted station closes down. This is caused by the screen-grid valve becoming overloaded because it has a very small grid swing, while the general selectivity is not exceptional owing to the low impedance necessary to give the valve a reasonable amount of grid swing.

The variable mu differs in construction from a standard valve only in the grid, which is irregularly spaced, but this small detail has a remarkable effect on the working of the valve, as it gives it a long, gentle slope, as shown at Fig. 1, very reminiscent of a super-power valve. Thus it is possible

to put a considerable grid bias on the valve, and so increase the grid swing in exactly the same manner, as the bias allows the power valve to handle large signals.

In addition to this, the increase of grid bias on a variable mu valve will reduce the slope and raise the impedance. Thus if some form of variable bias is used, it is possible to have a control that will go from

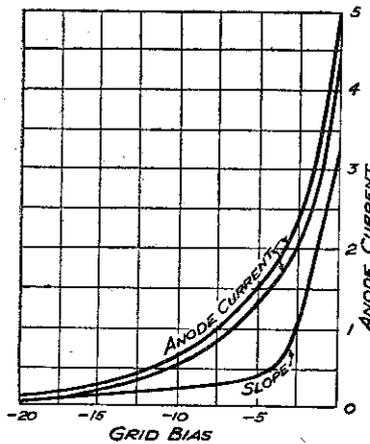


Fig. 1. The characteristic curve of the variable mu valve. Note the long, gentle slope caused by the irregularly spaced grid.

flat out up to any degree of selectivity that may be required, the only limit being if the amplification is too much reduced before the desired selectivity is obtained.

If such an arrangement were used with a screen-grid valve, a matter of three volts would give the most horrible distortion, and at about four volts the valve would stop working altogether, while the selectivity would be considerably reduced.

### Fitting Variable Bias

The illustration Fig. 2 shows the method of fitting variable bias to a battery type of variable mu. A glance at the connections shows how simple it is to adapt any existing set so that the great increase in selectivity can be taken advantage of. It is important that a three-point switch is used to stop the grid battery from running down when not being used, but if an ordinary switch is already in use, another one can be put in the positive lead and used in addition to the filament switch.

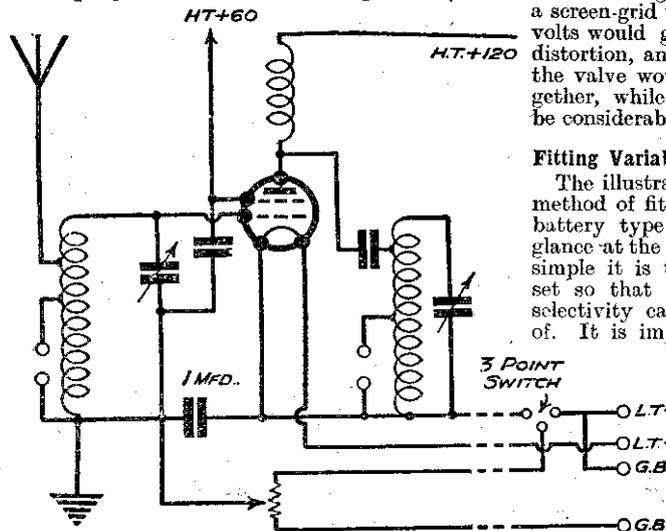


Fig. 2. The method of fitting variable bias to a battery type of variable mu.

The only parts required in addition to the valve are a 50,000 ohm potentiometer (preferably graded) and a 1 mfd. condenser. It is important that this latter com-

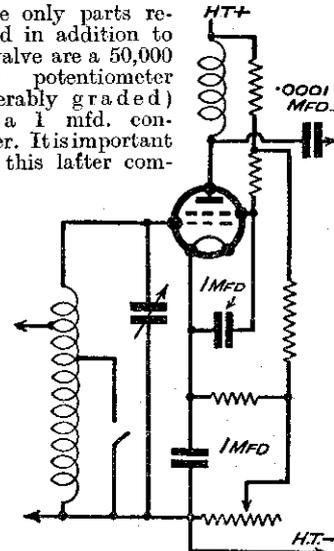


Fig. 3. The method of arranging the bias on an indirectly heated mains valve.

ponent be non-inductive, such as a T.C.C., otherwise it will upset the working of the set. If only one variable mu is being used, an ordinary nine-volt grid battery will do, but if two stages are used a fifteen or eighteen volt unit is desirable. It should be quite clear that the same battery will be used to bias the power valve and any other necessary. Fig. 3 shows the method of arranging the variable bias on an indirectly heated mains valve. The actual value of the resistances will vary with the particular make of valve used, but instructions are usually included with the valve.

### A Wide Range of Volume Control

The use of a variable mu will give several other advantages in addition to the vital one of increased selectivity already mentioned, perhaps the most important being the enormously wide range of volume control obtainable from the variable bias control. The chief charm of this control is that the quality of reproduction improves as volume is decreased. Thus excellent fidelity is possible from a powerful station a few miles away; with any form of volume control other than this, quality falls off with volume. An additional advantage is that this control can be turned through its full rotation without upsetting the tuning in any way. Thus it does away with the difficulties so often met with when tuning is so dependent on the selectivity control that three hands seem necessary to tune-in properly.

### Reduced Background Noises

Another advantage is that any background noises will be reduced to a minimum, and will be reduced at least in proportion to the incoming signal, which is very delightful after the usual type of valve that reduces the programme and leaves valve hiss at the original level.

When designing a set to incorporate a variable mu valve, it is not necessary to make any special arrangements for selectivity in the aerial coil, such as band-pass tuning, as selectivity can only be obtained at the expense of volume.

# THE LATEST KITS REVIEWED

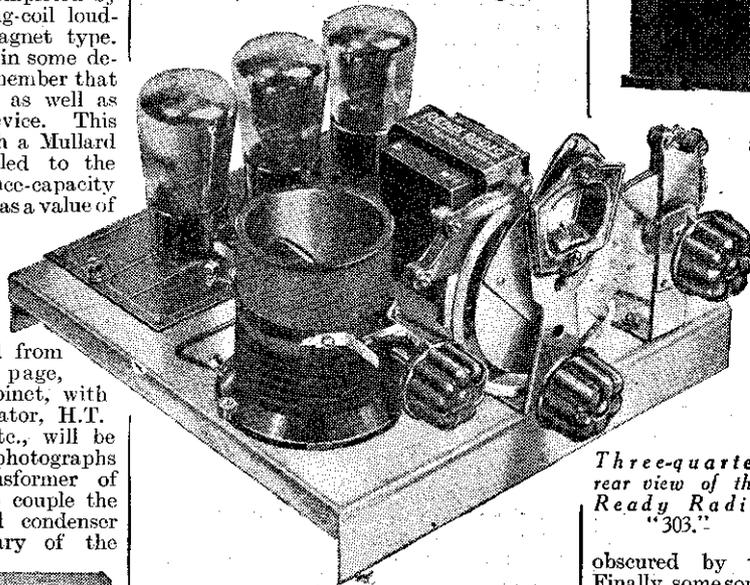
By  
**JACE**



**K**IT sets are now becoming both more popular and also more interesting in many ways. The latest kit to be placed on the market is the "303," which is a simple three-valver, using the same coil as the Dolphin Three described in last week's number of PRACTICAL WIRELESS. The kit consists of a small metal chassis upon which is mounted the terminals, valvoholders and some other parts of the receiver. Five wires are also included in the kit, which is completed by a cabinet containing a moving-coil loud-speaker of the permanent magnet type. The tuning coil was described in some detail last week; readers will remember that it contains the on-off switch as well as range switch and selectivity device. This coil is used in conjunction with a Mullard detector valve which is coupled to the first L.F. valve by a resistance-capacity coupling. The anode resistance has a value of 20,000 ohms, and the coupling condenser has a capacity of .01 mfd., so that the amplification and low-note response for this stage should be quite good. The very attractive lines of the assembled kit can be gauged from the centre photograph on this page, and the sturdy lines of the cabinet, with ample space for the accumulator, H.T. battery, grid-bias battery, etc., will be apparent from the other two photographs reproduced. An L.F. transformer of generous dimensions is used to couple the output valve, whilst a small condenser is shunted across the primary of the

## THE READY RADIO "303"

output transformer, which is of the universal type and is suitable for either power or pentode valves. The assembly of the kit was readily carried out, and the completed receiver was tested in North-West London. The two London stations were, of course, received at good strength, no



Three-quarter front view of the Ready Radio "303."

Three-quarter rear view of the Ready Radio "303."

There are just one or two points which perhaps could be criticized, and which no doubt could be easily adjusted by the makers in order to still further improve this little kit. One is the rather awkward situation of the aerial terminal, the identification of which is very difficult if no instructions are handy. The indications of the terminals at the rear of the chassis also, in my opinion, are engraved on the wrong side, as they are partially

obscured by the terminals themselves. Finally, some sort of indication on the wander plugs would facilitate the correct adjustment of the grid and anode potentials.

The kit is one of the most interesting we have seen, and when the price is borne in mind—which is £3 10s. 0d. exclusive of valves—it will be realized that this represents extremely good value for money.

Cabinets, generally speaking, are of rather plain construction, but the cabinet supplied with this particular kit is much above the standard usually met with. Walnut, with a very good finish, and a simple type of speaker grille with a silver fabric, enable the set to harmonize with practically any type of furniture. The general trend in kits is certainly in the direction of simplification, and with assemblies of the type of the "303" it can certainly be definitely stated that there is nothing difficult to be done. Even the removal of the insulation of wires has been obviated by the special type of terminal, which has a pointed end which pierces the rubber covering of the leads when tightened up. This fact must be borne in mind, of course, when attaching the wires so that good electrical contact is made. This creates a new standard in kit sets, and will appeal to those who wish to build up a receiver in the easiest manner.

reaction being needed to build up these signals, which were sufficiently loud to fill the room. Selectivity with the special coil control was quite sufficient for all ordinary requirements, and eight or nine stations were easily received on the aerial used for the test, which was a rather good one, being situated on a hill and attached to a 30-foot mast. On the long waves, 5XX, Radio-Paris, Hilversum and Eiffel Tower were also received before dark, so that the performance is very good indeed, and is a tribute to careful design.

### KIT:

Ready Radio "303."

### MAKERS:

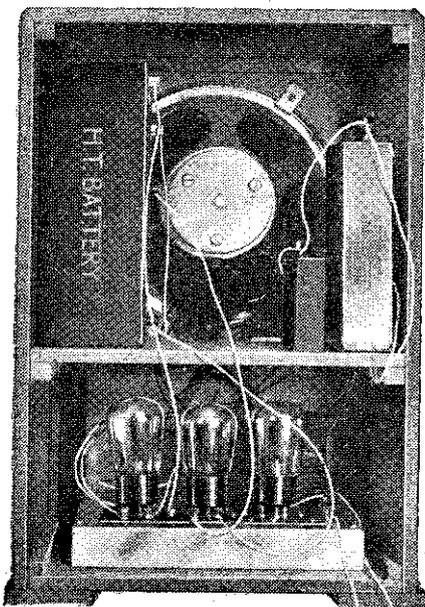
Ready Radio, Ltd., Eastnor House, Blackheath, S.E.3.

### SPECIFICATION:

Metal chassis, detector and two L.F. circuit. The ingenious dual range coil unit comprising on-off switch, selectivity device and wave-change switch is employed—one R.C.C. stage and one transformer coupled—moving coil loud-speaker of the permanent magnet field type—the whole housed in a walnut case.

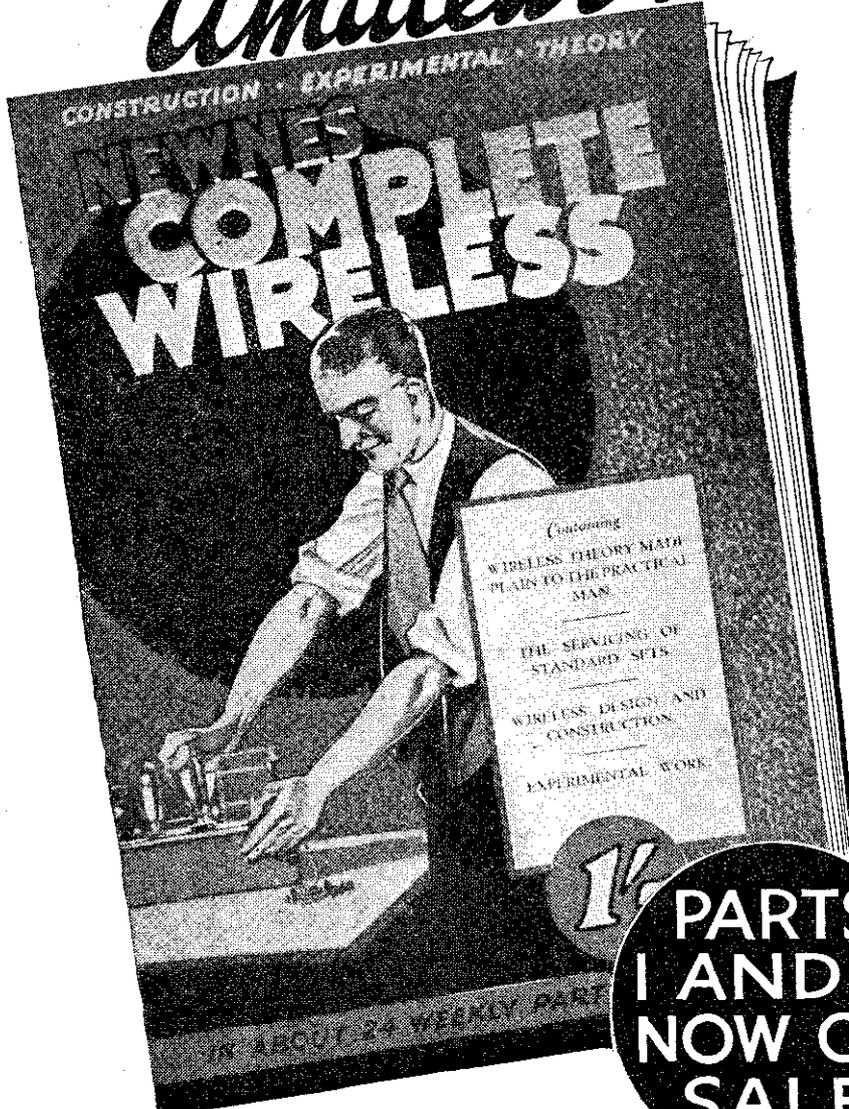
### PRICE:

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Rear view of the Ready Radio "303."

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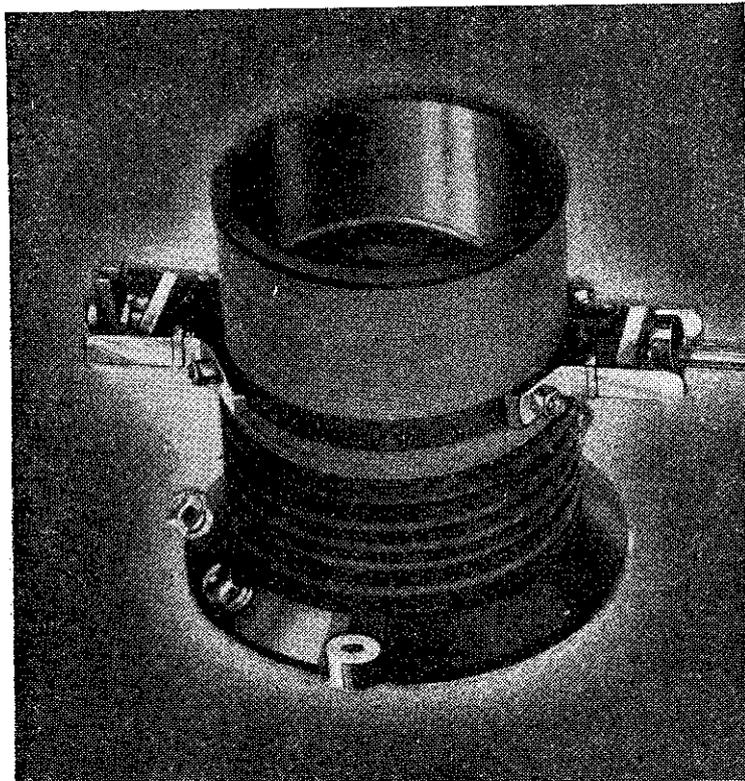
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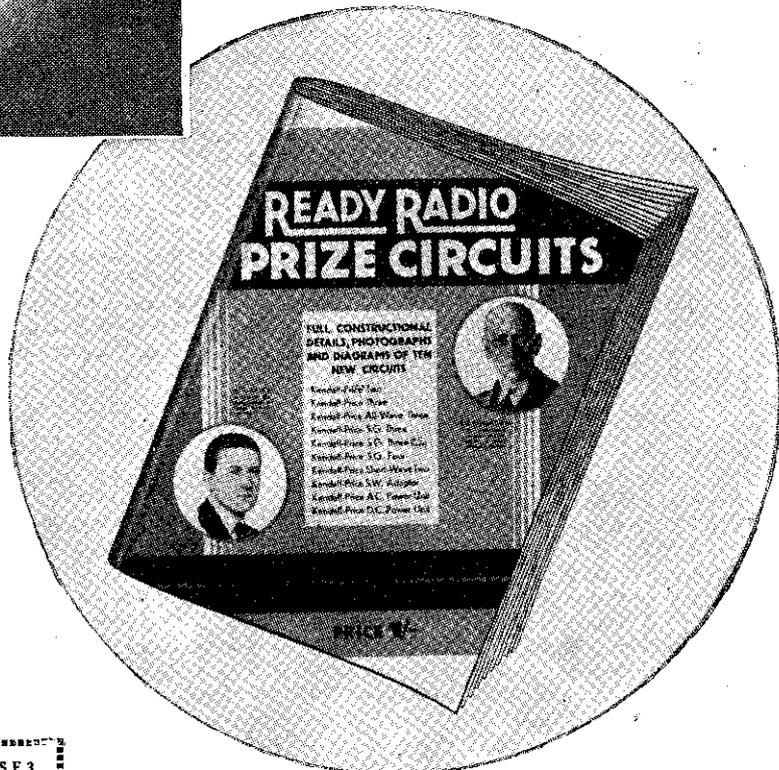
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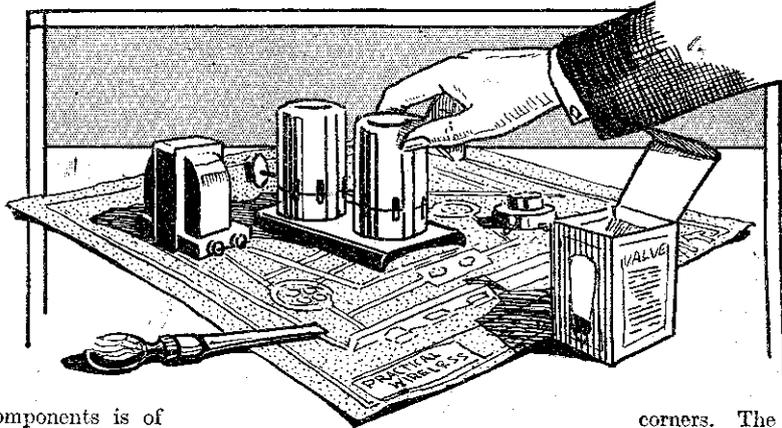
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# How To Use A BLUE PRINT

An Interesting Article Explaining How to Make the Best Use of Our Wiring Diagrams.  
By JACE

**P**ROBABLY the quickest way of building a set exactly to specification is to use a full-size blue print. Although primarily intended for the guidance of the beginner, there is no doubt that even the expert home constructor will find his work greatly speeded up by using a blue print instead of relying on the usual small wiring diagram. Besides that, there is the question of accuracy. With some modern receivers of very compact design the accurate positioning of the components is of utmost importance.



the blue print. When you have finished, all the wires should have been marked off. If any are not you know you have missed them out. At this stage, however, you will not have crossed them all off, since you still have to fix the panel to the baseboard and wire up any final points between the two. I always think that this is the best method, as if all the components and panel are in position first it is such a fiddling business making connections in the

### Making Ready

Now as to procedure. First of all stand all the components which are to be mounted on the baseboard direct on the blue print and have a good look at it. This will give you some idea of what the finished thing will look like, besides showing you if you have forgotten any of the parts. You can now either take them all off and stand them on the baseboard in approximately their right positions, and then make the final adjustments by careful measuring from the blue print, or you can stand them on the table while you mark the positions by placing the print on the baseboard and pricking through it with a sharp bradawl. The latter method is perhaps the better so long as you make the marks clear. The same method can be employed with the panel.

### Alternative Components

It may be that some of the components you are using are not the same make or quite the same pattern as those shown on the blue print. You may be using the

alternatives to those specified in the list. In this case it is usual to mount the components with the terminals in as nearly the same position as those shown on the print. This may mean turning the component round. However, in the case of unshielded coils or chokes it is better to lengthen or shorten the leads rather than alter the position of the components in relation to others.

### The Wiring

Do not necessarily mount all the components right away. If they are at all crowded you will find it best to fix them one by one, and complete as much of the wiring as possible each time. Perhaps I should have mentioned that in the case of sets employing under-baseboard wiring all holes for the wires to pass through should be drilled before mounting the components. In sets of this type you will usually find the underside of the baseboard will have to be marked out as well as the upper. Any skirting to the baseboard should be fixed last of all. As you wire each component cross off the corresponding wire shown on

corners. The set also becomes unwieldy. After all, it is no joke keep twisting and turning a heavy chassis perhaps containing a massive ganged condenser, whereas there is no difficulty in handling the baseboard or panel separately.

### A Few "Don'ts"

In conclusion, here are a few "don'ts." Don't spread your blue print on the baseboard and panel and fix the components directly on top of it with the idea of tearing it away when the parts are all fixed. You will find it a job to clear it away properly from between each component. Also you will most likely want it as soon as it has been "scrapped." When drilling holes for chassis type valve holders, etc., don't drill straight through from one side, but turn the work over as soon as the point of the bit comes through and drill from the underneath. This will give a clean edge to the hole. Don't be in a hurry to drill your panel till you have made certain that the components you are using will not foul one another. Alternative components may, for instance, need positioning slightly differently from those shown on the blue print.

**S**ULPHURIC acid in its proper place is all very well, but see that it stays there. Accumulators after recharging are unfortunately not always delivered in the dry condition externally that they should be, so make sure that yours is before putting it to further use.

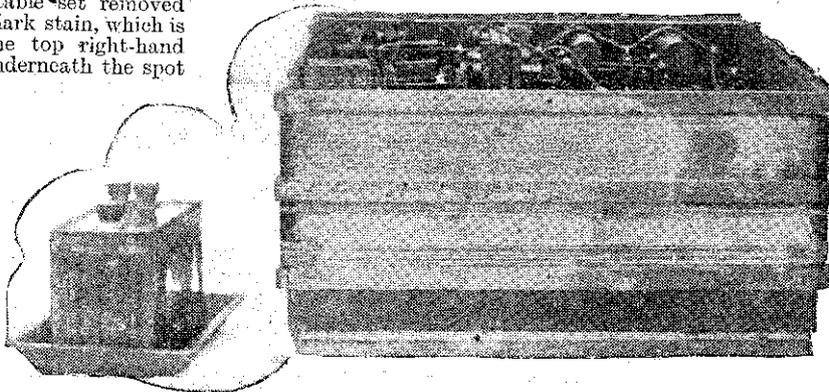
A case of neglect in this respect is that shown in the accompanying illustration, which is of a transportable set removed from its cabinet. The dark stain, which is clearly noticeable in the top right-hand corner, is immediately underneath the spot occupied by the L.T. battery, when the set is in the correct position, and was caused by acid penetrating the woodwork. Corrosion of the wires forming the frame aerial followed causing a breakdown necessitating re-winding. It is always advisable to place a piece of easily-cleaned material unaffected by the action of sulphuric acid's action, such as

## "ACID DROPS"

sheet glass, in the cabinet to stand the accumulator upon. The ideal article to use for this purpose is a Xylonite

photographer's tray of a suitable size. Such a tray is illustrated on the left-hand corner of the photograph.

Should an accident occur, and the accumulator be inadvertently dropped or knocked over, a simple precaution will avoid the ruination of carpets, etc. Common washing soda is all that is required, and it should be heaped on the spilt acid, and further soda added until effervescing ceases, after which the spot should be carefully washed. This will prevent a hole being burnt through the material, and the same remedy may be applied to any fabrics over which the acid is unfortunately spilt.



### WHAT IS THE SONOTONE?

SEE NEXT WEEK'S ISSUE FOR THE ANSWER



# ONE ON THE LONG

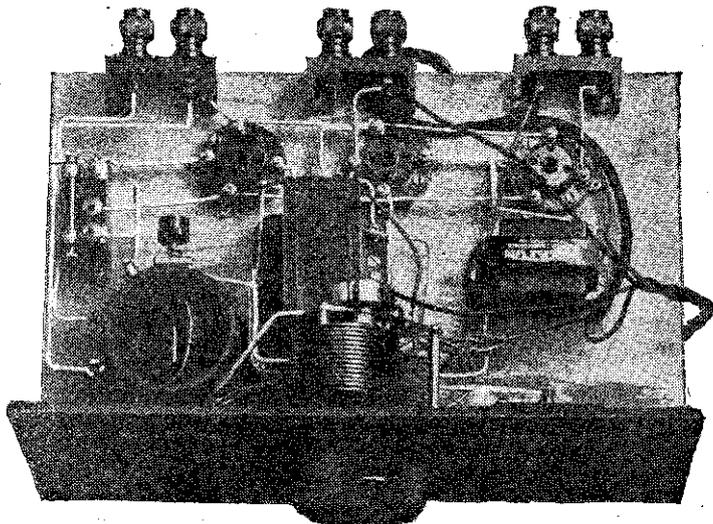
Week We Explained How to Build the Set.

The table in the centre of these pages indicates the fact that the set really is



*A blueprint of this splendid receiver was given with last week's issue.*

The main body of the page is a large table that has been almost entirely obscured by heavy black horizontal lines. Only a few fragments of text are visible on the left margin, including words like "the", "bear", "mos", "a H", "va", "men", "by", "bias", "whi", "curr", "Inter", "Vol", "nd-sj", "any", "in", "en", "mark", "ary", "ria", "oc-", "ovakia", "in", "any", "in", "in", "ho-", "yakia", "ee", "any", "in", "nd", "any", "su", "ce", "y", "ee", "um vol", "Volun", "erfers", "ce", "hem", "in", "any", "am", "L.M.", "2", "W", "Z", "A", "A", "expres".



A front view of the panel and baseboard.

## WHAT THE "DOLPHIN" WILL DO

How to Manipulate the Attractive Receiver Described Last Week. Simplicity is its Keynote

WHAT, actually, is it possible to hear on the Dolphin Three described in these pages last week? This question has probably arisen in the minds of those many constructors who have made up the receiver, and also those who are not certain whether or not to build this particular set. Accordingly the following interesting test was carried out under ten miles from Brookmans Park—in the neighbourhood of Golders Green. The receiver was taken into a house which could not boast a wireless set, and consequently no aerial was available, and the residents knew nothing at all about wireless. They were elderly people with no liking for modern ideas, and consequently it was thought that they would be ideal for the test in view. For an aerial a length of 22 D.C.C. wire was attached to the fence separating the gardens, the total height being only 5 feet. The wire was laid along the top of the fence and taken in through the french windows, with a piece of the same wire taken to the water pipe—a distance of 10 feet. The batteries were connected up and I handed a copy of the tuning instructions to the owner of the house and asked him to carry on.

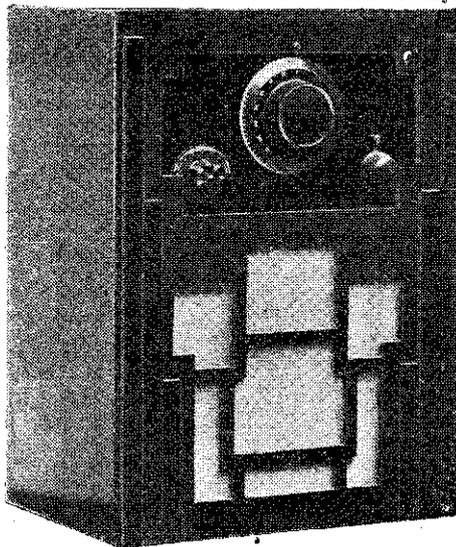
### First Test

He read the article through once or twice and then turned on the receiver. Actually, he turned the control knob half-way round so that the pointer was on the little indication between the letters "C" and "T" of the word "Selectivity." The tuning dial had been left about eight degrees below the correct tuning point for the Regional station, with the result that this station could be faintly heard in the speaker. The tuning dial was rotated to the correct tuning point, and quickly turned back again, and it was too loud for my friends. I had, in this particular instance, to demonstrate the use of the selectivity device, although the majority of listeners will have no difficulty in discovering how to manipulate the selectivity dial and reaction control.

### Actual Results

However, as soon as the idea was grasped the following results were obtained. The tuning dial was turned to 0, and the selectivity was adjusted to its weakest point—that is, to the point of maximum volume. The National programme could

reaction was advanced slowly. Speech could faintly be heard, and on rotating the tuning dial just four degrees the voice of the announcer at a German station was clearly



A three-quarter front view of the set, the construction of which was dealt with last week.

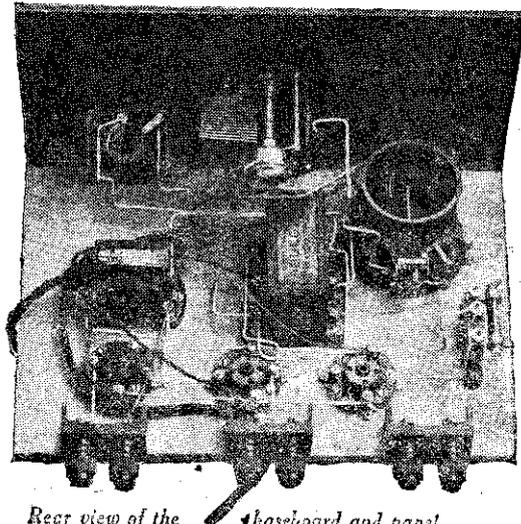
heard. No station name was given as apparently it had just been mentioned before the announcement being made, which was to the effect that the next item would be a Fox-trot—"Underneath the Arches." A few bars of this were listened to, slight fading being experienced, and then the dial was rotated a few degrees higher. Three stations were heard before London National was reached, the strength being more than sufficient for entertainment value.

### Too Loud

The National programme was much too loud with the selectivity control in its present position, and to make the volume of a level which was enjoyable the pointer of the control knob was turned to the indication under the letter "S." This gave a signal quite

enough for all ordinary results, and the National occupied a space of 8 degrees on the dial—without, of course, any reaction being used. Two more stations were just audible, with reaction, between the National and the next station to be comfortably received, which was the Regional. For this station the settings had to be the same as for the National, and, naturally, there was no background to spoil the reception. Selectivity was decreased and the tuning dial was rotated until at 108 degrees the Midland Regional was audible, with the London Regional in the background. A little reaction, and slightly increased selectivity, and the Midland came through quite clearly with no interference whatever. Billy Merlin and his Commanders were giving a very enjoyable dance programme, which was received at about the same volume as that to which my friends had reduced the London stations. A few minutes to enjoy the programme and the test was continued. Without altering either selectivity or reaction, the tuning dial was advanced, and when 119 degrees was reached a good, clear signal was heard. Nothing was touched, and as soon as the band had finished playing, the voice of the lady announcer at Rome was clearly heard. Increasing the reaction slightly, and a small adjustment of the tuning dial, and Rome was sufficiently loud to give an enjoyable programme, without interference.

Nothing further could be comfortably received until the North Regional was tuned-in at 133 degrees. Langenberg, just below the North Regional, could not be adequately separated, as the selectivity control had to be reduced too much, and then insufficient reaction could be employed owing to the resultant distortion. When the North Regional was silent, however, Langenberg came through at about the same strength as Rome.



Rear view of the baseboard and panel.

# FOR EVERY SET — there's a PILOT AUTHOR KIT

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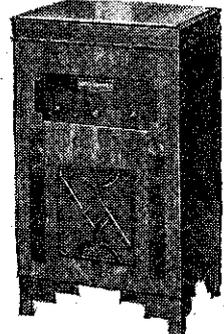
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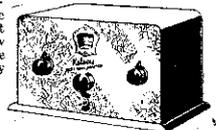
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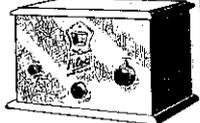


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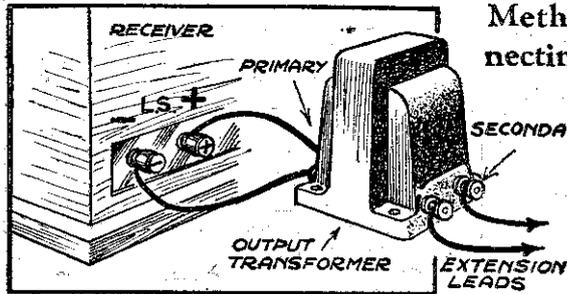
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# THE VOICE OF THE SET

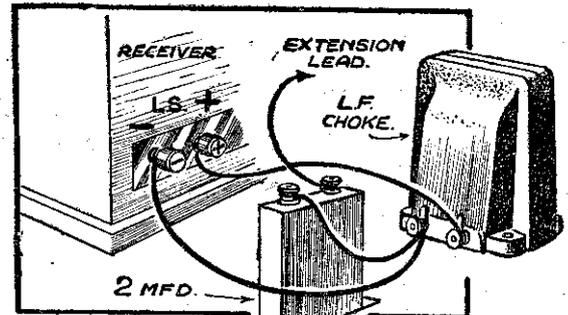
Mr. W. J. Delaney Explains Some Interesting Points About the Disposition and



## Methods of Connecting the Loud-speaker

Fig. 1 (left).—An output transformer connected between set and speaker.

Fig. 2 (right).—An output filter as an external addition.



QUITE a number of wireless listeners are under the impression that because the loud-speaker, when it is purchased, is fitted with connecting cords about six feet long it must be joined to the loud-speaker terminals of the set by those cords and placed as near to the set as possible. This is not the case by any means, and if you are doing this you may not be getting the best from your speaker.

First of all, the set, owing to its particular size and shape, will have to be placed on a table or sideboard where it will look nice, and at the same time be in a position convenient to the lead-in. This means that it is generally placed near a window. Where the speaker is of the cabinet type it is usually stood on top of the wireless set, or by its side. Just for an experiment, join two long lengths of covered wire to your loud-speaker leads and connect the ends of these wires to the correct loud-speaker terminals. Now switch your set on and take the speaker round your room, trying the effect of it in different positions. What do you find? In the majority of cases you will find that there are two or three places in the room where the music sounds much more pleasing, either due to reflection from the opposite wall (or the reverse, absorption by a drapery), or due to the height at which the speaker is placed. Try the effect of your own particular speaker standing on the floor, anywhere in the room. Now lift it up, and support it by some means right near the ceiling. Is not there a great difference in these two positions?

### Long and Short Leads for the Speaker

If you have carried out the above little test, you will have found that there is most likely some place in your room where the speaker is at its best, and this is some

distance from the receiver. Now, in most receivers (unless they are fitted with an Output Transformer or Filter) the current from the last valve has to pass through the windings of the loud-speaker, and naturally this results in a slight drop in voltage. When the speaker is joined to the set by a short lead of a few feet, this drop is not of very much importance. When, however, long leads, such as are occasioned by the above test, are employed, then this drop may become of real importance, especially in the case of the small receiver employing a valve of the Power Type running from a small H.T. battery. An Output Transformer or Filter will, however, enable you to use any length of lead for the speaker, and by this means the receiver may be operated in a different room.

### A High-resistance Speaker

The connections for an Output Transformer are shown in Fig. 1. The Transformer should be of the 1 to 1 type where a high-resistance speaker is employed, and of the step-down type (of the correct ratio) if a low-resistance speaker is used. Fit the transformer on to the back of the receiver cabinet, as near to the loud-speaker terminals as possible. The primary is joined to the L.S. terminals, and the leads to the loud-speaker are joined to the secondary. With this arrangement there is no need to bother about the gauge of the extension leads or the kind of wire, except that the two leads must be insulated from one another.

The Output Filter arrangement is shown in Fig. 2, and consists of an L.F. Choke and a 2 mfd. condenser. The Choke should be of good quality, and is joined across the L.S. terminals. The condenser has one side only joined to the L.S. negative terminal (this is very important), and the remaining terminal of the condenser is joined to one

lead for the speaker. The other lead is joined to H.T. negative. It will be noticed that in all receivers the H.T. negative lead is joined to earth, and therefore it will be obvious that there is no need with this filter arrangement to take two leads away to the loud-speaker. The one lead from the condenser may be taken to any distance and joined to one lead of the speaker (it does not matter whether this is positive or negative as there is no current flowing), and the remaining lead of the speaker may then be joined to the nearest convenient earth. In the case of the speaker taken down into the garden, for instance, it will be quite sufficient to stick the tag on the end of the wire into the ground. This latter arrangement will be found of great use during the summer, as only one strand of the waxed variety of bell-wire need be run along the garden fence, and this is both cheap and weather-proof. Where the speaker is used in different rooms in the house, a convenient earth can usually be found, and the bell-wire can be run from room to room in quite a neat manner, the speaker terminals in each room being joined up to the bell-wire and earth.

### Falling Off of Signal Strength

Where the speaker has been joined to a receiver in the ordinary way, and has been in use for some time, it may be found that signal strength has fallen off. This is due to the fact that the wrong connection of the speaker leads has demagnetized the magnet, and it will be necessary to have it re-magnetized. This only costs a few shillings, but the above methods of connecting the speaker will avoid this trouble, and consequently the expense of the transformer is justified, both in the extension of life of the speaker, and in the improved reproduction which will in most cases be obtained.

DESPITE the growing use of the all-mains receiver, the ordinary battery-operated set still remains by far the more popular type, and is likely to maintain this position for several years to come.

Users of battery sets frequently forget when they have to purchase a new battery that the technical engineers who planned the receiver made it one of their first considerations to see that the valves and other component parts are such that they will give the best results when working in conjunction with each other.

The outcome of this is that the set becomes a complete unit made to give you perfect radio reception.

The selection and use of the high-tension

## How To Choose Your Radio Batteries

and grid-bias batteries must, therefore, be in accordance with the type of valves in the receiver, as batteries play their part in helping to weld the set into the complete unit as much as the component parts themselves.

The manufacturers of Drydex batteries, for example, tabulate some 120 different types of portable sets alone, and recommend which of their five different types of high-tension batteries should be used to meet the requirements of the various sets.

There are many points which are over-

looked by the inexperienced wireless fan, and guidance by the battery manufacturer should, therefore, be all the more welcome. When the ordinary standard-sized H.T. battery is used, for example, the maximum plate current taken up by the valves should not exceed 6 milliamps. If the rate of discharge is greater than this, you should see that you get a battery of sufficient capacity to withstand the extra strain and so have a reasonably long life.

Drydex batteries, for example, are produced in various grades to meet the requirements of sets of different plate current. For the multiple-valve sets, which demand a very heavy plate current, there are batteries which are capable of withstanding a discharge up to 30 milliamps.

# Simple Tests Without Instruments

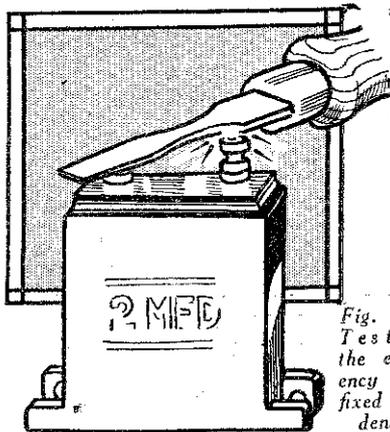


Fig. 2.— Testing the efficiency of a fixed condenser.

### Efficiency of H.F. Chokes

An easy way of testing the efficiency of an H.F. choke, is to connect it across the tuning coil of your receiver as in Fig. 1. This will naturally result in some loss of signal strength dependent on the efficiency of the choke, but with a good one it will not be very great, although the tuning will be slightly altered owing to the self capacity of the choke.

### Testing a Choke

To test the choke thoroughly the set should be tuned-in to all wavelengths. This will show up any flat spots in the choke. For instance, a choke which is inefficient over part of the waveband will cause a loss of sensitivity in your receiver when tuned to that particular part of the scale, whereas a really "dud" component will cut the signal strength

down very low on almost any wavelength. There is just one word of warning: If, by any chance, your choke is faulty, due to a break in the windings, which is very rare indeed, this test would be of no use. In such a case, however, the fault would most likely have been discovered beforehand through the receiver in which the choke was previously connected having stopped working altogether.

### Testing Fixed Condensers

Fixed condensers of 1 mfd. capacity or more may readily be tested by connecting them momentarily across the terminals of an H.T. battery. On removing the condenser, it will be in a charged state, and on shorting the terminals with a wooden-handled screwdriver, or similar metal tool which is insulated from the hand, quite a snappy spark will occur at the terminals. See Fig. 2. Any condenser which is of any use at all will do this, but to test its efficiency properly you should see how long it will retain its charge. If on shorting the terminals an hour after charging a spark occurs then the condenser is O.K. A very good one will hold a charge overnight if the weather is dry. When charging the condenser do not touch the terminals or the electricity will immediately leak away and your test will be useless.

### Atmospherics or Worn-Out Battery?

If your receiver develops intermittent crackling noises, and you are in doubt as to whether they are caused by atmospherics or are due to some trouble in the set itself, such as a worn-out H.T. battery, or burnt-out L.F. transformer, you can soon ascertain by disconnecting the aerial. If the noises stop or diminish very greatly they are due to atmospherics. Crackling caused internally would not be diminished by this procedure.

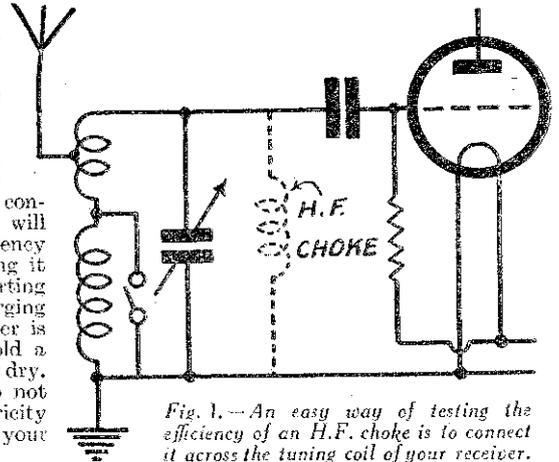


Fig. 1.— An easy way of testing the efficiency of an H.F. choke is to connect it across the tuning coil of your receiver.

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A WEEKLY FEATURE

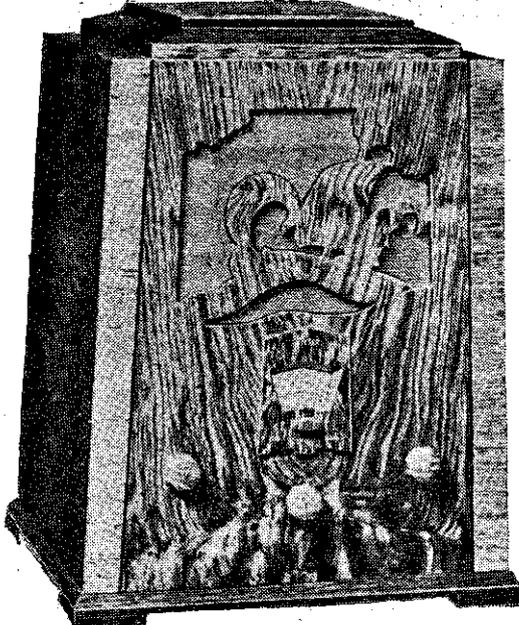
Tested

## ON OUR AERIAL

We shall be glad to advise readers concerning the purchase of complete sets.

## TEST REPORTS OF COMPLETE RECEIVERS

BY THE TECHNICAL STAFF



The Varley Three Valve receiver. The escutcheon is raised and lowered for short or long waves, thus exposing the appropriate tuning scale, which is graduated in frequencies.

WE recently undertook a very thorough test of this receiver under rather difficult conditions—in the heart of London, with a small indoor aerial. This particular receiver is supplied with an external voltage regulator and this, in addition to the actual set, has to be adjusted to suit the voltage of the mains being used. The receiver is housed in a cabinet of unusual design, the moving-coil loud-speaker being fitted in the top of the cabinet, and directed upwards instead of in the more usual position. A fretted opening forms the top of the cabinet, and this is protected by a lid. This lid lifts to an angle of about 45 degrees, in which position a switch is operated to bring the valves into circuit, and the under side of this lid reflects the sound from the speaker in a forward direction. This is a novelty which we have not met in any other receiver.

The circuit consists of S.G., Detector and Output Valves, which are of Mazda manufacture, S.S., A.C./H.L. and P.I. (These it will be noticed, are of the 4-volt type usually fitted to A.C. sets.)

One dial tuning is employed, two condensers being ganged, with a "balancing" device, giving partial rotation of the stators of each condenser to compensate for differences in the tuning circuits. A volume control and a reaction control, complete the panel lay-out, so that no difficulty should be experienced in handling the set. A log chart was supplied with the receiver, on which twelve stations were logged,

### THE VARLEY D.C. RECEIVER

provision being made for other stations to be entered.

At the actual test the London stations were easily tuned-in at the readings given on the log, and ample volume was obtained. The tone, as was to be expected from a M.C. speaker fed by a P.I. valve, was nice and full. The cabinet resonance, due to the small size of the cabinet, was very low indeed and served to give a fullness to the tone. On the long-waves, even on the very inefficient aerial, many stations were received. Radio-Paris was loud, and judging by the strength and the poor results usually obtainable on the aerial, there is no doubt that a good aerial would provide an even greater selection of stations.

Provision is made at the rear of

### NEXT WEEK: THE G.E.C. MUSIC MAGNET THREE

the receiver for the addition of an extra loud-speaker, and a gramophone pick-up, and with two alternative aerial connections the receiver will be found to meet every possible requirement.

The price of the complete receiver is 24 guineas, and with workmanship and finish up to the standard usually associated with Varley products, this receiver may be purchased with every confidence.

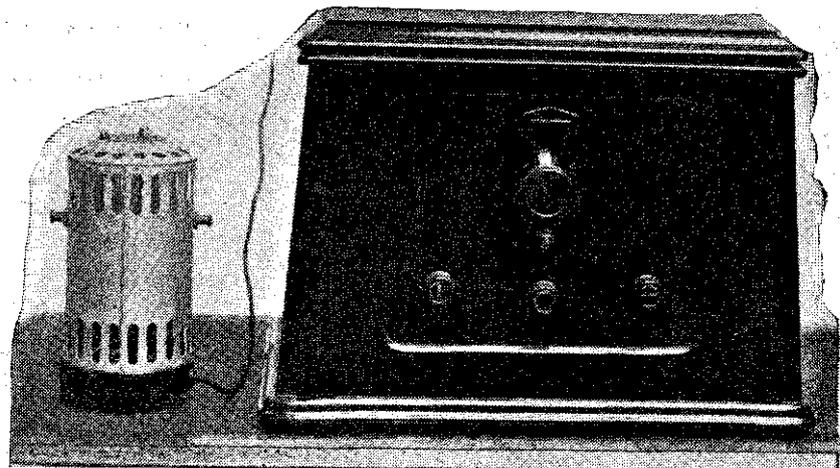
A gramophone pick-up may be used with this receiver, appropriate terminals with the necessary indications being fitted

on the terminal panel at the rear. The volume control which is fitted to the front panel will not be in circuit when the pick-up is being used, so that a separate volume control will be necessary. In the working instructions supplied by the manufacturers on the back of the log chart this fact is mentioned, together with three possible causes of breakdown with the appropriate remedy.

The full instructions relating to working and aerial conditions should enable even the most inexperienced to obtain the very maximum from this interesting receiver.

A further point which attracted our attention was the detailed information concerning the undistorted output and the current consumption. In the case of this particular instrument, the undistorted output is 600 milliwatts, and the total consumption is 250 watts. The A.C. model of the same instrument takes 36 watts, and is, of course, much cheaper to run, whilst it also has the great advantage of giving an output of 1,000 milliwatts. This serves once again to bring home the benefits which accrue to the listener who is fortunate enough to have an A.C. supply to hand, as apart from the cheapness of the running costs, a much greater output is available. The new D.C. valves will, of course, assist in reducing the current consumption, but the power output will still be favourable to the A.C.-fed receiver.

None the less, it is certain that it will be many years before A.C. is general throughout the country, and it is indeed fortunate that the listener whose mains are D.C. has available such a splendid receiver as the Varley here reviewed, and illustrated at the foot of this page. It is not an easy matter to design an efficient D.C. receiver, and the fact that Varley have done so is further tribute to the thoroughness which characterises this firm's products.



The Varley D.C. receiver and the regulating resistance in its container reviewed on this page.

# Direct Radio

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2 Polar No. 2 .0005 mfd. variable condensers	13 0
1 Pair Tammy coils	15 6
1 Wearite Standard screened H.F. choke	3 6
1 Wearite special screened H.F. choke	4 0
2 T.C.C. .0001 type 8 fixed condenser	2 6
1 T.C.C. .0001 upright 3 clip type fixed condenser	2 4
1 T.C.C. .01 type 8 fixed condenser	2 6
3 Dubilier 1 mfd. type condensers 9200	8 3
2 Dubilier 2 mfd. mansbridge type condensers 9200	11 3
1 Dubilier 30,000-ohms 1-watt fixed resist.	1 0
1 Dubilier 10,000-ohms 1-watt fixed resist.	1 0
1 2-megohm grid leak	1 0
2 Clix 4-pin chassis mounting valve holders	1 4
1 Clix 5-pin chassis mounting valve holder	1 0
1 Varley Nicore 11 No. DP2 L.F. transformer	11 8
1 Wearite 16-ohm 15 ma L.F. choke	10 0
1 Wearite ganged wave change switch	5 0
1 .0003 mfd. reaction condenser	2 6
1 3-point on-off switch	1 6
1 Lewcos 50,000-ohms potentiometer	3 4
4 Bulgin panel pointers No. 3	1 0
4 Belling-Lee spade terminals (Aerial, Earth, L.T. LT)	8
6 B-Lee wander plugs (GB2, GB-1, HT, HT1, HT2, GB)	1 0
3 Coils Lewcos Glazite	1 6
1 Long-Range Express Three 16 gauge metal panel 12 x 8 and baseboard 12 x 9 1/2	4 6
1 Bulgin 7-way battery cord	2 6
Screws, etc.	2
	<b>£5 12 0</b>

3 Cossor valves 220 YGS metallised, 210HF metallised, 230 DT metallised	2 1 0
1 Cabinet	17 0
<b>Kit less valves and cabinet</b>	<b>£5.12.0</b>
<b>No. 1 or 10/6 down and 11 monthly payments of</b>	<b>10/6</b>
<b>Kit with valves, less cabinet</b>	<b>£7.13.0</b>
<b>No. 2 or 14/- down and 11 monthly payments of</b>	<b>14/-</b>
<b>Kit with valves and cabinet</b>	<b>£8.10.0</b>
<b>No. 3 or 15/6 down and 11 monthly payments of</b>	<b>15/6</b>
<b>Kit with valves, Consolette cabinet, R. &amp; A. Challenge M'C Speaker, Siemens Power batteries,</b>	
<b>No. 4 Oldham acc., or 22/- down and 11 monthly payments of</b>	<b>£12.10.0</b>

**Recommended Accessories:**  
 2 Siemens 60-volt Power H.T. batteries 1 4 0  
 1 Siemens 9-volt G.B. battery 1 0  
 1 Oldham 0.75 2-volt 75 ampere hour L.T. accumulator 12 6

## DOLPHIN STRAIGHT THREE

1 Ready Radio dual range coil unit	10 6
1 J.B. .0005 mfd. variable condenser	8 6
Popular Log line with slow motion dial	2 6
1 .00015 mfd. reaction condenser	2 6
1 Bulgin Transcoupler	11 6
1 Slektun coil 5-1 L.F. transformer	4 9
3 W.B. 4-pin valve holders	1 6
1 T.C.C. .0002 mfd. fixed cond. 3-terminal type	2 4
1 2-meg. grid leak	2 10
3 Belling-Lee terminal mounts	2 0
6 Belling-Lee terminals (Aerial, Earth, L.S. + L.S., Pick-up +, Pick-up -)	1 3
1 5-way battery cord	1 9
4 Belling-Lee wander plugs (GB, GB-1, GB-2, GB)	8
1 Permol ebonite panel 12ins. x 7 ins.	3 0
1 Wooden baseboard 12ins. x 8ins.	9
2 Bulgin panel mounting dial pointers No. 3	4
1 Coil Glazite Lewcos	6
Screws, etc.	4
	<b>£2 13 0</b>

3 Mullard valves PM2DX, PM1LF, PM2	1 2 9
1 Special Dolphin Consolette cabinet	1 1 0
<b>Kit less valves and cabinet</b>	<b>£2.13.0</b>
<b>No. 1 or 6/- down and 9 monthly payments of</b>	<b>6/-</b>
<b>Kit with valves, less cabinet</b>	<b>£3.15.9</b>
<b>No. 2 or 7/- down and 11 monthly payments of</b>	<b>7/-</b>
<b>Kit with valves and cabinet</b>	<b>£4.16.9</b>
<b>No. 3 or 9/- down and 11 monthly payments of</b>	<b>9/-</b>
<b>Kit with valves, cabinet, batteries, R. &amp; A. type 50 loud-speaker, aerial and earth</b>	<b>£6.19.3</b>
<b>No. 4 or 13/- down and 11 monthly payments of</b>	<b>13/-</b>

**Recommended Accessories:**  
 1 Siemens 120-volt H.T. battery 13 6  
 1 Oldham 2-volt accumulator 9 0  
 1 Siemens 9-volt G.B. battery 1 0  
 1 R. & A. type 50 loud-speaker 15 0  
 1 R. & A. Bantam loud-speaker 1 7 6  
 1 Selectanet aerial 2 6  
 1 Selectanet earth 1 6

**TELSEN Kits to Manufacturers' Specification:—**  
**Ajax Three Kit £3.1.6.** 10/- down and 8 monthly payments of 7/6.

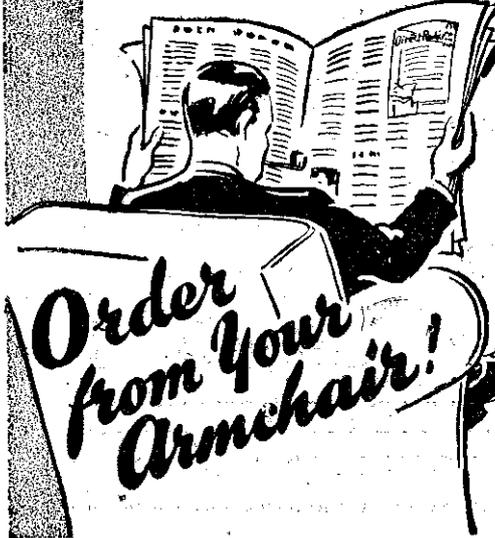
**Ajax Three Valve Kit £4.4.3.** 10/- down and 11 monthly payments of 7/6.

**Ajax Three Valve Cabinet Kit £4.15.0.** 15/- down and 11 monthly payments of 8/6.  
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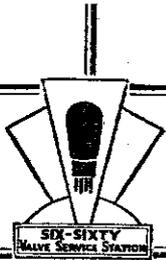
(a) I enclose  
 for which (b) I will pay on delivery {cross out line} £.....  
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Practical Wireless 1/10/31

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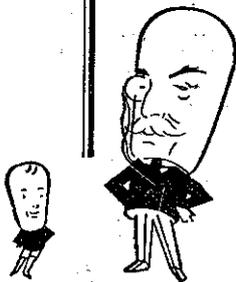


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Write to us for the address of the Six-Sixty Valve Service Station nearest to you.



B.V.A. RADIO VALVES and EQUIPMENT

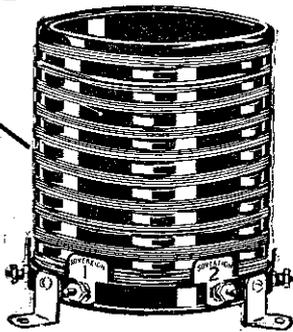
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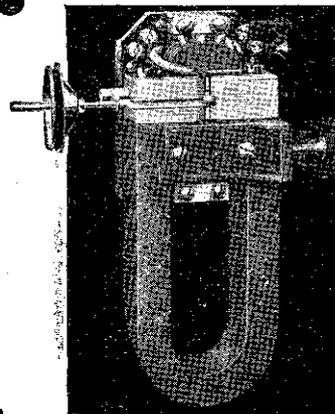


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# RESISTANCE-CONTROLLED VOLUME

An Article Describing Some Novel Uses for a Variable Resistance

**U**NDoubtedly all those readers who interest themselves in wireless matters will have realised that present-day efforts appear to be devoted more to the refinement of existing circuits and components than to the discovery of some startling feature which would bid fair to alter known practice. This offers ample scope to the experimenter for trying out ingenious schemes which, in their successful accomplishment, give to the radio user a sense of satisfaction and make him feel quite at home with the wireless set and its performance. To quote just one instance,

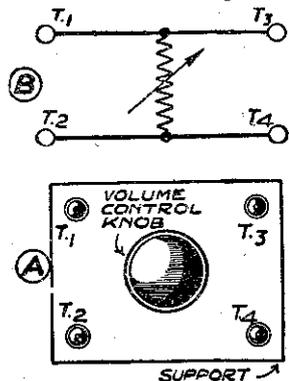


Fig. 1.—(A) The volume control, and (B) its circuit arrangement.

has it ever occurred to you how a good variable resistance can serve a number of useful purposes? Essentially it acts as a form of control, and provided the variable resistance purchased is of good quality, with a smooth action, then its applications are multitudinous.

### Variable Resistances

In this short article it is proposed to deal mainly with the variable resistance as a form of volume control, leaving uses in other directions to a future article. You are then in a position to adapt your reception to any occasion, for in effect you are providing the loud-speaker with soft and loud pedals in just the same manner as a piano. About the best value of continuously variable resistance for this purpose is one that adjusts from zero to 100,000 or 200,000 ohms, the alteration in resistance being continuous, smooth, and silent with a complete absence of jerkiness. Such resistances can be purchased from several radio firms such as Claude Lyons, Varley, Watmel, Regentone, etc., and it is nearly always best to mount them up as a separate little unit, as then it is available at will for several different purposes.

### An Easily-made Unit

To achieve this procure a piece of conbrite, the exact size being governed

By  
**H. J. BARTON-CHAPPLE**  
*Wh. Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.*

primarily by the size of the variable resistance, and mount the component on it with four terminals. Two pieces of wood can act as feet to raise the resistance from the table or bench, and Fig. 1 A and B show clearly the method of mounting and wiring. It is necessary merely to link terminals T<sub>1</sub> T<sub>3</sub> and T<sub>2</sub> T<sub>4</sub>, joining the resistance across the wires as illustrated.

Now to put the little unit to good service. Naturally, for volume control, the most satisfactory way is to use the control as near as possible to the aerial end of the set. One of the simplest solutions is, therefore, to join terminals T<sub>1</sub> and T<sub>2</sub> either across the aerial and earth terminals of the set or in series with the lead in. Both these are shown in Fig. 2 A. Adjustments may then be made on the resistance knob to give the required control of volume. Incidentally, this arrangement brings about an improvement in the sensitivity of the set and is especially desirable when situated close to a powerful transmitting station.

Another effective form of volume control is to connect your home-made unit across the secondary terminals of the first low-frequency transformer in the set. The scheme is portrayed diagrammatically in Fig. 2 B. The refinement used in this way flattens out the frequency response curve of the transformer if this happens to be somewhat "peaky."

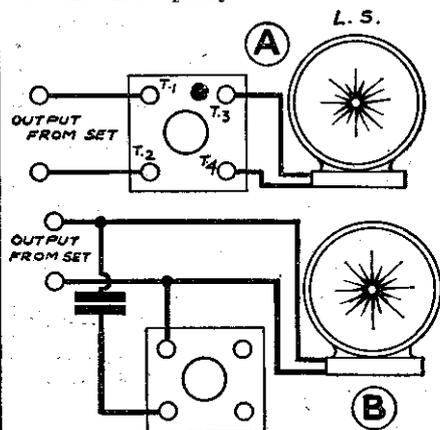


Fig. 3.—(A) Using the control to modify the volume at the speaker, and (B) converted as a tone control.

### Control at Output

A third way to control volume is indicated in Fig. 3 A. Here the loud-speaker terminals of the set are joined to terminals T<sub>1</sub> and T<sub>2</sub> of the unit, while the loud-speaker itself is connected across T<sub>3</sub> and T<sub>4</sub>. In many cases this method is not so good as the previous two, but readers can test for themselves to ascertain which best

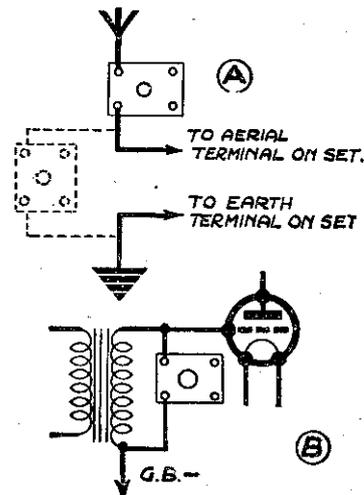


Fig. 2.—Two methods of using the control: (A) on the aerial circuit, and (B) across a transformer.

suits their requirements. With the addition of a fixed condenser the resistance unit forms an excellent tone control. It will be appreciated that, whereas for speech the reproduction should be sharp and crisp, with music a softer and more mellow tone is desirable. The simplest way of putting this into operation is shown in Fig. 3 B. T<sub>1</sub> of the resistance unit is connected to one loud-speaker terminal of the receiver, while T<sub>2</sub> is taken to a terminal on a 0.1 mfd. fixed condenser, the other terminal linking to the second loud-speaker terminal of the set, the loud-speaker itself occupying its normal position.

It is clear, therefore, that this easily-made-up unit has a variety of applications, and no doubt other ways and means of applying it to the set will occur to readers. By mounting the resistance in the manner suggested it can be kept near at hand, "at your elbow," in fact, and adjustments made without having to touch the set itself, a feature which is particularly convenient on many occasions.

**T**HE relief afforded to motorists, whereby they can obtain a generous allowance for an old car when purchasing a new one, has proved a great boon, but it is now possible to secure similar advantages as far as radio sets are concerned. This is one of the many features offered by the newly formed Radialaddin Club, whose headquarters are situated at Berners House, Berners Street, W.1. A shilling weekly subscription is the only fee to be paid, and for this the member is assured of a constant

## NEW SETS FOR OLD

change of his set, with a knowledge of its exchange value at any period. Used sets are available for cash or hire purchase at a fraction of original costs, whilst technical advice is given on all problems. The wireless

experimenter who is constantly building up sets will welcome this scheme, as it provides him with a ready means for exchanging his apparatus without accumulating large and obsolete stocks. Furthermore, the ordinary radio man can keep his set right up to date at a small outlay. Many other advantages are open to club members, especially local organisers, and existing or prospective radio users will find it worth while to write to the secretary at the address mentioned for full particulars.

# "OUR BEST WISHES"—

A Further Selection of Congratulatory Messages which the Editor has Received from Leading Manufacturers

**From A. F. Bulgin (Director, A. F. Bulgin and Co., Ltd.)**

"When broadcasting first commenced it is questionable whether anyone visualized the extraordinary rapidity with which it would capture the whole world.



"It is not more than a decade that I, like many of my confrères, was enthusing over the first 'Writtle transmissions,' and it is therefore amazing that radio should have presented the world with one of its greatest industries in so short a space of time.

"That the British radio industry should lead the realm of Radio is a matter for the greatest satisfaction to all employed in the manufacture of British products, whether it be an inexpensive gadget or a 100 guinea radio-gram.

"It is, therefore, but common justice to acknowledge the part the actual listener plays in every stride made by radio. No manufacturer can exist without the support of the public, and in personally tendering our sincere thanks let us also include the Press.

"A new paper affords new scope and marks still further progress:

"The industry is still 'young,' and any effort to still further enhance the position of the British radio industry deserves the support of all who have that industry at heart or extracts the slightest modicum of enjoyment from the ether."

**From J. G. M. Rees (Messrs. Varley)**

"Congratulations on your new publication! There is no doubt that the man who builds his own set and uses sound components will get the maximum of satisfaction and entertainment if he follows the practical advice contained in your columns. Moreover, the amateur can build his set exactly to his own requirements, and can remodel it at any time in accordance with the latest radio practice at a cost of a few shillings for new parts.

"Good luck to you."



**From L. E. Tillmore (Jackson Bros.)**

"There is room for a paper like PRACTICAL WIRELESS, with a 'Queries and Enquiries' column run by experts, and technical articles written in simple language that all can understand. If your new paper has the success which it deserves, there will soon be an end to the confusion in the public mind between the mystic microfarad and the still more mysterious micro-microfarad!"

"It is not more than a decade that I, like many of my confrères, was enthusing over the first 'Writtle transmissions,' and it is therefore amazing that radio should have presented the world with one of its greatest industries in so short a space of time.

**From H. Freeman (Parr's Advertising, Ltd.)**

"The writer welcomes the practical editorial policy set out in the printed matter he has received from the publishers of PRACTICAL WIRELESS.

"Approximately 5,000,000 licences have been issued to the public, and there is, in his opinion, a wide field open for PRACTICAL WIRELESS, which from its very name is evidently going to appeal to the ever-growing number of constructors.

"My first receiver was a commercially-constructed one, but since 1920 I have built several others. Set-construction is a most interesting hobby, and not like other hobbies, because it invariably brings pleasure to all in the home.

"I wish every success to your publication and await with great interest a copy of your first issue."

**From A. W. Hambling, A.M.I.R.E. (A. W. Hambling, Ltd.)**

"First of all I would like to congratulate the publishers on the occasion of No. 1 of PRACTICAL WIRELESS, which will undoubtedly be welcomed by the Trade and Public alike. As a very early member of this Industry, one reflects on the great help given by the Press to the public in explaining the mysteries of radio and the general spread of radio knowledge. At the present time the public has arrived at the stage of knowing what results to expect from different classes of sets. Also they are aware of the shortcomings of the 'mass production' type of circuit one usually sees put forward as new. I feel sure that PRACTICAL WIRELESS, as its excellent name implies, will be of great value to the constructing public, by placing before them the best tested and proved designs with practical constructional articles that can easily be followed. By this token readers will be certain of results. One can look forward to PRACTICAL WIRELESS each week with certain knowledge that it is based on sound experience, and its pages will be full of really interesting notes covering every phase of radio."

**From E. Leete (London Electric Wire Co.)**

"It seems to me that the ever-increasing interest that Britain's population shows in wireless matters will create very much more than a niche for your paper. I am sure that you will receive a very warm welcome from those thousands of heads who are always craving for new conquests in the wireless world, and from twice as many hands who restlessly wait to build new circuits, and even from humble folks such as ourselves, who will be prepared to spare no pains or expense in making good components that will back worthily and successfully the imagination and ingenuity of your Engineers. Therefore, I look forward with great interest to your new publication and again may I wish it great success."

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**From E. S. Lancaster (Colvern Ltd.)**

"Every success to PRACTICAL WIRELESS!

"If you cater fully for the needs of constructors, we are confident you will succeed.

"There is no limit to progress, and Colvern will continue to improve and embody new features in their coils which no doubt will be available to constructors of PRACTICAL WIRELESS receivers."

**From Norman Goldsworthy (Managing Director Scientific Publicity, Ltd.)**

"From what we have seen of your plans for PRACTICAL WIRELESS we judge that your new publication will make a very strong appeal to the home constructor who is a critical judge of quality and performance and we shall, therefore, welcome its pages as an excellent medium for the components marketed by our own clients."

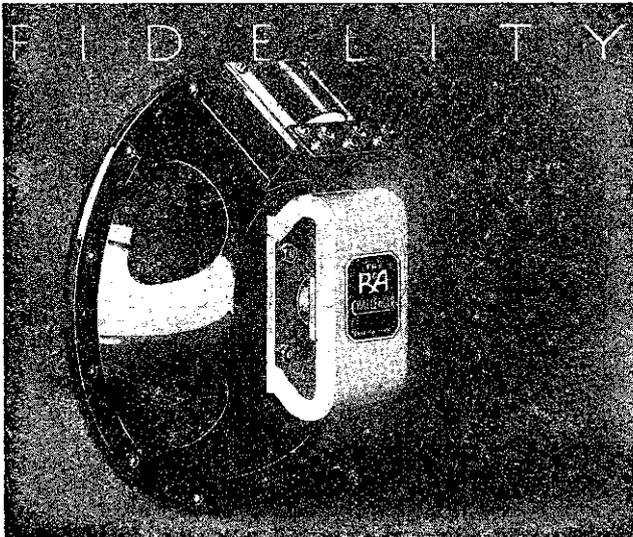
**From A. H. Whiteley (Whiteley Electrical Radio Co.)**

"The scope for the amateur constructor in radio to-day is remarkable. He may start with no more technical knowledge or skill than how to use a screwdriver, and put together a set that in appearance, in technique, and in performance is absolutely up to date—even to having a moving-coil speaker. Under your wise guidance he soon will venture, and succeed, in more elaborate achievements which manufacturers are making easier and surer for him.

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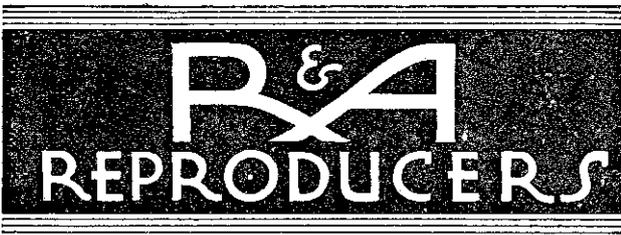
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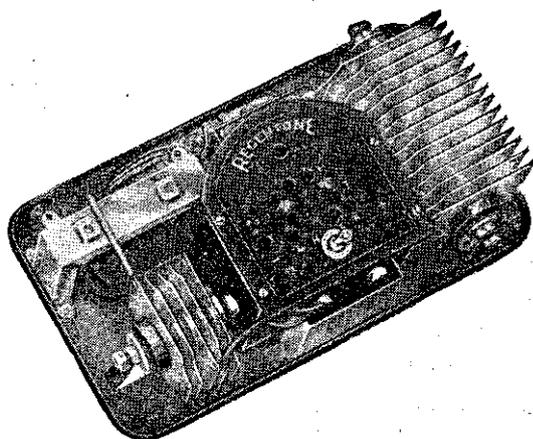
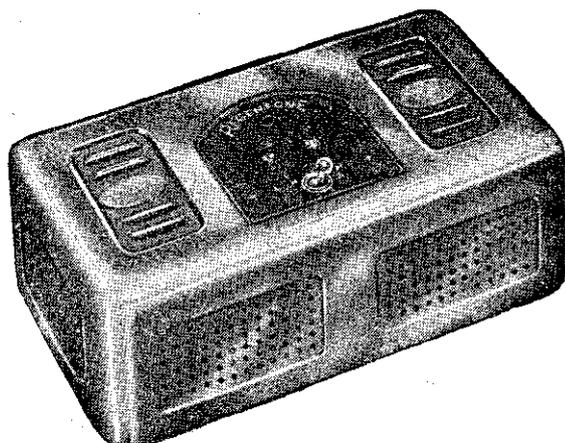
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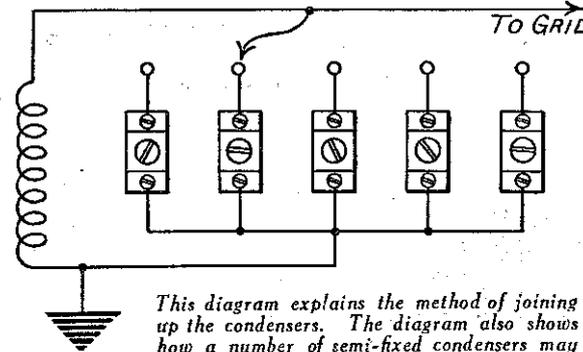
**S**EVERAL receivers were seen at the recent Radio Exhibition in which the customary tuning arrangements had been disposed of, and some form of automatic selection installed instead. One receiver had a number of small buttons which could be labelled, and the depression of a button tuned the receiver to the station indicated on that button. In another the centre of the loud-speaker fret was fitted with a knob, and disposed round the fret were small windows bearing the names of the more powerful European transmitters. Rotation of the knob tuned the receiver to fixed points, the indication being provided by a travelling light behind the windows. Devices such as these tend to make radio much simpler, and a receiver may be adapted to a similar automatic selecting device by the following means.

**Varying the Capacity**

The tuning of practically all receivers is effected by the variation in the capacity of a condenser connected across a tuning coil. As the value of the condenser is increased, so is the wavelength to which the entire circuit is tuned. If the condenser (or tuning) dials were graduated in capacity values instead of degrees you would find that a capacity of, say, .0002 mfd. tuned to the London National and a capacity of .00035 mfd. tuned to the Regional. Obviously then a fixed condenser of one of these values could be connected across the coil in place of the variable condenser with the same result, but the reason that the variable condenser is employed is that the value necessary for the different stations does not unfortunately work out to a simple figure, and furthermore, where many stations are wanted it is much simpler to have a rotatable dial to vary the capacity. How-

**PRESS THE BUTTON**

Existing Receivers, says Mr. D. James, may be Converted to Automatic Sets in Quite a Simple Manner.



This diagram explains the method of joining up the condensers. The diagram also shows how a number of semi-fixed condensers may be connected up to enable the scheme described in this article to be carried out.

ever, the small, semi-fixed type of condenser may be usefully employed to convert an ordinary receiver into an "automatic" one, and quite a useful range can be covered by using a number of these condensers.

If you examine the wiring of your tuning circuit you will find that there are two wires leading from the tuning coil to the tuning condenser. One of these wires is "earthed" and the other is joined to the grid of the first valve—either direct or through a grid condenser. If these two wires are disconnected from the variable condenser, but left connected to the other parts of the circuit, the following additions will make the set tunable by means of a selector switch.

**The Conversion**

A number of the semi-fixed condensers should be obtained, the exact number depending upon the number of stations it is desired to receive. Obviously, only those stations which are received at good strength should be chosen. Screw these condensers to the baseboard of the receiver as close to the tuning coil as possible, and join all the terminals on one side of the condensers together and connect this "common" lead to the lead from the tuning coil which is earthed. The remaining terminals of the condensers should then be taken to the selector device which is chosen, and this may be of the type having a rotatable arm travelling over a series of small studs, or a number of sockets mounted on the panel. In the case of the rotating arm device, the condensers would be joined to the studs, and in the other arrangement they would be taken to the sockets. The lead which joins the tuning coil to the grid of the valve would then have to be joined to the rotating arm in the first device, or to a flexible lead provided with a plug in the second arrangement. The diagram attached should make the idea quite clear. Each condenser should be individually adjusted to a station, and an indication provided so that the appropriate condenser may be brought into circuit as required. Where a reaction control is fitted, this will, of course, have to be operated separately, but the idea of plugging-in to the required station will no doubt appeal to the older members of a family, and a very simple and at the same time stable receiver may be built up on these lines.

If care is taken it may also be possible to arrange that the Reaction condenser can be controlled by a similar method.

**A NEW RADIO FACTORY**

**Progress**

It is always a pleasure to record progress, especially when it is well merited, and I was therefore delighted to form one of a party which visited the new works of Belling & Lee Ltd. My friend, Mr. E. M. Lee, is a director of this company, formed ten years ago, and from its inception the specialisation has been in the manufacture of terminals, wander plugs, in fact, anything that bears a relation to radio connections. The new building covers 22,000 square feet of floor space, and has been constructed with a view to obtain flexibility so that new developments and new ideas can be put into practice with the minimum delay or disorganisation. Partitions have been kept to the absolute minimum, and are so constructed that they can be moved to another position very quickly. The whole factory is ready to be expanded at any moment by building further bays on to the south side, and then removing the temporary south wall as soon as the new bays are ready for occupation.

**Automatic Machinery**

THE machinery consists mainly of high-speed automatic lathes, and is capable of turning out almost any shaped

part in either metal or insulation material. The principal materials worked are brass and casein rod, this latter being made from milk by first extracting the pure casein, which is rather like cheese, and then dyeing it and adding suitable fillers, and hardening with formaldehyde to produce the very attractively-coloured substance from which so many small wireless parts are made. Many parts have to be polished, which is done mainly by automatic methods, and a dust-extracting plant prevents dust getting into the air from these machines. Metal parts are mostly sent to the nickel-plating department, where they are first freed from all dirt and grease by means of the latest

chemical processes, including a de-greasing plant, which uses the chemical trichlorethylene in the form of vapour for removing the last traces of oil. All the oil removed is refined and used again, while all the waste metal and brass dust is sent back to the makers to be melted down.

**Press Work and Fuse Wire**

THE press section includes a special type of press, which Belling & Lee Ltd. have developed for producing the permanent lettering on their terminals, plugs, etc. From the press work we proceeded to the hand assembly and finished inspection. In one corner of the assembly department some exceedingly fine wire was being handled in the production of radio fuses. This wire is so fine that it melts before the filament of a valve could be damaged in the event of any fault in the receiver. Some of the wire is only one-twentieth of the thickness of the human hair, and it takes some months of training before the operators are able to handle it safely and speedily. Altogether this was a most interesting visit, which afforded ample proof that a real industry has been built up round the "bits and pieces" of radio.

H. J. B. C.

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## Radio Ramblings

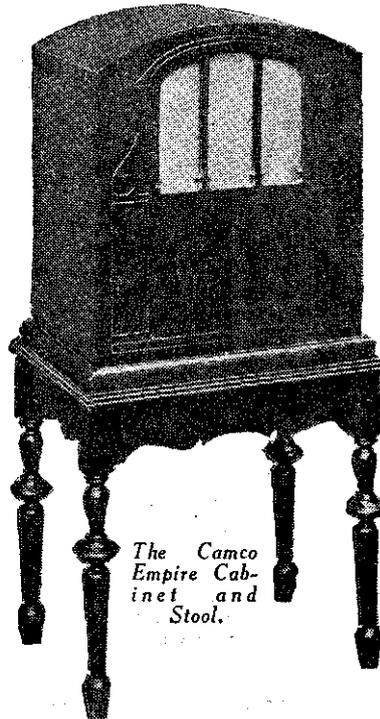
JOTTINGS FROM MY  
NOTEBOOK.  
By "DETECTOR."

### Tracking Interference

**I**N a report recently issued by the research department of the Post Office, it is stated that over 10,000 cases of electrical interference with wireless sets have been dealt with during the past twelve months. Most of the interference has been caused by electric motors, flashing signs, trams, and medical apparatus, and it has been found that, while it is possible for motors to cause trouble to a wireless set 200 yards away, a modern motor rarely offends at more than fifty yards. High frequency medical apparatus can, however, offend up to 300 yards. Now you know! If you are troubled with weird noises in your speaker, draw (as the old school joke about the Equator has it) a "menagerie" line around your house at about 200 to 300 yards radius, and then go on an interference hunt. Your hunt would be very much simplified if you could get hold of a frame aerial and notice from which direction the unwelcome signals were strongest, remembering that these signals come in a direction at right-angles to the plane of the frame. Having done this you have cut down the district to be investigated to a long slice of ground in a straight line, but you can locate the offending machinery even to closer limits, if you attack the problem even more scientifically! Get a conveniently situated wireless friend living in some other part of your locality, and take your frame aerial to his house, and notice the direction of the offending signals on his set. Draw a rough chart of your part of the world, and on it mark the positions of your houses, and the directions of the signals relatively to each. Theoretically where these lines cross is the source of the interference, though it is quite possible you may be a little wide of the mark at first. Still, you will have narrowed your field considerably, and if your rough map of the district is not too inaccurate, you should come within fifty yards of the trouble. I do not propose to tell you what to do now! That is a matter for your own tact and judgment, and the experience of telling a deaf and elderly spinster all the bother her artificial sunlight apparatus is causing you will stand you in good stead in later years. Sufficient to say that the Post Office engineers recommend that offending apparatus of a medical nature should comprise a closed non-radiating secondary circuit—**A METAL SCREEN OF LARGE ENOUGH DIMENSIONS TO COMPLETELY ENCLOSE BOTH PATIENT AND APPARATUS!!!** Now tell that to your elderly spinster! At the great risk of flogging a dead horse, however, I would like to whisper in your ears. Before you set out on this drastic business, just go over your own set and that of your friend's, and make sure you have no loose connections! They make more row as a rule than a dozen modern electric motors.

### A Question of Psychology

**A** FOREIGN firm of electrical equipment manufacturers in advertising a refrigerator they make, announce that anyone buying a machine within so many days will receive a free present of enough electricity to run the thing for three months. Isn't it strange that the sale of this refrigerator has gone up considerably since the advent of this announcement? Particularly when you consider that the cost of three months' electricity for quite a hefty cold-producing machine would be amply covered by half a sovereign? And yet, if the concern in question had announced a discount of one per cent., I don't suppose anybody would have taken the least notice. There's psychology for you!



The Camco  
Empire Cab-  
inet and  
Stool.

And there's a tip for British all-main radio manufacturers, free, gratis, and for nothing. Can't you imagine it? "Run your radio set for two years at our expense!" In other words, knock five shillings off the selling price.

### Radio for Fire Fighting

**T**HOSE of you who have at any time lived in the great lumber belts of North America will know the great dread in which forest fires are held by the inhabitants and the forestry authorities, and I retain vivid recollections of a visit paid to the scene of desolation after such a fire had passed by. As in most conflagrations, time is of paramount importance, and preventive measures taken in time will often

save the situation. To deal with such calamities a new radio receiver-transmitter set has been developed for use by the fire-fighting patrols in the forests of North America, and which allows the alarm to be given to all the patrols in the vicinity. The set weighs about ten pounds—the weight depends on the capacity of the dry batteries used—and the set can transmit or receive at will by the flick of a switch. Three valves are used, and by a very ingenious circuit they are used for both the receiving circuit and for transmission. A common wavelength and fixed tuning is used so that there is no tuning control, and a standard aerial of 70ft. of insulated wire is carried and slung up on to bushes or trees when required. Reliable speech transmission and reception is obtained up to ten miles and Morse can be used up to twenty-five miles.

### B.B.C. Birthday Broadcast

**E**VERY programme innovation of the B.B.C. comes in for a lot of criticism, and the "Farewell to Savoy Hill" broadcast of last May had its fair share. If I may be allowed to add my voice I should say that the affair was very well done, and was quite interesting, even if it was much too drawn out. Also, the ceremonial accents of the gentleman who did all the talking flavoured rather much, I thought, of the days of "Good Queen Bess." Whatever you thought of it, anyway, you will be sure to "register" surprise when you learn that we are to have another affair of similar nature. This will be in the birthday celebrations of the B.B.C. in November, and listeners will be taken in turn to every studio in the new Broadcasting House. I make but one comment! Savoy Hill had nine studios—Broadcasting House has twenty-two!

### Colliery Radio

**M**ARCONI has again been in the limelight due to his work in mid-ocean on the ultra-short waves. It is at once a tribute and an ironical commentary that the inventor of this most wonderful science should be compelled to seek the solitude of ocean wastes in order to obtain the minimum of interference from the wide-spread ramifications of the child of his brain. Meanwhile, a little band of experimenters are working in a Yorkshire colliery to still further cause the name Marconi to be blessed whenever the alleviation of human suffering or the saving of human lives come to be considered. I allude, of course, to the attempts that are being made to provide a really dependable form of communication underground in times of disaster. A fair success has already been attained and research work is going ahead, thanks to the generosity of the colliery owner who has placed his mine at the disposal of the experimenters for tests. The transmitter used has an output of 0.25 kW and is used

in conjunction with an aerial fixed to 35ft. masts at the pithead. Those of you who saw the German mining film *Kameradschaft* will recall how miners endeavoured to effect some form of communication by rapping on the pipe lines, and it needs very little imagination to realise the boon of a dependable radio link with the surface of the mine. Of course, many modern pits have telephonic communication throughout the workings, but when the unexpected happens telephone wires are among the first things to be fractured and torn up.

**Sparking Dangers in Mines**

A CERTAIN prejudice exists as regards the use of electrical apparatus in mines owing to sparking dangers in volatile gases, and one of the major problems in providing radio service underground is that of obtaining spark proof apparatus. For various reasons reception is vastly inferior as a rule to that obtained above ground, and blind spots are often found in the region of metalliferous veins in the geologic structure.

**Experiments in the Severn Tunnel**

YOU may remember the attempts made to receive the Cardiff station by members of a Radio Society whilst travelling by train through the Severn Tunnel—Britain's longest tunnel. The reception was worst at the deepest part in the middle of the tunnel, a gradual improvement being noticed as the train neared ground level. While this is perhaps not an exactly parallel case, it serves to illustrate that the difficulties of wireless communication underground are many. We hope that the difficulties will not be too many to discourage those who are seeking to further lighten the burden of the members of the mining industry—men who earn every penny of the small wages they get.

Every wireless enthusiast who reads PRACTICAL WIRELESS will have long since realised that the wonders of radio are legion. Every day we hear of some new development, every day some untiring worker discovers some new aspect of this young-old science. Probably, apart from television, the problem of broadcasting light and heat and power by means of the ether has most engaged the thoughts of experimenters, and it has been left to an American body to demonstrate that cooking by wireless is possible. The Americans, with their old-world attitude toward their women folk, have a happy knack of harnessing most of their new-found industrial processes to the alleviation of domestic drudgery, though it is a debatable point whether our less sophisticated wives and mothers will take kindly to meals cooked by means of dials and knobs. Well, I have seen socks, dusters, and other domestic oddments hanging from an aerial to dry; will I live to see cakes, pastries and other edibles supported from the self-same wire to cook? I think not, for by then the consumption of heavy meals will probably be nothing but a spectre of the horrible past, and we will all be fed by wireless or by some form of tabloid food that remains as yet the dream of our most progressive dietetic scientists.

Make certain of your copy of—  
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### Concerning Variable Condensers

(Continued from page 79.)

turer he had complaints that there was, with this new condenser, an apparent station crowding at the top end of the scale.

The outcome of all this was the appearance on the market of what might be termed a happy medium, namely, the log mid-line condenser. The shape of the plates followed what is known as a logarithmic law, and in the calculation and resulting plate shaping, allowance was made for an average capacity value of the stray capacities introduced in the set. The advantage of this type of condenser can perhaps be more readily appreciated if we think of modern wireless practice. In the early days when two or three tuning operations had to be carried out before a station was received properly, difficulty was experienced by the person handling the set unless he was skilled.

Matching the inductance of the tuning coils was a big step forward and reduced these dial differences considerably, but with a log condenser even perfect matching was not absolutely necessary. This is brought about by the fact that when two or more circuits are tuned to any one wavelength the resultant alteration in the dial setting when tuned to another wavelength is the same for each condenser.

That is to say, equal wavelength changes coincide with equal dial setting changes, say, 10 to 30, with one condenser and 14 to 34 with another. It was therefore possible to set each tuning condenser to give the same dial reading when a station had been tuned in accurately merely by releasing the grub screw securing the dial to the moving plate spindle. The simultaneous tuning of all the circuits then became a relatively easy matter and paved the way for the ganging of condensers.

In conclusion, let me say a word on a popular fallacy which existed some time ago. It was often said that this or that type of condenser brought about added selectivity.

The dial separation for stations working on wavelengths fairly close to one another is certainly altered with the different types of condensers that are used, and a better distribution of the stations round the dial results from the use of the square law or log types. This is really only a psychological effect, however, and the ability to separate the stations one from the other so that they can be listened to without interference is a function of the set itself and the aerial with which it is employed.

### Sound Sales Mains Transformers.

In addition to correct design, the actual construction of a mains transformer can play an important part in its operation. A badly clamped core, for instance, can give rise to hum caused by the vibration of the laminations. Sound Sales Ltd., appear to have paid particular care to all details in the design and manufacture of their mains transformers. Silicon steel core; screened primary windings, heavy gauge screening case, and fuses, are all embodied in these products, resulting in very efficient components. The insulation test is carried out at 25,000 volts, and a leakage test at over 2,000 volts, enables the transformers to be used for all ordinary purposes with confidence. We are using one in our Mains Express Three to be described next week.

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This Receiver tunes to Ultra-short Waves. **READY RADIO 303 KIT.** Cabinet Model, including moving-coil unit and valves. Cash Price, £6/17/6. And 11 monthly payments of 12/9. **With 10/- order**

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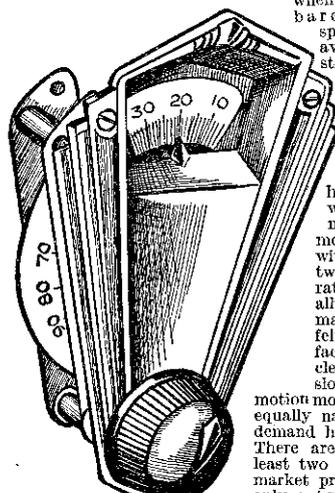
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# A CHAT ABOUT THE LATEST COMPONENTS

## SLOW-MOTION WIRELESS DIALS

THE designers of the popular short-wave sets have discovered that while they may be such wizards with the "knobs" that they can bring in Australia when handling the bare condenser spindles, the average constructor finds it quite beyond him to capture the distant stations (who's c "whistles" he can hear), with the normal slow-motion dial, with its ten or twelve to one ratio. Naturally, the demand has been felt in manufacturing circles for an even slower slow-motion movement; and equally naturally that demand has been met. There are already at least two dials on the market providing not only a twenty to one ratio between the gears, but also so designed that the scale can be illuminated very easily, thus still further simplifying tuning operations. These dials are of the disc type, and their mounting is extremely simple. For those who are keen on distance-searching, whether on the short or normal broadcast wavebands, they provide a new accuracy that is very valuable. Telsens Electric Co., Ltd., Aston, Birmingham.



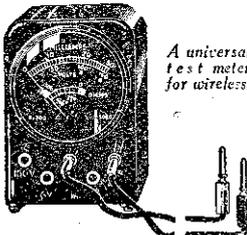
A slow-motion dial with a 20 to 1 reduction ratio.

## A UNIVERSAL TEST METER FOR WIRELESS

THE instrument shown on this page is a wireless test meter giving four readings on one dial, including direct measurement of resistance. It may be used to test H.T. and L.T. voltage, current consumption, valves, transformers, coils, condensers, short circuits, resistance, distortion and bad connections. It is fitted with a battery for valve and circuit testing. The readings are up to 150 volts for H.T., up to 6 volts for L.T., 30 milliamps for current, resistance up to 2,000 ohms. An interesting book on testing is included with each instrument, which costs 12s. 6d. Standard Battery Co., 184-8, Shaftesbury Avenue, W.C.2.

## A SCREWDRIVER AND SCREW-HOLDER

A WELL-KNOWN firm of screw manufacturers has recently marketed the combined screwdriver and screw-holder shown in the illustration in the next column. It grips the screw whilst it is being turned, and it can therefore be used with one hand only. It will be found ideal for working in awkward places, as the blade cannot slip out of the screw-slot. Additionally, it dispenses with the need for a gimlet or bradawl hole in ordinary woods and it is suitable for metal or wood screws. It is made in three sizes: No. 1 accommodating Nos. 0 to 6 gauge wood screws, 10 to 4 BA screws, and Whitworth screws 1/16in. diameter; No. 2 size suits 4 to 9 gauge wood screws, 5 to 3 BA screws, and 1/8in. to 5/32in. Whitworth screws; No. 3 caters for 8 to 14 gauge wood screws, 2 to 0 BA screws, and 3/16in. to 1/4in. Whitworth screws. No. 1 size is suitable for



A universal test meter for wireless.

wireless or model purposes, and is made in all-steel. No. 2 is a householder's model, and No. 3 a carpenter's and engineer's model. Guest, Keen and Nettleton, Ltd., Heath Street, Birmingham.

## A SPECIAL PAIR OF PLIERS

THE special pair of pliers shown in the illustration in this column will rapidly and neatly form eyes in the ends of wire, and of a diameter to suit the terminal or bolt they are intended to pass over. Eyes formed with ordinary pliers are seldom neat or satisfactory, nor do they always make good electrical contact. The pliers provide eight standard sizes of loop-forming ends which make perfectly circular loops. These range from 1/16in. to 5/16in. in diameter. The inner faces of the pliers meet in perfect contact along a line 1in. in length. The tool may also be used for other small bending jobs. The usual side cutters are incorporated. Volute Pliers Co., 19, Victoria Square, S.W.1.

## POLARITY INDICATOR FOR WIRELESS

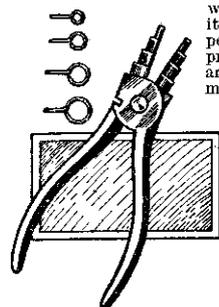
HERE is a neat little polarity indicator which will be found useful by radio enthusiasts, car-owners, and others interested in electrical matters. It will instantly indicate the negative polarity of any source of current from a few milliamps to much higher currents and up to 500 volts. It is convenient in size, for it can be carried in the waistcoat pocket. It will show alternating current or direct current wiring as well. It costs by post 3s. 6d. from I.C.A., Ltd., 28, Park Road, Nottingham.



A screwdriver and screw-holder combined.

## TEST PRODS FOR WIRELESS AMATEURS

WHEN wireless sets which have given satisfactory results fail to function, the first thing the amateur does is to search for a broken circuit. This is a somewhat lengthy process, but it can be considerably expedited by means of two test prods. In use, the prods are connected to a voltmeter and a small battery in series with the ends of the length of wire to be tested. Working along the wire with the prods (the needle points, of course, will readily pierce the insulation) at intervals of 1/4in. or so the break is soon located. It is sold by J. J. Eastick & Sons, 118, Bunhill Row, London, E.C.



A useful pair of loop-forming pliers.

## MINIATURE WIRELESS TESTING INSTRUMENTS

WIRELESS becomes much more fascinating when you have a set of instruments by means of which you can measure voltage, current, resistance, etc. For best results it is desirable to have these incorporated on the panel, so that by pressing a button readings may be taken. Miniature instruments for panel mounting having 2in. diameter dials are now available at 6s. 6d. each (postage 4d.), nickel plated.

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they may be obtained to read 5, 6, 10, 12, 15, 25, in volts or amps. They are sold by J. J. Eastick and Sons, 118, Bunhill Row, London, E.C.

## CHAKOPHONE UNIVERSAL TUNING UNIT

THE Eagle Engineering Company have improved their well-known Chakophone Tuning Coil, and under the name of the Chakophone Universal Aerial Tuning Unit it is complete with rotary magnetic reaction coil and wave-change switch. This new tuner takes the place of the old de Luxe model, the manufacture of which has now been discontinued. It is built on a bakelite moulded former and a push-pull switch in the base is used for wave-changing. The switch is arranged so that several tuners can be ganged. A panel plate is included to indicate the increased volume and switching movements. The tuner can be used as an aerial tuning inductance and as aerial or anode coils in screen-grid circuits.



A neat pocket polarity indicator.

## NEW LISSÉN LINES

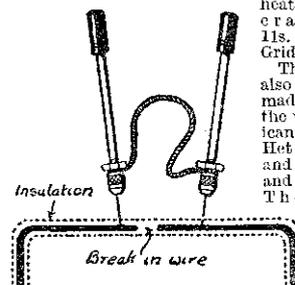
NEW Lissen lines produced this season are the triple Short-wave coil, which covers the useful short-wave range from 12 to 85 metres by means of a simple switch (no coil-changing), the astatic choke, which can be supported by the wiring or fixed down to the baseboard and occupies very little space, and the anti-break-through choke, specially designed for insertion in series with the aerial to eliminate "break-through" of medium-wave stations when receiving on the long waves. Lissen will also list many new valves, including the variable-mu S.G. 2v., the S.G. 215, which has a very high amplification factor and a low impedance.

## FERRANTI PRODUCTS

THE constructor on the look-out for a reliable measuring instrument would do well to obtain a copy of the latest catalogue of Ferranti Radio Meters, which contains a complete range of high-grade instruments suitable for either D.C. or A.C. measurements, for audio-frequency current, and instruments for use in radio-frequency circuits. Other recent catalogues which we have received from this firm show a complete range of Ferranti components and one confined to mains components only, including anode feed resistances, chokes, mains transformers and safety boxes. Separate leaflets are also available dealing with moving coil speakers, including Ferranti Inductor Speaker, push pull transformers, audio-frequency transformers, chokes and condensers, and the Ferranti seven valve mains console, a fine A.C. operated superhet set. Readers can obtain a copy of any of these lists from Messrs. Ferranti, Ltd., Hollinwood, Lancashire.

## PIX VALVES

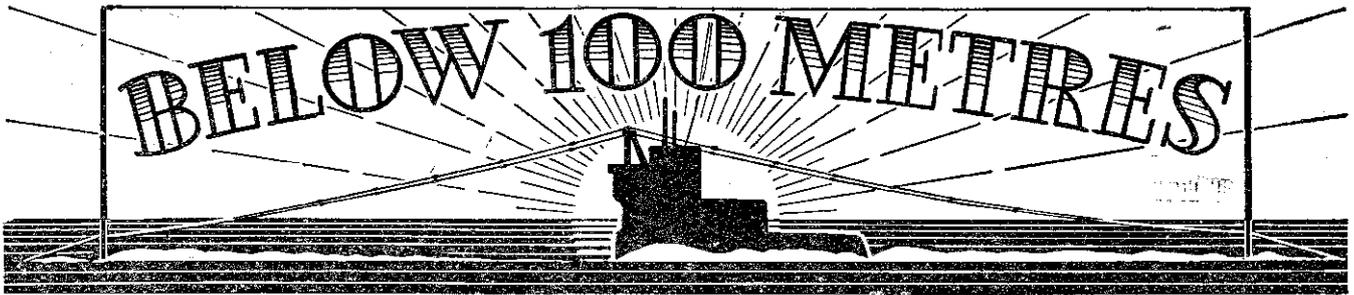
THE prices are: General purpose, 4s. 6d.; Power, 6s. 6d.; Super-Power, 8s. 6d.; Screened Grid, 11s. 6d.; 2 and 4 volt range Full Wave Rectifier, 8s. 6d.; indirectly heated types—General purpose, 11s. 6d.; Screened Grid, 15s. 6d.



Test prods for wireless constructors.

(Continued on page 116.)

The company is also producing British-made versions of the well-known American Crosley Super Het Sets, with long and short waves, and British valves. The "Goodwood," a seven-valve model, sells at 20 guineas, and the five-valve "Ascot" Model, sells at 16 guineas.



**R**ADIO receivers for use on the short-wave bands below 100 metres require to have special attention paid to a number of points which do not usually occur in the ordinary broadcast receivers. The short-wave receiver does not differ from a normal wave receiver in fundamental principle and the general circuit design remains the same in most cases. Differences occur whereby we have to deal with such matters as body capacity troubles, tuning arrangements, etc., whereby we can overcome the extraordinary sharp tuning experienced in a short-wave receiver. If the receiver is to be used for reception which will be as consistent as possible, we shall have to strive for a generally higher level of volume, owing to the weakness of the average short-wave signal. We have to decide in the first place whether the receiver shall be used for headphone or loud-speaker operation. Even in short-wave work it is nowadays customary to use only a loud-speaker, and so we find that the general trend of short-wave receiver design is to use a larger number of valves, four or five being used in the most useful types of receivers.

**Metal Chassis**

It is nowadays customary and practically essential to use a metal foundation for the short-wave receiver, if it is to have a reasonable degree of efficiency. This is necessary, not only to provide sufficient stability in the amplifying stages but to ensure that little or no body capacity shall be present. This trouble can exist in a short-wave receiver in various forms and generally makes itself known by the fact that if the hands are brought in close proximity to the tuning controls, the frequency to which the receiver is tuned will alter to some extent. This, of course, prevents tuning the receiver with any degree of accuracy and it can be overcome by careful circuit design and construction. Shielding alone will not necessarily cure it, and it is generally necessary to incorporate a number of high frequency filter and by-passing arrangements in the receiver itself

**SHORT WAVE RECEIVER DESIGN**

By Mander Burnett

before the trouble is completely cured. Aluminium is probably the most satisfactory metal to use for a screening material, and it can quite easily be shaped and drilled by the home constructor.

**An Efficient Two-valve Circuit**

In Fig. 1 we have the circuit of an average two-valve short-wave receiver of a type used

about 15 to 80 metres. On the lower band, from about 15 to 35 metres, the coil  $L^2$  is not used, being shorted out of the circuit by the switch S. Sufficient reaction to cover the whole band with one coil can be obtained if the coil  $L^3$  is of the correct size and a compromise has to be struck whereby the coil will be of sufficient size for both wavebands. The tuning condenser  $C^3$  will have a capacity of about .00025 mfd., and owing to the enormous range of frequencies to be covered, tuning, even with a condenser of this capacity, will be very sharp indeed and a high ratio vernier dial will be necessary for easy tuning.

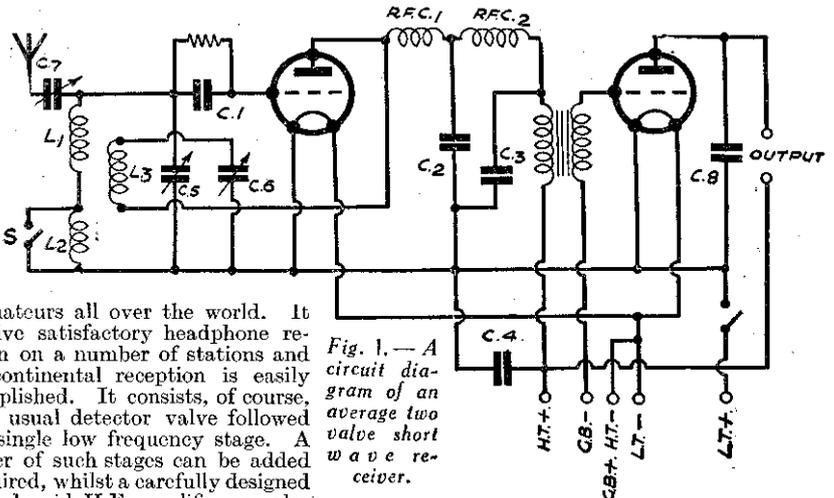


Fig. 1.—A circuit diagram of an average two valve short wave receiver.

by amateurs all over the world. It will give satisfactory headphone reception on a number of stations and inter-continental reception is easily accomplished. It consists, of course, of the usual detector valve followed by a single low frequency stage. A number of such stages can be added if required, whilst a carefully designed screened grid H.F. amplifier can also be added ahead of the detector. The inductances  $L^1$ ,  $L^2$  and  $L^3$  may consist of any one of a number of types of short-wave coils designed to cover the required bands. If the receiver is to be used solely for short-wave reception, the three coils may well be wound on one former and built into the receiver as a permanent unit. If a commercial type of dual wave coil is used, the wavelength covered will generally be from

The high frequency filter composed of the chokes RFC<sup>1</sup> and RFC<sup>2</sup> and condenser C<sup>2</sup> and C<sup>3</sup> is necessary in order to prevent high frequency currents passing into the low frequency amplifier. This filter may take various forms but it is essential that the condensers remain of small value, otherwise the low frequency response characteristics of the receiver will be considerably altered.

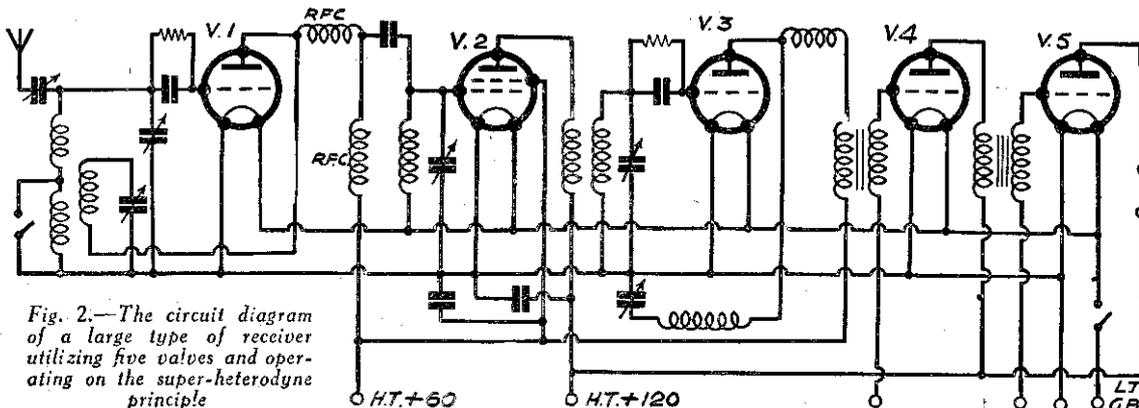


Fig. 2.—The circuit diagram of a large type of receiver utilizing five valves and operating on the super-heterodyne principle

**A Five-valve Super-Het. Circuit**

Finally, in Fig. 2 is given the circuit of a larger type of receiver utilizing five valves and operating on the super-heterodyne principle. This is without a doubt the most satisfactory type of receiver for short-wave work where powerful signals are required. By means of the super-heterodyne system (conversion of the

received frequency to a lower one before final rectification and amplification) we can use a very high degree of amplification without the use of powerful low frequency amplifiers. The first valve,  $V^1$ , is a combined detector and oscillator—a separate oscillator is not required when the difference between the received frequency and the local beat frequency is only a low percentage of the original frequency, thus—assume that we are receiving a signal with a frequency of 10,000 kilocycles (30 metres) and our intermediate frequency is 150 kilocycles, then our I.F. is only a very low percentage of the original frequency of 10,000 kilocycles. Tests have proved that a single valve is capable of dealing with both the original and the beat frequency quite efficiently with only one tuned circuit. Thus in our short-wave super-heterodyne we are able to get true single dial operation without the use of any complicated ganged circuits. This does not apply of course to normal broadcast receivers where the difference between the received and the intermediate frequency represents a high percentage of the original frequency. Two valves are necessary here for both operations.

**Amplifier Stages.**

The second valve,  $V^2$ , is the screened grid I.F. amplifier, and further stages may be added here before the second detector, if required. This super-heterodyne system of reception is generally made use of in the transatlantic telephone receivers and has proved very satisfactory.

The third valve,  $V^3$ , is the second detector, and signals are then again amplified by the low frequency amplifiers. This type of short-wave receiver has a further very big advantage over other types in that the tuning is very much more simple. Reaction is introduced at the intermediate frequency instead of at signal frequency, thus it is possible to have a reaction control which has practically no "reaction-tuning" effects, and it is also possible to set the I.F. detector just below the point of oscillation and tune in all the short-wave stations without hearing a single "chirp" or whistle. Thus critical control of reaction is not required.

**Screened-Grid Amplification.**

Finally we come to the type of short-wave receiver which makes use of one or more screened-grid amplifiers which amplify the original signal before rectification. Quite appreciable amplification can be obtained from a single screened-grid valve down to about 15 metres if the circuit is carefully designed, but, of course, each amplifying stage of this type generally means another reaction control as the task of ganging H.F. circuits in a short-wave receiver is not one to be tackled lightly. However, quite satisfactory results can be obtained from a receiver incorporating a S.G. high frequency stage, detector and L.F. amplifier, and the somewhat more simple type of construction of this type of receiver undoubtedly makes it an attractive proposition for the average user.

In the above remarks the writer has, of course, been using battery models as examples of short-wave receiver design. A.C. operation of a short-wave receiver is to-day quite an attractive proposition, and in the majority of cases no trouble will be experienced down to 20 metres if ample smoothing arrangements are incorporated; the superior characteristics of the modern A.C. valves resulting in a general overall increase of volume, compared with a battery model of the same type.

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# VOLTS AND VALVES

About a Little which Often Escapes Attention

IF you examine the chart or instruction sheet accompanying a valve you will find certain values of H.T. and grid bias are specified. Now these values are really important, and it is not only a

circuit of a valve reduce the potential which is eventually applied to the valve.

### Ohm's Law

The elementary formula known as Ohm's Law tells us that a current passing through a resistance causes a voltage drop, and this formula is represented by the equation  $I = \frac{E}{R}$ , I

being current in amps, E being voltage in volts, and R being resistance in ohms. Now from your valve, curves you will see that there is a certain anode current at a given H.T. and G.B. value, and if therefore you wish to apply the maximum H.T. to the valve, it is essential to ascertain the voltage drop through all the components in the anode circuit, and then add this figure to that required at the anode.

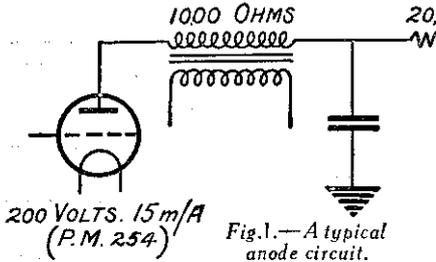


Fig. 1.—A typical anode circuit.

question of plugging a valve into its socket and then adjusting the grid bias until signals are clear. When you want to get the best from a set, the correct valves should be chosen for each stage, and then the value of the H.T. which should be applied at the H.T. terminal should be ascertained. (Of course, if you are making up a receiver described in these pages, the correct potentials will be quoted.) It is too often overlooked that all resistances in the anode

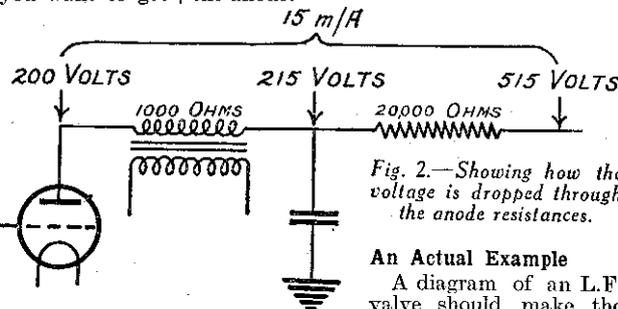


Fig. 2.—Showing how the voltage is dropped through the anode resistances.

### An Actual Example

A diagram of an L.F. valve should make the idea clearer. The figure shows a Mullard 254 valve with a transformer and a decoupling resistance in the anode lead. The valve makers give the maximum voltage as 200 volts, at which figure (when correctly biased) the anode current is 15 m.a. We will assume the transformer primary has a D.C. resistance of 1,000 ohms, and the decoupling resistance a value of 20,000 ohms. There is therefore a current (at correct maximum voltage) of 15 m.a. traversing a total resistance of 21,000 ohms, which, by the above formula, we find will give a drop of 315 volts. Therefore, to enable 200 volts to be applied at the anode a source of 200+315, or 515 volts would be required.

This is made up as shown in Fig. 2, and this fact must be borne in mind when working out the values of decouplers or grid bias. Remember, the grid bias must be decided by the voltage on the actual anode, not at the H.T. positive tapping.

### Care and Upkeep

(Continued from page 75.)

#### A Valve's Length of Service

The valves are the most important items in the set. The life of a battery valve is naturally governed by the number of hours of use, and it is generally taken that 1,000 hours represents one year of service, after which the valve begins to deteriorate, commencing very slowly at first until distortion becomes perceptible to the human ear, gradually getting worse. The limit to a valve's life can, therefore, be taken as approximately two years. It may still continue to be used, but only with decrease in amplification and an increase in running cost. Fig. 4 illustrates this deterioration.

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ATTACHING AN OUTSIDE AERIAL TO A PORTABLE

"I have a 3-valve Portable Receiver, which gives fairly good reception from the local stations, but is very poor on any others. There is no provision for connecting an outside aerial, but I am told that the set could be modified in some way so that an aerial could be used when greater volume was required on more distant stations. Will you please advise?"

The simplest way to connect an aerial would be to take it to one terminal of a .0001 mfd. pre-set condenser of which the other terminal was joined to the grid terminal of the first valve-holder. An earth connection would also be desirable, and should be made to L.T. negative. This method would certainly give increased volume, but it might not afford sufficient selectivity to enable the "local" to be eliminated. A better way is to wind two or three turns of 24's gauge double cotton-covered wire round the frame aerial, and connect the ends to aerial and earth respectively. The optimum position for the winding will be somewhere between the long and medium-wave aerial windings, but it can best be found by trial. A position should be obtained which will give a balance between maximum volume and maximum selectivity. In this case also stability will probably be improved by taking a lead from the "earth" end of the new winding to L.T. negative.

USING ELECTRIC SUPPLY MAINS AS AERIAL

"I notice that a number of commercial all-mains receivers can be used without an outside aerial, being specified as having a 'mains aerial' connection. I take it that this means that the supply mains can in some way be used as an aerial, and wonder if I could alter my home-made A.C. set to operate in a similar manner, because, living in a flat, I am unable to erect an aerial. Is the mains aerial as good as an outside one?"

The supply mains can be used as aerial with any receiver merely by connecting the aerial terminal to one mains-lead through a small fixed condenser. The condenser should have a capacity of from .0001 mfd. to .0005 mfd., and it is essential that it should be a really good one of no less than 400 volts D.C. working. You might be interested to know that Messrs. Dabillier make a special condenser with lamp plug fitting, and designed principally for use with battery sets. Generally speaking a mains aerial is less efficient than a normal outside one, although better than the average inside aerial. The efficiency depends principally upon the characteristics of individual mains supply leads.

FRAME AERIAL WINDINGS

"I am building a 4-valve portable receiver of my own design, but am at a loss to know how many turns are required on the frame aerial. Is there any simple method of determining the correct number of turns without using advanced mathematics?"

Yes, there is! It is sufficiently accurate for frames from about 1ft. to 3ft. square to allow a winding length of 240ft. of wire for long waves and 75ft. for

medium waves. Tuned by a .0005 mfd. condenser, windings of these sizes will cover tuning ranges of from approximately 1,000 to 2,000 and 250 to 500 metres. In practice it is found best to arrange the windings in two parts, one of 75ft. and the other of 165ft. For long-wave reception both windings are connected in series, but for medium waves the larger winding is short circuited by means of a push-pull switch. The medium-wave winding should for preference consist of side-by-side turns, whilst the larger winding can be accommodated in three sections placed in convenient slots or notches. (See Fig. 1.)

MICROPHONIC VALVES

"I have a 3-valve receiver, which has given very good service for the past two years, and recently decided to convert it into a cabinet radio gramophone, but immediately the speaker was put in the same cabinet as the set all music was drowned by a terrific yell. What is wrong, please?"

This is a fairly common source of trouble, and is due to the detector-valve being microphonic. That is, when subject to vibration, it causes a musical note to be emitted by the speaker (due to vibration of the electrodes). When the speaker is not very near to the

gave fairly good results on my set. Can you kindly explain the reason for this apparently peculiar behaviour?"

The peculiarity is explained by the fact that your pick-up is of a low-resistance pattern, whilst your friend's is a high-resistance one. Generally speaking, a low-resistance pick-up must be used in conjunction with a volume control of low resistance, and vice versa. Now your volume control has a high resistance, and therefore probably matches the high-resistance pick-up. On the other hand, your friend's volume control is of lower resistance, and therefore suits the low-resistance pick-up. The remedy in your case lies with the substitution of a low-resistance volume control for the quarter megohm one at present fitted. The correct resistance will be found on the makers' instruction sheet, and will probably be in the region of 20,000 ohms. In most cases the exact value is not critical, but should not differ from the specified

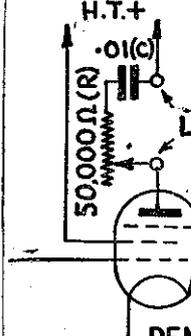


Fig. 2.—How tone is regulated by fitting a resistance and condenser across the loud-speaker terminals.

valve by more than 100 per cent. or so. If the resistance is too high, reproduction will be "screaky," as you have discovered, but if too low, the higher musical frequencies will be lost.

TONE CONTROL WITH PENTODE

"With the object of increasing the volume from my two-valve battery set I have just fitted a pentode in place of the three electrode power valve. Volume is certainly greater, but reproduction is higher pitched and less natural. Is this inevitable when a pentode is employed, or is there some simple cure?"

A pentode always does give emphasis to the higher frequencies, but it is not a difficult matter to regulate the tone by fitting a resistance and condenser across the loud-speaker terminals, as shown in Fig. 2 given herewith. The resistance (R) should have a value of about 50,000 ohms, and may be either fixed or variable. If variable the tone can be controlled as desired. The condenser (C) should be of about .01 mfd. capacity. When the speaker is fed through a transformer the tone control should be put across the primary winding of the transformer. If choke-capacity feed is employed the correct position is in parallel with the choke.

FITTING A VARIABLE MU VALVE

"I understand that a number of advantages are to be gained from the use of a variable mu valve, and contemplate the substitution of one in my S.G.-Det-Pen. battery set in place of the ordinary S.G. valve at present in use. I would be obliged if you could give me particulars of any alterations which would become necessary."

It is worth while to use a variable mu valve, especially when the receiver is used near to a powerful transmitter. The necessary alterations are of a simple character, but vary slightly with different receivers. Different methods are shown at (a) and (b) in the accompanying diagram (Fig. 3). At (a) a single-circuit aerial tuning is employed, and the grid of the S.G. valve has been connected to H.T.—, through the tuning coil. To make the circuit suitable for a V.M. valve a grid condenser and leak have been added. The condenser breaks the circuit between the grid and H.T.—, and the leak, being connected to a potentiometer in shunt with the grid bias battery, carries the variable

(Continued Overleaf)

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GAUGE (S.W.G.)	LENGTH PER OHM.	SAFE CURRENT CAPACITY	
		YDS.	AMPS.
16	184.6	13	
18	83.4	7	
20	42.4	4	
22	25.6	2.5	
24	15.3	1.5	
26	10.6	1.0	
28	7.18	.7	
30	5.03	.5	
32	3.82	.4	
34	2.77	.25	
36	1.89	.15	
38	1.18	.1	
40	0.75	70 m/a	

valve all is well, for the note dies away immediately the vibration ceases. But when the speaker and valve are close together sound-waves return to the valve and cause still more vibration. This process goes on indefinitely until the sound reaches maximum intensity, after which the note remains at a loud and steady pitch. The most obvious cure is to fit a new valve, but this is not always essential, because it is sometimes possible to "damp-out" vibration by fitting the valve in a sprung valve-holder or by wrapping it in thick felt. During the past year or so manufacturers have paid great attention to this particular valve fault, with a result that very few present-day valves suffer from the defect. Even so, one does seldom come across a new valve which is microphonic, as did the writer only a few weeks ago. This particular valve was, however, immediately replaced on returning it to the makers.

PICK-UP VOLUME CONTROL

"I recently bought a pick-up of well known make with the intention of using it on my 3-valve receiver, which is provided with pick-up terminals and a quarter megohm potentiometer volume control. When I attempted to use the pick-up, however, reproduction was very shrill, and constant high-pitched whistle could be heard above the music. Now the peculiar thing is that the pick-up worked perfectly well on my friend's set and his pick-up (of different make)

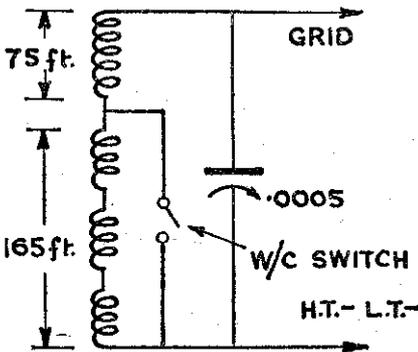


Fig. 1.—Diagram illustrating reply concerning frame aerial windings.

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**Queries and Enquiries—continued**

grid bias. Notice to which side of the battery switch the positive grid bias lead is connected. If it were joined to the other switch terminal the battery would soon become exhausted, due to the potentiometer continuously drawing current from it. With the connections shown the potentiometer load is removed immediately on switching off the set.

At (b) a slightly different method is illustrated, this one being suitable where a band-pass tuner is employed. The by-pass resistance (R) which was previously taken to H.T.—, is now connected to the slider of a 50,000-ohm potentiometer, which is in parallel with the normal grid bias battery. Here again operation of the potentiometer allows a variable bias voltage to be applied to the grid of the V.M. valve. In this case it has been assumed that the connections of the G.B. battery shown at (a) were not convenient, and the usual two-pole battery switch has been replaced by one of the three-pole type which isolates G.B.+ from the potentiometer when in the "off" position. In each of the examples given, use is made of the same grid bias battery as is used for the L.F. valves.

**REDUCING VOLTAGE OF TRANSFORMER WINDING**

"Could you please tell me if there is

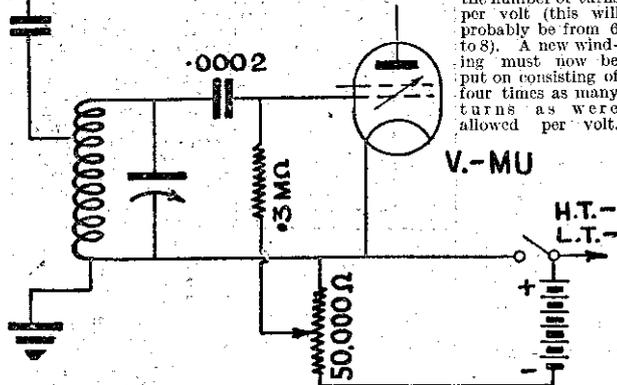


Fig. 3A.—The substitution of a variable mu valve in a single circuit aerial tuner.

any way of reducing the A.C. voltage given by the secondary winding of a mains transformer? I ask this question because I have bought (very cheaply) an old type of mains transformer which is designed to give, in addition to 250 volts H.T., 6 volts at 1 amp and 7.5 volts at 3 amps. I wish to use this in a four-valve A.C. receiver which requires a heater voltage of 4, at 3 amps, and one of 6, at 1 amp. If I could alter the 7.5 volt winding, therefore, the transformer would suit my purpose very well."

The suggested alteration can be made fairly easily, although it might entail dismantling the whole instrument. The method is as follows: Remove the 7.5 volt winding, carefully counting the number of turns. By dividing this number by 7.5 you can find the number of turns per volt (this will probably be from 6 to 8). A new winding must now be put on consisting of four times as many turns as were allowed per volt.

The same wire will do as was previously removed since the current in each case is the same. Had the 7.5 volt winding been designed for a lower current, though, a different gauge of wire would have been necessary. For 3 amps, 20's gauge is suitable, and either enamelled or double cotton-covered wire could be used.

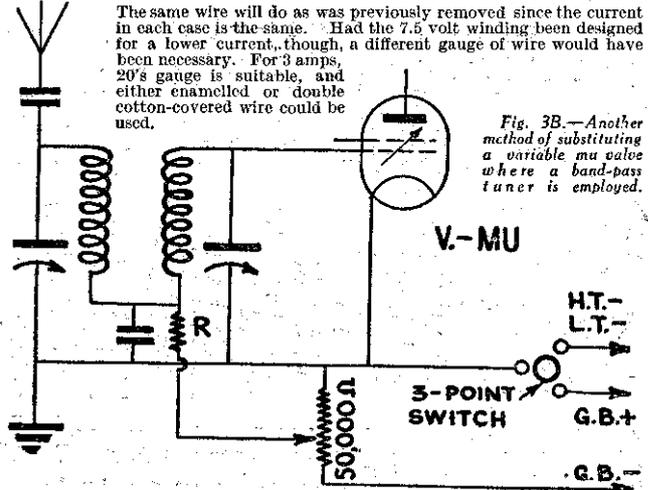


Fig. 3B.—Another method of substituting a variable mu valve where a band-pass tuner is employed.

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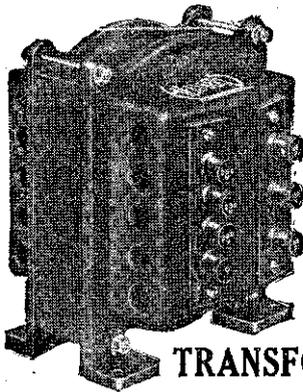
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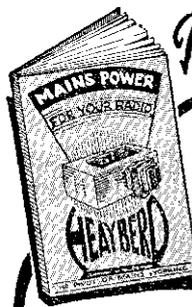
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The popularity of the permanent magnet moving coil speaker is largely due to the marked advance made in these instruments during the last two or three years, as a result of patient research work and careful testing. The excellence of design and performance of some of the modern instruments leaves their predecessors of two or three years ago far behind, and the fine range of "Motor" permanent magnet moving coil speakers by Tekade Radio and Electric, Ltd., are no exception. Several types are shown in a neat folder issued by this firm, including the "Motor Minor," a sturdy little speaker with cobalt magnet and cast aluminium chassis selling at 39s. 6d. A balanced armature type of unit and chassis is also listed, together with some well-designed cabinets with speakers, and ranging in price from 52s. 6d. to 69s. 6d. complete.

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**HARLIE PRODUCTS**

An interesting little booklet entitled: "Discovery" has been received from Messrs. Harlie Ltd., Cambridge Arterial Road, Enfield, Middlesex. Among the items mentioned in this book are microphones, pick-ups, switches, motors, tone controls, etc. In addition, very interesting technical details are given at the end of the book, explaining how to connect up pick-ups, volume control at pick-ups, switching from radio to gramophone, etc. The tone selector is the latest device to be marketed by this firm. This is a small device to connect across the terminals of a loud-speaker, and it is provided with a knob giving variations of tone from low to high. It may also be used in conjunction with a pick-up to eliminate scratch.

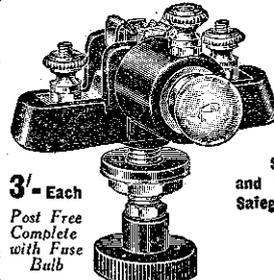
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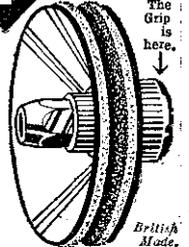
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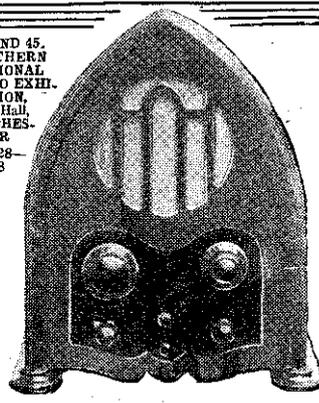
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The London Electric Wire Co. and Smiths Ltd., at Church Road, Leyton, E.10, are well known as manufacturers of all gauges of instrument wire. In addition, however, such items as Spaghetti Resistances, all types of tuning coils, and transformers are also manufactured. The catalogue issued by the above firm gives details of these, as well as of the latest sets of coils for the super-heterodyne circuits.

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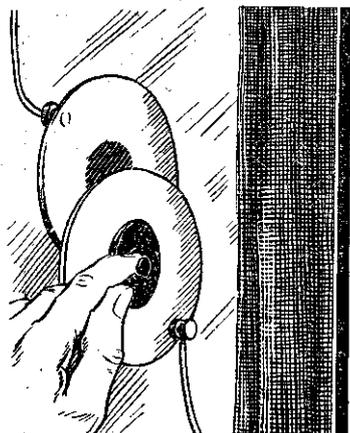
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## A CHAT ABOUT—

(Concluded from page 109)

### WEARITE EARTH TUBE AND LEAD-IN

THE earth tube manufactured by Messrs. Wright and Weaire is now well known, and there is no need here to mention its novelties, such as the easy and ingenious scheme which permits of the soldering of the earth lead without the use of a soldering iron. The latest novelty from this firm, however, is the lead-in device. This consists of two discs of aluminium, covered with a cellulose-coloured coating, one disc being red and the other blue. Each disc is provided with a terminal of the Fahnestock type, and has a hole in the centre through which a rubber suction cup may be fixed. The two discs are intended to be used as the plates of a condenser, the dielectric being furnished by the glass of the window pane. The red



The Wearite window-pane lead-in device.

disc is stuck outside the window, and the lead-in attached to the clip on this disc, whilst the other disc is fixed inside the window, and a lead taken from this to the aerial terminal of the receiver. The device thus saves drilling a hole and at the same time serves as a series aerial condenser. The capacity may be

## Broadcast Query Corner

UNDER the above title, with the assistance of a recognised authority on foreign broadcasting matters and a regular contributor to wireless publications both at home and abroad, we are inaugurating a special Identification Service, which should prove of great assistance to our readers. When tuning in well-known stations it happens frequently that listeners pick up wireless transmissions of which they fail to recognise the origin. It is to solve these little problems that the *Broadcast Query Service* has been organised.

In order that a careful search may be made it is essential that certain data should be supplied to the best of the inquirer's ability and knowledge. When sending such queries to the Editor the following rules should be followed:—

1. Write legibly, in ink. Give your full name and address.
2. State type of receiver used, and whether transmission was heard on headphones or on loud-speaker.
3. State approximate wavelength or frequency to which receiver was tuned, or, alternatively, state between which two stations (of which you have the condenser readings) the transmission was picked up.
4. Give date and time when broadcast was heard. Do not forget to add whether *a.m.* or *p.m.*
5. Give details of programme received, and, if you can, some indication regarding the language, if heard.
6. State whether and what call was given and/or kind of interval signal (metronome, musical box, bells, etc.) between items.
7. To facilitate publication of replies, append a *non-de-plume* to your inquiry.

Although the service is mainly applicable to broadcasting stations, wherever possible replies will be given in regard to morse transmitters (commercial stations, fog beacons, etc.) and short-wave broadcasts. For the identification, however, of stations operating on channels below 100 metres it will be evident to inquirers that a closer estimate of wavelength must be submitted than in the case if broadcasts on the medium or long waveband, if successful identification is to be carried out.

All inquiries should be addressed to *The Editor, PRACTICAL WIRELESS, 8-11, Southampton Street, Strand, London, W.C.2,* and the envelope marked *Broadcast Query Service,* in top left-hand corner. Stamped addressed envelope should not be enclosed, as replies cannot be sent by post, but will be published in due course in each issue of *PRACTICAL WIRELESS.*

## THE LATEST COMPONENTS

varied by adjusting the relative positions of the two discs. The price of this neat device is only 1s.

### AN INVISIBLE AERIAL

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### NEW COMPONENTS—LISSEN SHORT-WAVE COIL

THE key to the successful operation of a short-wave receiver or adaptor is undoubtedly an efficient coil, and bearing this in mind constructors will welcome the new Lissen Triple Range Short-Wave Coil, which covers the whole of the short-wave band and entirely eliminates the inconvenience of coil-changing. In the new component, which is very compact, the tuning and reaction windings are set rigidly in three sections on the grooved ribs of a well-finished bakelite former, and stray capacities are reduced to a minimum. The coil can be used in any type of circuit—in a straight detector circuit, in a superhet, or in an H.F. amplifying stage. The tuning range with a .0002 mfd. variable condenser, is 12 to 85 metres. The coil is priced at 4s. 6d.



### PIX AT MANCHESTER EXHIBITION

THE British Pix Co. Ltd., on Stands S5 and S6, will be showing the famous Pix and Pix Clips, also the British Pix Valve, manufactured from British materials, which embodies all the latest improvements in design and construction, the Pix valve has a triple-coated neodymium filament.

The Wearite self-soldering earth tube.

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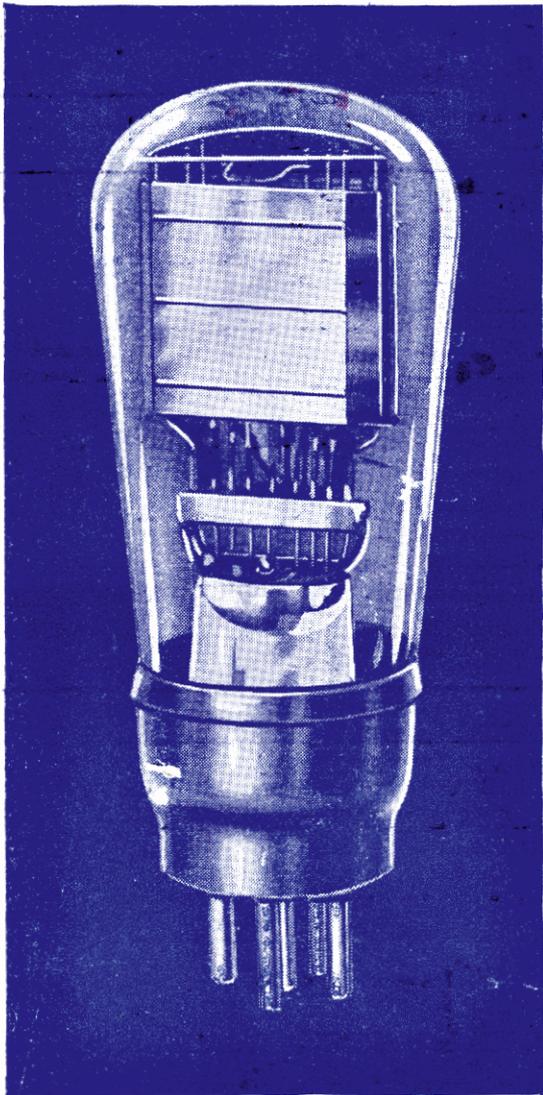
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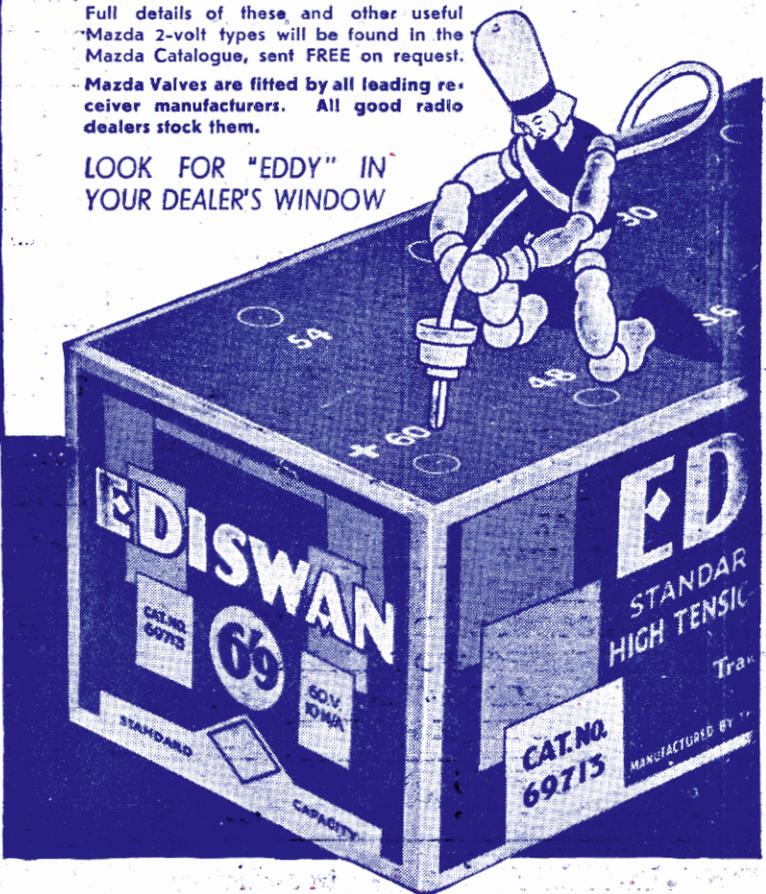
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