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Amateur Wireless And Electrics

Vol. IX. No. 226 SATURDAY, OCTOBER 9, 1926 Price 3d

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"Selectivity"

"Why Grid Bias Matters"

"Best Possible Crystal Sets"

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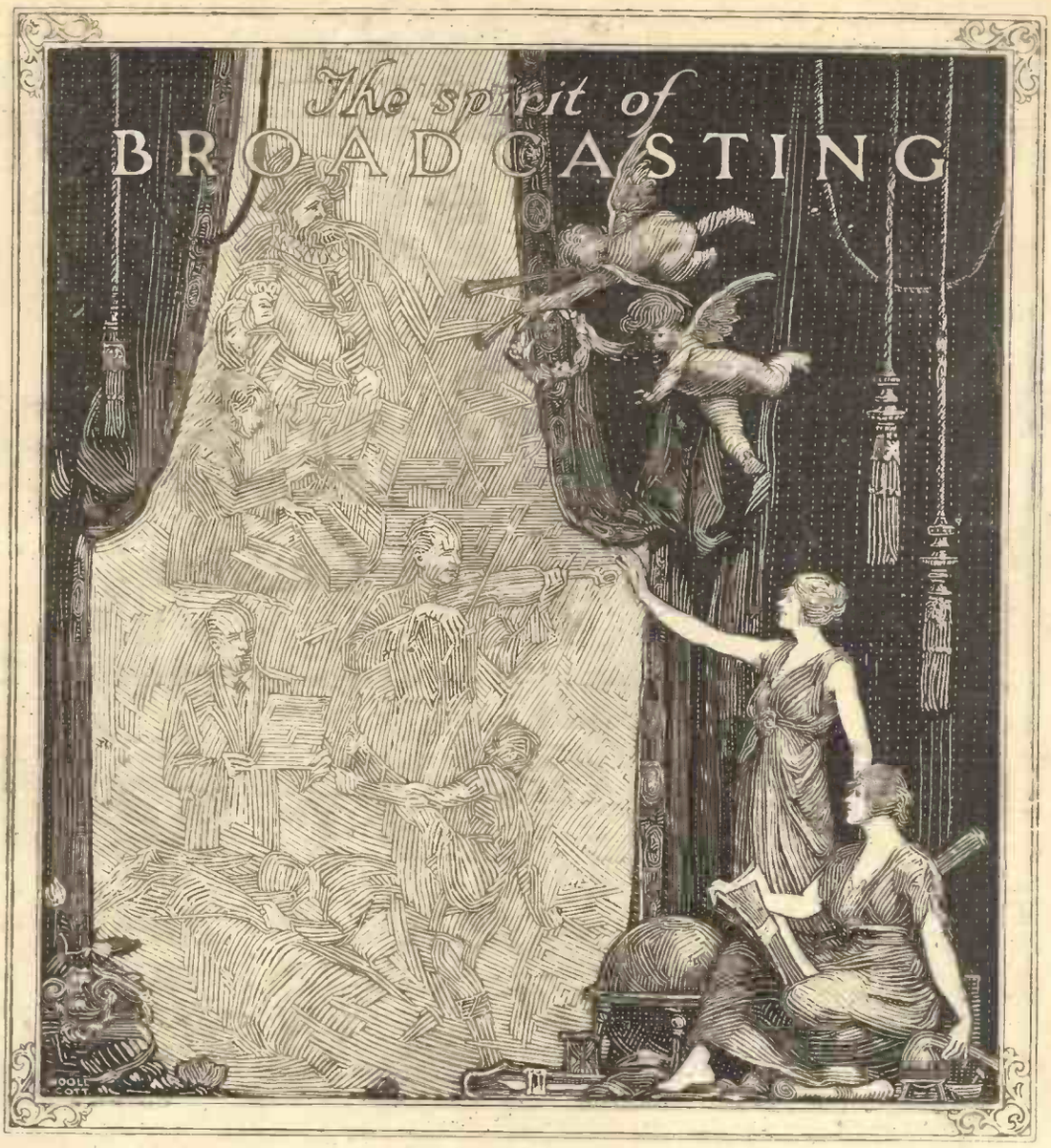

BECAUSE the Science of Radio is so essentially young, great developments are bound to appear unheralded almost overnight. Cossor, ill-content to rest on the international reputation gained through the excellence of the Wuncell Dull Emitter has once again excited considerable comment by introducing a valve incorporating far-reaching improvements. Not only is the new Cossor Point One at least a year ahead in design, but for the first time there is available a filament which is well-nigh proof against the ravages of time. The new Cossor Kalenised filament is the latest step in the search for a process of manufacture to secure an adequate electronic emission without perceptible glow. And by the almost total elimination of wasteful heat, exceptional robustness has naturally followed. It is a scientific fact that even after a very lengthy period of use, the character of the Cossor Kalenised filament is quite unchanged. It is as pliable as ever. Its electronic emission is just as prolific. While its current consumption continues at a miserly one-tenth of an ampere. For 14/- you can now buy an entirely new type of Dull Emitter which will give you greater satisfaction and more lasting service than you have ever before experienced

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Advertisement of A. C. Cossor Ltd., Highbury Grove, N.5.

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Amateur Wireless and Electrics

The Leading Radio Weekly for the Constructor, Listener and Experimenter

Edited by BERNARD E. JONES

Technical Adviser: SYDNEY BRYDON, D.Sc., M.I.E.E.

Vol. IX. No. 226 — OCTOBER 9, 1926

Chief Contents

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Contributions are always welcome, will be promptly considered, and if used will be paid for.

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"JUICE" FROM THE MAINS

EVERY once in a while comes an announcement of some new invention or discovery which is to "revolutionise" wireless reception. Such revolutions, however, seldom materialise. The last really revolutionary invention was that of the three-electrode valve, and it would now seem that the future progress of wireless will lie along the lines of steady development without any startlingly sudden changes.

It is not very long ago since it was predicted that the *four*-electrode valve would make H.T. batteries obsolete. It is true that H.T. batteries are not now used so extensively as they were formerly—but the four-electrode valve is not responsible for this.

A Great Need

The need for "high-tension" is still as great as ever, but people are discovering that it is, in many cases, possible to utilise the electric-lighting mains of the house as a source of supply, thus rendering unnecessary the H.T. battery.

When the house is lighted with direct current the procedure is extremely simple. If the voltage of the mains is more or less the same as that required by the set it is only necessary to connect up the mains to the set through suitable smoothing apparatus.

Smoothing is necessary, as no special care is taken at the power station to make the flow of current intended for lighting purposes perfectly even. There is always a slight "ripple" which, if not smoothed out, would result in a hum being heard in the phones or loud-speaker.

No elaborate apparatus is required to enable the ripple to be smoothed out. Just a fairly large iron-cored L.F. choke coil, connected in series with each of the leads, and a couple of large-capacity condensers across the mains before and after the choke coils.

If the voltage of the supply is higher than is required by the plates of the valve, a number of resistances, such as lamps, can be connected in series across the mains, the negative H.T. terminal of the set connected to the negative main, and the positive H.T. terminal on the set to a suitable point in the series of resistances. The greater the proportion of the resistance included between the negative main and the H.T. positive tapping to that included between the latter tapping and the positive main, the greater the H.T. voltages applied to the plates of the valves.

A.C. Supply

Should it happen that alternating current, and not direct current, is used for lighting, the problem is slightly more complicated. As direct current is required by the valves some form of rectifier is necessary. The rectifier may conveniently be either a thermionic valve or a Nodon valve.

Each of these "valves" has the property of being conductive in one direction only when used under suitable conditions. The thermionic type of rectifier requires only two electrodes—the filament and plate—and possesses the property of one-way conductivity because electrons are only emitted by the hot electrode, the filament. A three-electrode valve can be used as rectifier if the plate and grid are connected together and are used as the anode.

The Nodon Valve

The Nodon valve consists of an electrode of aluminium and another either of lead or steel immersed in a neutral solution of ammonium phosphate; it is a rectifier because a current can pass from the lead (or steel) to the aluminium, but not in the reverse direction. When the aluminium is positive, and therefore when current tends to flow from aluminium to lead, an insulating film forms on the surface of the aluminium and so renders the "valve" non-conductive.

Although an alternating-current supply makes a rectifier essential, it has the compensating advantage that the voltage of the supply can be reduced by using a suitable step-down transformer. This does not result in a considerable loss of energy, as is the case when resistances are used when the house supply is D.C. Also the

(*Concluded in third column of next page*)

YOUR CONDENSER CAPACITIES—ARE THEY CORRECT?

WHAT are the sizes of the fixed and variable condensers you use in your set? What made you decide upon these values? There has grown up a sort of convention with regard to condenser capacities which no one seems to think of breaking.

For instance, the aerial-tuning condenser nearly always has a capacity of .0005 microfarad, the anode-tuning condenser of .0003 microfarad, the grid condenser of .0003 microfarad, and that across the primary of the first L.F. transformer of .001 microfarad or .0002 microfarad.

Early Ideas

It was not ever thus. At one time .001 microfarad was not deemed too large for a variable condenser for tuning the aerial circuit, while .0005 microfarad was considered the correct size for the anode condenser. In the past opinion has varied, with regard to the proper size for the grid condenser, from as low as .00001 microfarad to as high as .005 microfarad.

But for a long time the present convention has been in force, and no one seems to question whether the values most generally used nowadays are the most suitable.

They may be good average values—the writer does not deny that. But he does assert that they can be varied with advantage in many cases.

The usual capacity for the aerial-tuning condenser, .0005 microfarad, is well enough for broadcast wavelengths. The capacity generally used in the anode circuit, .0003 microfarad, is, however, much too high if the anode-tuning coil has low self-capacity. It can often be halved conveniently. Anyone desirous of trying the experiment need not disturb his set further than to connect a .0003 microfarad fixed condenser in series with the anode-tuning condenser.

The self-capacity of the coil has, of course, a lot to do with the matter. When it is high a small coil and large tuning condenser will be required. At one time tuning coils had such a large capacity that a 50-turn and a 75-turn coil were needed in the anode circuit to enable the broadcast band to be covered.

The writer uses a No. 100 coil (of the usual size of plug-in coil), which when used in the anode circuit with a .0003 microfarad variable condenser tunes from about 200 to 600 metres. Obviously .0003 microfarad is much too large a capacity to use in this case, as the broadcast stations are all received when using only a small portion of the condenser scale.

Condenser Capacity and Overlap

The capacity of the grid condenser does not seem to be at all critical, but that most annoying symptom known as "overlap" can often be cured by altering the size of this condenser. A little experiment with regard to the size of the condenser across the transformer, however, will soon show that, with modern transformers, the generally accepted capacities are very much too large. When a condenser of .002 microfarad is used a great deal of energy passes through this condenser, and so does no useful work in the transformer.

In the case of a very poor transformer this may seem to make for purity. All that happens, however, is that the signals are so reduced in volume that distortion is less apparent. A good size for this condenser is often around .0005 microfarad, and it is a good plan to shunt the transformer primary with a .001 microfarad variable condenser.

With regard to the coupling condensers used between resistance- and choke-coupled L.F. valves there is at present a great difference of opinion. Circuit diagrams have been published showing condensers in these positions with capacities of only .01 microfarad each, while other circuits have coupling condensers as large as 1 microfarad each.

G. N.

MAKING HISTORY—AMPLIFIERS AT AN INCORPORATION

The Charter which was received at Twickenham was read to many thousands of people who were enabled to hear it by means of amplifiers and loud-speakers.

"'JUICE' FROM THE MAINS" (*continued from preceding page*)

voltage can be increased, if necessary, by the same means, a process which is impossible with a D.C. supply.

When the A.C. has been rectified it can be treated in the same way as direct current (which, indeed, it then is) and passed through a suitable smoothing unit before being applied to the plates of the valves.

The lighting of valve filaments from D.C. mains constitutes essentially the same problem as the obtaining of H.T. current from the same source. Of course, in the former case the resistances have a high value to prevent undue wastage of energy, while in the latter case the current required is considerably greater than is required in the plate circuits of the valves.

Obtaining L.T. current from A.C. mains is, however, beset with more difficulties. For really good results it is highly desirable to use a rectifier, though it is possible to do without one. When the house is supplied with alternating current, however, it is to be advised that only H.T. current be derived directly from the mains, an accumulator being employed to heat the valve filaments. As the accumulator can be charged from the mains through a Nodon valve, there should be no charging worries.

Many articles dealing with obtaining H.T. and L.T. current from both D.C. and A.C. mains, and charging accumulators from these sources, have appeared in the pages of AMATEUR WIRELESS and the *Wireless Magazine* in the past, and many similar articles will appear in the future.

The second part of "A New Practical Guide to Wireless" (the first part of which is given away with this issue of "A.W.") will also deal with the subjects in considerable detail.

THE BEST POSSIBLE CRYSTAL RECEPTION

Some Notes on the Construction of an Efficient Receiver

ON June 5 we published an article entitled "The Best Possible Crystal Reception." This article dealt with the design of the tuner, but did not give any constructional details, and there are, no doubt, many readers who will be glad of the particulars given below of a receiver embodying the suggestions contained in the previous article.

Briefly, the article of June 5 stated that the diameter of the tuning coil should be approximately 2½ times the length. Air spacing can be dispensed with, that provided by the double cotton covering on the wire being sufficient. As reception with a crystal set is usually limited to one station, the tuner should be designed for the reception of that one station only, so as to avoid losses caused by too great a length of wire or unwanted capacity. Various tuners were compared, and the variometer type preferred.

The variometer used in the receiver was essentially a single coil, made as nearly as possible to the exact size necessary for the reception of the local station (2 L O) with the particular aerial and earth system with which it was used. The variometer principle was only introduced to give fine tuning.

It is not necessary to use very heavy gauge wire, but No. 20 d.c.c. is recommended on account of its stiffness, making it suitable for a self-supporting coil. The diameter of the complete coil need not be exactly 2½ times the length, and a suitable former is a 3-lb. jam-jar, which has a diameter of about 4¼ in.

A strip of stout but flexible cardboard, an inch or two wide, should be cut and formed into a ring by sticking its two ends together, so that it will slip comfortably on to the jam-jar. Holes should be made near the edges to take the ends of the wire.

Before winding, the wire should be drawn several times through a duster held tightly in the hand, so as to remove all kinks. The cardboard former should be placed on the jam-jar and ten turns of wire wound on, the ends being secured through the holes at the edges. The coil should then be removed from the jar and a portion of the cardboard pushed inwards, so that a piece of adhesive tape may be passed round the coil (see Fig. 1).

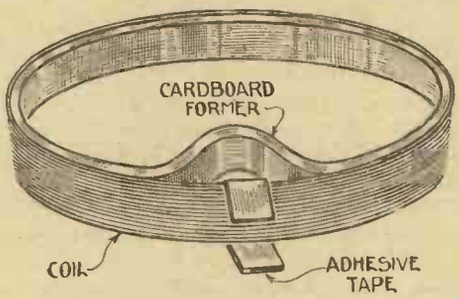


Fig. 1.—Method of Making Rotor Coil.

The piece of tape should be of sufficient length to permit of the two ends overlapping, and the whole of the adhesive surface should be damped, so that it sticks to the cotton covering of the wire. Four pieces of tape should be stuck round the coil at equal distances, and the ends of the coil should be tied with cotton to the adjacent turns. The coil should be removed from the former, and several other coils made in the same way on the same former.

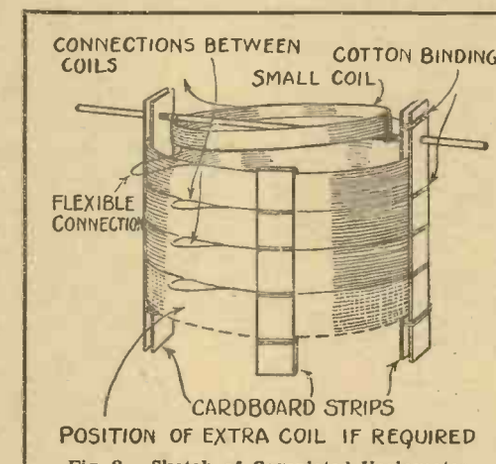


Fig. 2.—Sketch of Completed Variometer.

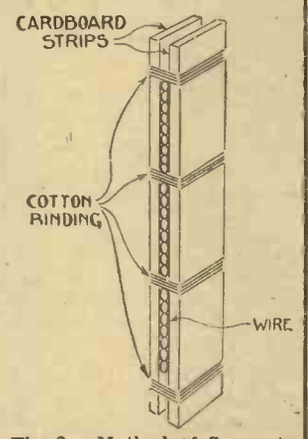


Fig. 3.—Method of Supporting Stator Coils.

The number of coils will depend upon the wavelength of the station which is to be received and the aerial and earth system. In the case of the tuner being described, three coils of ten turns each and a smaller one of five turns (for tuning) were suitable for 2 L O, but for experimental purposes two extra coils were made.

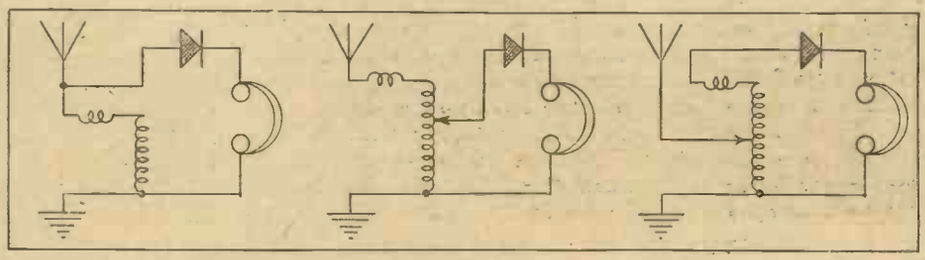
The coil of five turns just mentioned should be made in exactly the same way, but on a smaller former. The completed variometer, shown in Fig. 2, may appear very rough and amateurish, but it should be remembered that solid material should be avoided as much as possible in order to reduce absorption losses, and the means of tuning can be of a very primitive character as, once the best setting has been found, no further adjustment should be necessary.

Eight strips of stiff cardboard should be cut and arranged in pairs, as shown in Fig. 2 and in detail in Fig. 3, so as to support the coils, the strips being bound together tightly with cotton. The ends of the coils should be cut off short and, during preliminary tests, should be connected with pieces of flex. Fig. 3 will also make clear the arrangement of the small coil, which is bound to a thin wooden skewer with cotton, the skewer passing through holes in two of the cardboard supports.

Having connected the tuner to form a simple crystal receiver (Fig. 4), the effect of turning the small coil should be noted. If maximum strength is obtained with the small coil in the position shown in Fig. 2, then an extra coil of ten turns should be connected in the position shown.

If turning the small coil in opposition to the main coil increases signal strength, then one of the large coils should be removed. In a very few cases it may be found that the alteration of tuning with rotation of the small coil is not sufficient, and a coil of five or six turns, connected in series with the main coil, will be found an

(*Concluded in 3rd col. of page 486.*)



Figs. 4, 5 and 6.—Suggested Circuits for the Receiver.

TAKE YOUR H.T. FROM THE MAINS!

A Transformer for the Rectifier described in "A.W." No. 220

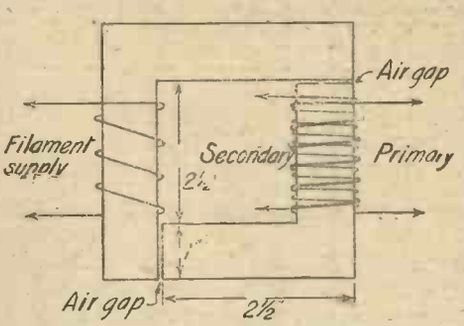


Fig. 1.—Details of Transformer Coil.

THE simple thermionic rectifier for H.T. supply described in the issue of "A.W." for August 28 (No. 220) is quite capable of working directly off the mains, the positive and negative wires being connected to the two input terminals on the H.T. unit. For best results, however, a transformer is necessary, and the rectifier will be more economical than ever if this easily-made component is connected between the mains supply and plate and filament of the rectifier.

The transformer is shown in dotted lines in Fig. 1 (p. 229 of the original article), as is the accumulator supplying the filaments of the rectifying valves. When winding the transformer it is but small trouble to put on a second winding of a few turns to supply the necessary filament current, thus eliminating the need for two batteries, and making the rectifying unit quite self-contained.

The following are details of the construction of the writer's transformer, made up to work in conjunction with the rectifier described and for a mains supply of 240 volts 50 cycles. Slight modification in the specification will be required for supplies of different voltage or frequency, but for all usual systems the change necessary will be small. If the voltage, say, is different, and either more or less than 240, the simple rule should be remembered that within limits the voltage varies with the number of turns. Thus a transformer for 120 volts will require only half the number of turns on the primary, and the number of secondary turns will remain unchanged.

Construction of the Transformer

The iron core has first to be constructed, good-quality Stalloy strip metal being used. Details of the core are given in Fig. 1, in which it will be seen that the dimensions are 4½ in. by 4½ in. by 1 in. This leaves an interior space of 2½ in. by 2½ in. in which to place the windings. The core is 1 in. by 1 in., and is made up of laminated Stalloy strips 0.018 in. in thickness.

Two very small air-gaps are left, as shown in Fig. 1, by inserting thin mica strips between the ends of the laminations.

On one side of the transformer core are wound the mains primary, 2,500 turns of No. 30 d.s.c. copper wire, placed first on the core, and the secondary for connection to the H.T. rectifier, 2,800 turns of No. 36 d.s.c. or enamel-covered wire. Great care must be taken to insulate the primary from the core and the two other windings, and shellac or Ohmaline varnish and electrician's adhesive tape may be used freely if there is any doubt about the quality of the insulation.

The smaller secondary for supplying the filament current is wound on the other side of the core, and consists approximately of 150 turns of No. 20 enamel-covered wire. This winding varies largely according to mains supply and the degree of accuracy of winding the primary coil, and a test

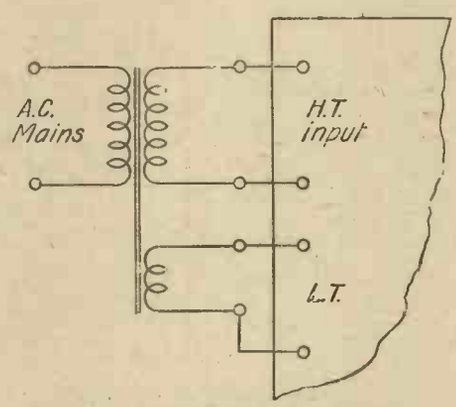


Fig. 2.—Connections of Transformer.

with a voltmeter and lamp should be made before connecting the complete transformer to the valves. About 250 turns should be put on the core first, and the wire can then be taken off until the correct point is reached. It is really impossible to give accurate figures for this coil, as a slight error in the primary (quite easy to make when winding on over 2,000 turns of wire) will upset all calculations.

When the windings are complete the transformer should be well taped up to prevent moisture causing any ill-effects, and a coating of insulating varnish may be applied if desired. The terminal board may be mounted at any convenient spot on the core, but particular care must be taken to see that the shanks do not project on to the core itself, thus causing shorting to the frame.

The windings should be tested for breaks or insulation faults with a dry cell and a pair of phones, and the filament-lighting secondary should be tried out to see that it is not providing an excess of current.

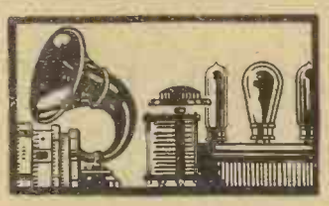
Connections to the rectifier should be made as shown by Fig. 2, which should be studied in conjunction with the circuit diagram of the H.T. rectifier, shown on p. 229 of "A.W." No. 220. K. U.

NEW LIGHT ON THE UPPER AIR

AN article of unusual interest has been contributed to *Nature* by Professor F. A. Lindemann, of Oxford. It establishes with very great probability the remarkable fact that at a height of about forty miles above the ground the temperature is nothing at all resembling the Arctic frost prevailing at twenty miles, but is much the same as it is at the earth's surface.

It may seem incredible that a cold layer of air should permanently exist between two warmer layers, but the same sort of thing may occur in any conservatory exposed to a broiling sun, where the glass surface may be considerably hotter than the air inside. The reasoning by which this fact is established is somewhat complicated, but it concerns the height at which meteorites are observed to burst into brilliancy. Most meteorites consist either of nickel-iron or a glassy substance resembling olivine. No meteor can become visible until it begins to evaporate under the friction of the air encountered at planetary speed. The temperature required is above 2,000 degrees. The observed velocities are about seven and a half miles a second. Now it can be shown by calculation that they cannot attain 2,000 degrees (absolute) unless the initial temperature is 300 degrees absolute or 30 degrees C. (77 degrees F.).

Professor Lindemann's own conclusion is that the layer above forty miles consists mostly of highly ionised ozone. This could be the Heaviside layer, whose existence is indicated by so many phenomena of wireless reception. E. E. F. D'ALBE.



PRACTICAL ODDS & ENDS

Efficient Indoor Aerial

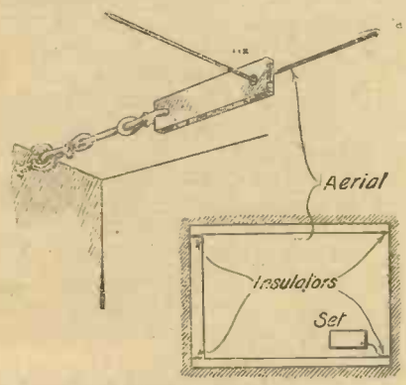
MANY listeners who use indoor aerials imagine that any haphazard method of erection will do, and that careful attention to detail will not make much difference to signal strength.

This is not so, and the writer's indoor aerial, of which a sketch is shown, certainly gives 75 per cent. of the signal strength obtained with a large, high outdoor aerial.

It will be seen that the wire is kept well clear of the walls, and that it is in the shape of a rectangle—with only three sides. One single length of wire is required, that actually used being 24 S.W.G. d.c.c., about 56 ft. in length.

The method of insulation is shown in the large drawing—small strips of ebonite forming the insulators and "guyed" with thin cord.

Selectivity with an aerial like this is



Indoor Aerial Arrangement.

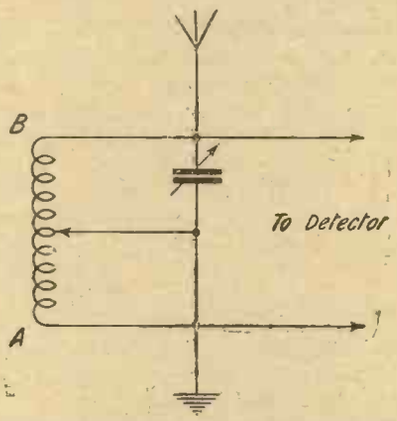
much better than with a large outside aerial, and with an auto-coupled aerial circuit enables many distant stations to be received at decent strength, free from interference from the "local" on a simple detector and one L.F. amplifier set.

H. A.

Avoiding Dead-end Losses

CONSIDERING it does not involve any additional apparatus whatever, the method illustrated in the diagram of avoiding dead-end losses deserves some attention from amateurs using slider or tapped coils.

It will be seen that instead of connecting the slider to the end A of the tuning coil, the latter is connected direct to earth. With the slider connected in the position shown, moving it from A up towards B decreases the number of turns in circuit but at the same time earths the unused turns, until when the point B is reached the aerial itself is earthed. Of course the method is equally applicable to the more modern



Circuit Avoiding Dead-end Losses.

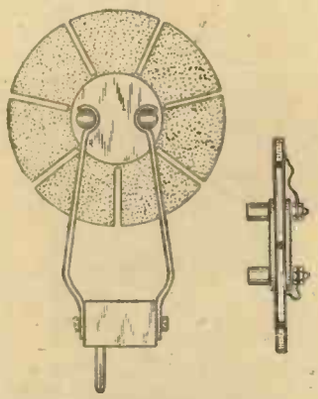
tapped coil, whether used in a crystal or valve set.

A. S. H.

Simple Coil Mount

THE sketch depicts a convenient method of mounting small basket or card inductances on the interchangeable principle, the coils being so arranged to clip into a pair of metal supports attached to a standard coil plug occupying a permanent position in the usual two- or three-coil holder.

Small discs of thin sheet ebonite are



Simple Coil Mount.

clamped to the centre of each coil, one on each side, the attachment being effected by means of two ordinary contact studs (see right-hand figure). The ends of the winding are soldered to the shanks of the studs or clamped between locknuts. The bodies of the studs engage the upper or hooked portions of the metal supports, the lower ends of the same being attached to the sides of the standard coil plug by means of the two contact screws. The supports should be made from strips of fairly stout spring brass about 4 in. long and ¼ in. wide.

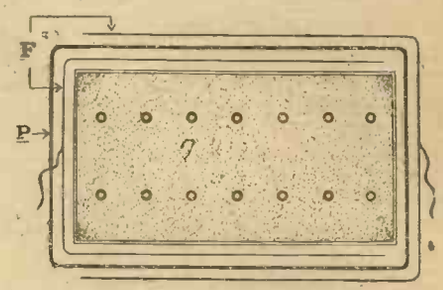
In order to change a coil it is only necessary to press the two clips together in tong fashion, release and remove the unwanted coil and insert another. The spacing of the studs on all coils should, of course, be the same.

O. J. R.

Cheap Reservoir Condenser

THE sketch shows a very simple and efficient substitute for the usual 1 or 2 microfarads shunting condenser for an H.T. battery. It consists of two large sheets of tinfoil F which are wrapped round the outside of the battery casing and separated in the usual manner by means of a waxed paper dielectric P.

There should be a space of about ¼ in. between the edges of the foils and the rim and base of the battery casing, and each



Cheap Reservoir Condenser.

foil should embrace the two sides and one end of the casing. The waxed paper should be cut to cover all four sides of the casing.

The foils and dielectric are attached in the following manner: Secure the first foil direct to the casing by means of thick shellac varnish, bind the waxed paper tightly over this, and then secure the second foil in the position shown, taking care to avoid kinks in the foils and applying the shellac sparingly.

Next comes the problem of making a connecting point to each foil; small slip-on paper fasteners, previously fitted with small terminals, will be found quite satisfactory. The final binding, which consists of several turns of thick brown paper, holds the paper fasteners in position, and with a little care in handling such joints will be found quite efficient.

R. O.

IN SEARCH OF SELECTIVITY

THE problem of interference by unwanted stations is likely to be a difficult one to many amateurs as time passes, and perhaps a few words on this subject at the present date will be of some help to those who are even now experiencing this trouble.

Coast towns have a very difficult time with interference from both spark and C.W. stations. The former is the most difficult form of jamming to obviate, although the latter is often a great nuisance. Of course, as regards the latter, if one transmitter is actually touching the edge of the carrier wave of another transmission you have no remedy, with the exception possibly of a frame-aerial set. The people who are responsible for the transmissions are the only ones who can assist you, and they cannot do this unless they learn that the jamming is taking place. Such a form of interference is characterised by a continuous whistling note exactly the same as you hear when a near-by receiver is oscillating and spoiling your reception.

Care should therefore be taken not to mistake one form of interference for the other. The particular trouble with which we are concerned at the moment is easily identified by the fact that it is modulated, that is, speech and music are faintly heard in the whistle or heterodyne note. Another fact of some interest is that unless you do actually get this whistle, the interfering station is nowhere near the wavelength of the wanted station—a metre or so, or possibly a hundred metres, separate you from the interfering source. The whole trouble in this event is that you are suffering from a shock effect; that is, your aerial is responding of its own accord to a shock in the ether, and unless you are able to control your receiver so that it receives or answers only to the signals from the wanted station, your set will respond to this shock, and you will receive both wanted and unwanted signals in the headphones.

Those people who have the misfortune to be in the immediate neighbourhood of a transmitter will find that this shock will be impossible of control unless special means of overcoming the difficulty are embodied in the receiver. It may be thought by many that if a receiver is tuned to receive 400-metre signals they should not hear 300-metre signals, and that if they do so the 300-metre station is badly or flatly tuned. In order to explain the effect which I have termed "shock effect" we will have recourse to a simple analogy. Take, for instance, the useful "cork-in-a-pond" illustration. Fig. 1 illustrates a pond which represents the ether, in which there are two corks A and B. We will imagine that for the moment cork A is an aerial tuned to 300 metres for reception purposes, and that cork B, a much larger and heavier cork, is tuned to receive 400-metre signals.

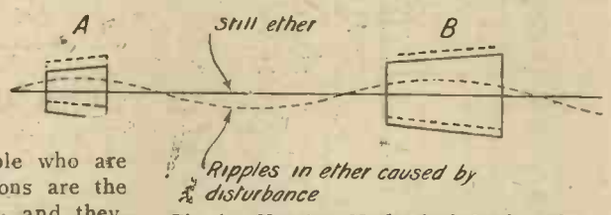


Fig. 1.—Showing Mechanical Analogy for Ether Vibrations.

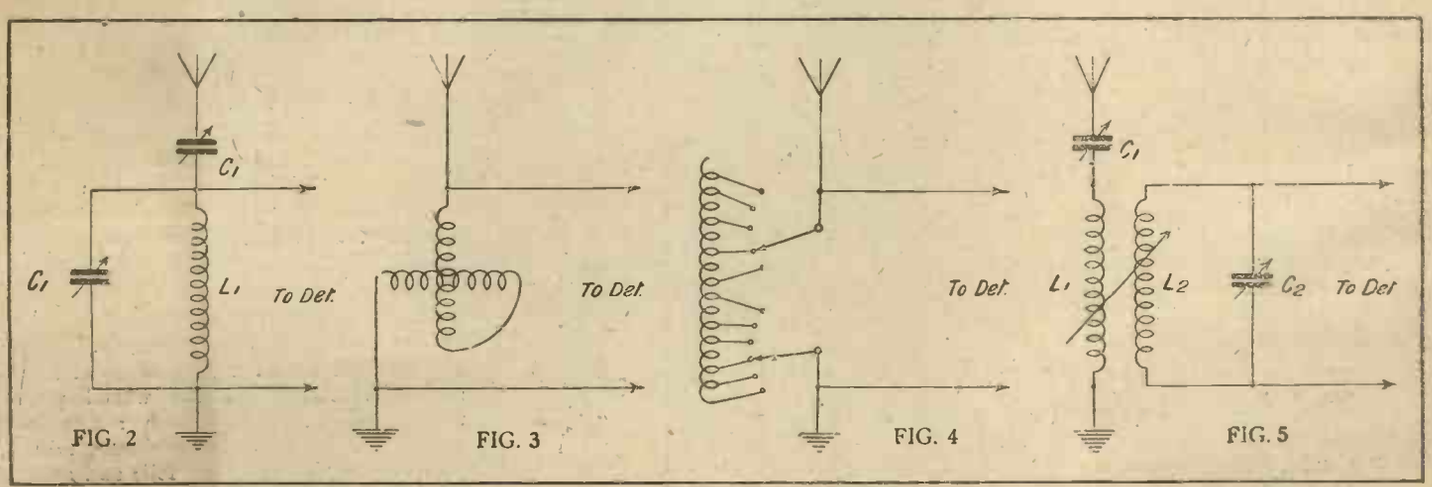
Now if we throw into the pond a very small stone, cork A, the lighter of the two, will rise and fall in accordance with the ripples caused by the stone falling into the pond, and, moreover, will rise and fall to the exact height and depth of each wave or ripple. On the contrary, cork B will rise but a little with the ripples. Cork B might therefore be considered to be in tune with the waves or wavelength transmitted by the heavier stone, but will certainly suffer from shock to a slight extent when the shorter wavelength is transmitted by the smaller stone, *because they are both in the same pond or ether* and are in no way protected from shocks. The analogy ends here, and for the matter of our explanation we are not concerned with the fact that the small cork also moves when the longer wavelength is used. It is well known that a station transmitting on a long wave does not cause such a percentage of interference to a short-wave station as does the shorter wave to the longer.

The aerial will respond to all signals in the ether to a greater or smaller extent whether they be of long or short wavelength, and we have therefore to resort to means of tuning out or tuning in the signals which we prefer, or, to put it in another way, we must render the aerial sensitive to only those signals which we hope to receive, and protect the receiver from shock excitation.

If we employ a non-directional aerial we shall receive considerable interference from every direction, but if we employ a directional aerial, and erect it so that maximum strength of reception is obtained from a direction contrary to the source of interference, we may expect to avoid a large amount of interference from that source.

There are therefore two points which we must consider in our search for selectivity:

(*Continued on page* 506)



Figs. 2, 3 and 4.—Selective Circuits Employing Low-loss Coils.

Fig. 5.—A Very Good Selective Circuit.

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On Your Wavelength!

The New Programme Times

ANY alteration of broadcast programmes is bound to please some people and displease others. Since the alteration of the second talk to 9.30 and the musical feature to 9.45, I have heard adverse comments from listeners who have been accustomed to waiting for the conclusion of the second news bulletin before going to bed. The complaint against this new arrangement is that for the listener who has to be punctual about rising in the morning only an hour and a half is left for the programme proper, the remaining half hour from 9.30 to 10 being taken up by definite features. Last year, they point out, it was possible to have a complete two hours, while the second news bulletin came as a stolen luxury. The B.B.C. stated that listeners did not like their dance music or late features being encroached upon. To provide for a more definite period, all talks and serial items were put before the news bulletin. The result has been to borrow from Peter to pay Paul. The countryman who must go to bed has been robbed for the benefit of his night-loving townsman, and he feels that radio is a much more necessary entertainer twenty miles from Piccadilly Circus than in the Metropolis. On the face of it, dance music is only extended by a quarter of an hour, and the space booked by the musical recitals is not replaced by anything of value. I rather feel that the net result is greater patchwork than ever.

Alternative Wavelengths

The whole question emphasises the necessity of alternative wavelengths. It is extremely difficult to draw the line between instruction and entertainment. One man's meat is another's poison, and thus this reshuffle has robbed the early bird, while for his later brother a very small advantage is gained. I shall be interested to hear the remarks of listeners when the short days bring out the change more pointedly.

A Silent Dance

Had you been with me the other evening you would have had a novel and interesting wireless experience. The occasion was a small dance given by the Junior Car Club, and the curious thing about the whole affair was that the dancers foxtrotted and tangoed and jazzed round the room apparently without any music to help them. There was not a sound to be heard in the room but that made by their feet as they moved over the floor, and occasional remarks by the spectators. When you had got over your first astonishment you would have found that each dancer was wearing a small and light pair of headphones. Now in the ordinary way dancing with the headphones on is not a practice to be recommended; with a receiving set such as yours and mine it cramps the style of the performers, or if it does not it is distinctly bad for the apparatus! These phones, however, were peculiar in having no leads attached to them. A peculiar system of reception was, in fact, in use. Dance music was picked up in the ordinary way from 2 L O, but the output was passed to a special piece of apparatus provided with distributing grids. From these it was radiated into the room, where the bodies of the dancers and the phones that they were wearing acted as the necessary collectors.

Possibilities

The system in use was that known as the Hale-Lyle, which was actually brought out a year or two ago, though I have not heard much about it for some little time. It has now been developed to an extraordinary pitch of perfection, and it seems to me that there are distinct possibilities about such a system of broadcast reception. You can, for example, work a loud-speaker from the receiving set should you feel so minded; but if some of those present want to read quietly, whilst others desire to hear the music, the thing can be done in a trice. You switch off the loud-speaker, and provide those who wish to listen with phones. Wearing these, they can move about just as they like, or can sit in any part of the room. They hear all that they want to, whilst others obtain the silence that they desire.

One reason, I think, why wireless has not been introduced into many clubs is that the loud-speaker would be found a positive nuisance by many members. The system described removes this difficulty entirely; it would, in fact, be possible to install receiving gear in rooms where silence is the rule. So far as I can see the ultimate success of the system will depend almost entirely upon the headphones. If it is found possible to design phones that are really light and comfortable it should become popular. On the other hand, phones of most of the standard types in use to-day are loathsome things to wear for any length of time. That, at any rate, is my experience. I hate the pressure on my ears, and I very quickly develop a headache owing to the bands, which seem after an hour or so to be eating their way into one's very skull.

The Big Fight

American stations had been coming in so well on the ordinary broadcast wavelengths for a week or more before the night of the big fight that I sat up, like thousands of others, full of hope. But for one brief snatch of speech from W B Z I heard nothing but atmospherics of the most violent type and a large selection of spark signals. I suppose that the big sun spots which were then visible to the naked eye had something to do with it. I wished afterwards that I had got out my short-wave set, for those who listened to W G Y on 32 metres reported excellent reception. Atmospherics were not particularly bad down on the very short waves, and almost every word of the ringside announcer's description of the fight could be heard. The only thing that did not come through was the referee's decision, for just as the announcer was giving it out Nature delivered her knock-out in the form of a stupendous atmospheric, which drowned everything.

Wireless Pictures

I expect that most people have been amazed by the excellence of the pictures both of the Miami disaster and of the great fight which appeared in the daily papers. Any photograph must suffer to some extent when it is reproduced in the dailies owing to the coarse screens that must be used, to the rather rough paper, and to the high speed at which the rotary printing presses are worked. Even the clearest picture will thus become slightly smudgy when it appears at one's breakfast table. The actual wirelessed photographs of the fight were amazingly clear, the amount of detail in them being extraordinary. A good deal of this was naturally lost in rapid reproduction, but even so the results were wonderfully good. Enormous progress has been made of late in the sending of wireless photographs. The speed at which this can be done is now so great, that several of those used by the newspapers were actually transmitted in two or three minutes.

Some Noises!

Great preparations are being made for the radio tournament which is to be broadcast from the B.B.C. stations on October 9. One of the greatest problems facing those responsible concerns the noises peculiar to all tournaments. The microphone is a funny piece of goods in this matter of noises. Some, such as those made by water, it reproduces to perfection, but with others it will have nothing whatever to do. A loud, sharp noise like the report of a gun or the slamming of a door is very difficult to deal with. It was recently discovered in the course of experiment that much better results were obtained when "difficult" noises were made not in the

On Your Wavelength! (continued)

studio itself, but in an echo room (or should we call it an *Ecko* room?) adjoining it. It has further been found that the use of such a room enables the volume of the noises to be controlled to a remarkable degree. I venture to prophesy that most listeners will be surprised at the extraordinarily faithful reproduction of sounds that have hitherto been regarded as rather too much for the microphone.

Oscillation

With the coming of winter, oscillation, of course, is on the increase. Many listeners still do not seem to realise that they may be oscillating even when their own set is not whistling and when the music *sounds* perfectly clear. There is only one test. Put on the headphones, wet the tip of a finger, and touch the aerial terminal. There will always be a click when the finger makes contact with the terminal, but there should not be one when the finger is taken away again. If there is the set is oscillating. It is an outworn topic, but it really cannot be stressed too much.

There has been some discussion recently about the area affected by an oscillating receiver. Accurate tests were carried out in the States some two years ago that established this as a fact without any further experiments being necessary. A single-valve receiver is capable of interfering with other sets within a radius of twenty-five miles when oscillating, and in many cases interference was traced as far away as fifty miles. These tests were published in the American press, and were carried out by experts. The receiver which was made to oscillate was located in the centre of a thickly-populated area in one of the biggest cities in the States.

The Wavelength Changes

The results of the wavelength changes in accordance with the Geneva Conference are still much in doubt. It is a pity there cannot be some more definite ruling made than at present exists. It would have been fairly certain that British listeners would have benefited by the changes made at Geneva—they may do so even now—but for the lack of power possessed by the negotiators. It is doubtful if even officials of the B.B.C. can say what effect upon affairs in general the rumoured new high-powered station in Ireland and its two attendant relay stations will have.

It is obvious, of course, to any listener who has been "on the ether" for a year or so that the conditions now are worse than they have ever been. For a station to be heterodyned is the rule rather than the exception. Recently on one night there were only two stations in England which were not being interfered with. The new idea, as most of us know, is to allot to each country one or more "exclusive" wavelengths and several common ones. The exclusive wave should always be free from heterodyne. The freedom of the others from heterodyne is to be secured, it is hoped, by ensuring that stations which share them shall be geographically some distance apart.

Another Problem

The idea is good. But it brings a new problem forward, a problem that has, in fact, already cropped up. Freedom from interference will depend upon the position of the listener. Also listeners in different districts who do experience interference may find that the identity of the station interfering depends upon their locality. A listener in France may find that the station interfering with his enjoyment of the London programme is a Spanish one. A listener in Leeds may find that the interference he experiences upon London is due to a station in Norway. It is well that listeners generally should understand this, for it is perfectly obvious that the most the B.B.C. can attempt under present conditions is to ensure freedom from interference to listeners within a very prescribed area. And if they do manage things so that everyone shall be able to listen to his local station without the programme being ruined by outside heterodyne, then we shall have much to be grateful for. With things as they are it will be a great pity if Northolt—which has lately been working overtime on its harmonics—and one or two other commercial stations are allowed to butt in and ruin the whole affair.

A Regular Culprit

It is doubtful whether some of these high-powered Government stations can ever be restrained within their proper limits. Not all the trouble lately has been due to arc transmitters or even old-fashioned systems. But much can be done. That is proved by the fact that after energetic press campaigns Northolt invariably quietens down. But why does it always break out again until another chorus of protest temporarily silences it? Many of us would give much to know. There is one form of totally unnecessary interference that can, however, be easily dealt with, and that is amateur morse transmissions during broadcast hours. There is a very great deal of this in the south coast area, particularly in the Southampton district, which is already overwhelmed with ship transmissions.

Short-wave Broadcasting

The question of broadcasting from England on the short waves has been discussed several times. In fact, the B.B.C. have come in for some criticism because they have not established a short-wave relay station after the lines of the short-wave station at Pittsburg. The answer of the B.B.C. is a simple one, which has apparently satisfied British listeners. They say that the progress that has been made in short-wave work does not justify the expenditure of money on such a scheme. They point out that K D K A may be received, but it is not a musical enjoyment to anyone owing to the amount of blasting and other imperfections which occur.

A Link of Empire

This is all very well, but there is another side to the question—and a very important side. British listeners may be satisfied with this answer, which is, substantially, correct. But listeners in our colonies are not so satisfied. South Africa in particular has long been pressing for a short-wave station in England, so that British programmes can be heard in the Union. The opinion in South Africa is that though musical perfection may not be possible at the present stage in short-wave experiments, yet reception is possible. And they want to hear British news and topics direct.

Whether we like it or not they have a very strong argument. It certainly does seem curious that the Americans should construct such a station purely for long-distance transmissions, while we, the heart and soul of the greatest Empire the world has ever known, omit to do so. I commend to the B.B.C. the idea of a short-wave station, which, even though reception may be imperfect, will serve as a link with the homeland to the scattered dominions and colonies of the Empire. We badly want such a link, and we should have had it long since.

"N. W. W."

I hear some good news. Nov. 7 to 13 is to be celebrated as a National Wireless Week, and I understand great things are afoot. It is to be a week of real activity. The wireless trade is making special preparations for every wireless store to be in itself an exhibition of things latest and best in wireless. The B.B.C. is taking a keen interest in the project and will put on special programmes for every day of the National Wireless Week. There is some scheme, I believe, for a competition in which listeners will be invited to vote upon the most popular programme broadcast during the week, and already I hear some very fine prizes have been offered. The slogan for the week is "Let your friend listen!" and evidently the idea is for every wireless enthusiast to be a missionary and do his best to extend the blessings of wireless to friends and neighbours who have so far remained without its joy and interest. I expect the Editor will have more to say on the subject in a later issue, but I thought I would get in first!

THERMION.

"A.W." TESTS OF APPARATUS

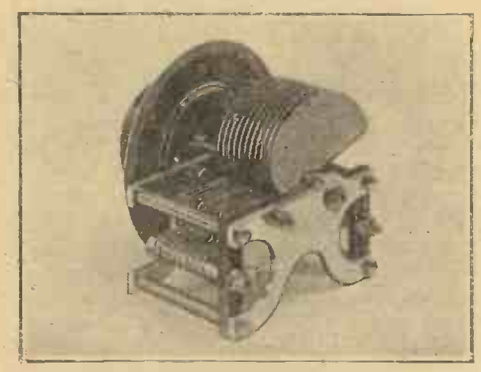
Conducted in the "Amateur Wireless" Research and Test Department

Cyldon Variable Condenser

THE photograph illustrates a Cyldon variable condenser manufactured by Sydney S. Bird and Sons, of Cyldon Works, Sarnesfield Road, Enfield Town, Middlesex. In design and finish this component is one of the best we have examined, and is a credit to British manufacture.

The metal framework, to which the moving plates are electrically connected by means of a flexible copper strip, is of very rigid construction, thereby ensuring that the moving plates will not become out of alignment due to the warping of the frame when the instrument is mounted. An ingenious friction device gives a smooth motion when the moving plates are rotated.

The fixed plates are supported by two pillars mounted on short strips of ebonite



Cyldon Variable Condenser.

bolted to the frame. The plates are shaped to give a straight-line-wavelength effect, or, if desired, a straight-line-frequency shape may be obtained. For fixing purposes three screws pass through holes drilled in the panel, screwing into tapped tubular distance-pieces. This method, although not so simple as the one-hole fixing, has many advantages, chief among which is the inability of the condenser to turn when the knob is rotated. A large, handsome polished dial 4 in. in diameter is supplied with each condenser.

Varley H.F. Choke

A VERY efficient H.F. choke is made by The Varley Magnet Co., of Bloomfield Road, Woolwich, London, S.E.18. The choke is wound in six sections in the Varley bi-duplex system, which ensures a maximum air spacing between the turns and layers of wire forming the choke. The ebonite former on which the choke is wound is 3½ in. long and 1 in. in diameter, and the two ends of the winding are brought out to metal soldering tags. Each of the six sections is spaced about ¼ in. from the sections on each side, and this form of multi-cellular construction gives an extremely low self-capacity.

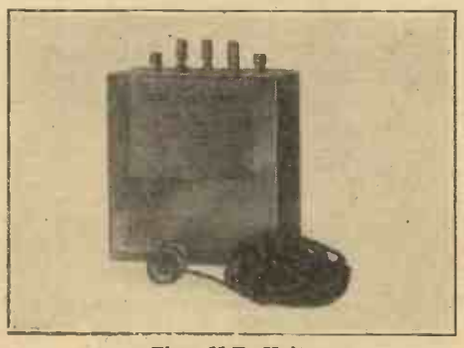
Varley H.F. Choke.

This type of choke is intended for use in such circuits as the Reinartz, where the H.F. oscillations are to be confined to a particular portion of the circuit and where any self-capacity would by-pass these H.F. oscillations.

Not only is the choke extremely well made, but it is very efficient, and on test has shown itself to be what a good H.F. choke should be. It has our thorough recommendation.

The Ekco H.T. Unit

E. K. COLE, of 513, London Road, Westcliff-on-Sea, have supplied us with one of their H.T. units suitable for D.C. mains. The unit is built into a small polished oak cabinet and is extremely compact, measuring 6½ in. by 6 in. by 3½ in. In the particular unit illustrated two positive H.T. tappings are provided at 120 and 60 volts, although other units are obtainable



Ekco H.T. Unit.

having more tappings and variable output voltages.

An internal inspection of the unit revealed the smoothing circuit, which consists of two iron-cored chokes and large smoothing condensers. Wire-wound resistances are employed to provide the voltage taps, whilst a condenser of .1 microfarad is connected across the two outside terminals. The earth terminal of the receiver is connected to one of the outside terminals on the unit, and the earth lead is joined to the other outside terminal. In this manner the fixed condenser is connected in series with the earth lead, and so prevents a possible short-circuit of the mains.

We have tested this unit on the 210-volt D.C. mains laid on in our testing laboratory, and we have found it to be capable of supplying a 4-valve set (using 2-volt valves) with a steady voltage. No trace of hum could be heard in the loudspeaker, and, using phones, the ripple of the D.C. mains could only just be heard.

The Artic Valve Holder

THE Artic valve holder, manufactured by the Artic Fuse and Electrical Manufacturing Co., Ltd., of Birtley, Co. Durham, possesses several unique features that are worth noting. As with most anti-microphonic valve holders, the Artic is made in two parts, the outer casing and the floating disc on which the valve sockets are mounted. The chief feature, however, is the method used of suspending the disc, in which phosphor-bronze gauze strips are used, with the warp and weft strands cut on the bias in such a manner that no single strand is connected directly between the outer casing and the suspended valve-holder sockets.

The Artic Valve Holder.

This principle has been used for some time by many of the large consumers of electric lamps, including the British Admiralty.

The gauze strips are wholly inert to the passage of vibration, and, unlike metal springs, they have no inherent periodicity. By the use of several gauze strips a mechanical strength is obtained which will withstand the strain imposed when a valve is inserted or withdrawn.

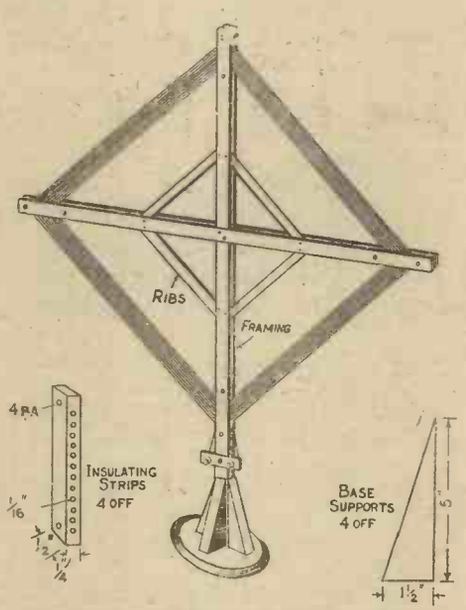
A FRAME AERIAL FOR THE SUPER-HET

ONE of the first requirements of the user of the super-heterodyne is an efficient frame aerial. The one described below will be found particularly simple and cheap in construction, and will give good results on the ordinary broadcasting wavelengths. It can also be used, with a suitable loading-coil, for reception of the longer waves, but it is preferable to employ a specially wound frame of larger dimensions for this purpose if the utmost efficiency is to be obtained.

Materials Required

The materials required are as follows: About 14 ft. of ⅞-in. by ¼-in. and 3 ft. 6 in. of ⅝-in. by ¼-in. pine. These are often sold ready-cut by many hardware dealers for use in stiffening and weighting the bottom edges of paper window blinds, and will be found very suitable for the framework of the aerial. Four triangular pieces of ⅝-in. wood with 5-in. by 1½-in. sides, and a circular wooden base 6 in. or more in diameter are necessary. This latter may be purchased for a few coppers from any gas-fitter or ironmonger, from whom they are usually obtainable as gas-bracket bases. Two 4 B.A. terminals, about 100 ft. of No. 22 d.c.c. wire, eight 4 B.A. 1-in. screws with nuts, and one or two pieces of ¼-in. ebonite are also required.

Two 3-ft. 6-in. and two 3-ft. lengths of the pine should be cut and half-notched together so as to form two crosses, each with one member 6 in. longer than the others. Two small screws at the centres of each cross will ensure a firm joint. The ⅝-in. pine should now be cut into four 10-in. lengths. After this has been done, the ends of these should be mitred, and having placed one of the crosses flat on



Constructional Details of Frame Aerial.

the bench, they should be fixed in place with short sprigs, as shown in the diagram. The second cross can now be placed upon the other so that the longest members of each coincide; they are then nailed through into the 10-in. strips.

This longer portion of the frame should have a 5½-in. length of the ⅞-in. pine screwed between its two ends. This forms a solid foot to which the triangular pieces may be screwed. After this has been done, the circular base can be attached to these supports with long screws.

Constructional Deta ls

The ebonite insulating strips are 5¼ in. long and ½ in. wide. Three of them have twelve holes and the other thirteen holes through their narrow edges. These are spaced $\frac{5}{16}$ in., and two 4 B.A. clearance holes can be drilled at the ends of each strip for fixing. Care must be taken when fastening these strips in position to secure the bottom one, which is that having thirteen holes, in its correct place along the upright, otherwise the frame will have an awkward appearance when wound.

The terminal strip, which is 2¼ in. by ⅝ in., should be mounted with the two terminals, and, if required, can be recessed into the framing, but this is not essential. A coat of varnish prior to winding the frame will improve its appearance, and when dry one end of the wire should be threaded through the bottom hole in the upright and pulled through until the next arm is reached. It will be found necessary from time to time to unwind a certain length of slack wire from the bobbin, and to pull it through in order that subsequent turns can be easily drawn on. This procedure should be continued until all the turns have been drawn tightly into place, and the frame can be finished off by securing the ends of the wire under the back nuts of the terminals. A. S.

VOLUME CONTROL

WHEN a receiver is constructed for loud-speaker work it is most essential that it should give ample power without "pushing" it, otherwise the reproduction will suffer.

A method of volume control which is rapidly growing in popularity is the use of a damping resistance connected across the secondary of one of the L.F. transformers. This resistance is usually variable and is of such a value that, when in the position of maximum resistance, there is no loss of volume. A suitable maximum value is 1 megohm, and if this is variable down to zero (no resistance) or a very low value, the volume can be varied from maximum to a mere whisper.

The use of such volume control is very convenient and pleasing; often a full orchestral item is too loud for comfort and a reduction in volume is desirable, whilst some speakers or solo performers require the full volume obtainable from the receiver.

The use of a volume control usually results in an improvement in tone also, and when two L.F. stages are used it will often cut out that annoying whistle which is often experienced.

When two transformer stages are employed it is usual to connect the resistance across the second secondary, but it proves quite satisfactory if connected across the first transformer, and it can, of course, be used when only one transformer stage is employed, either by itself or in conjunction with L.F. stages coupled by other methods.

A volume control can also be used connected across the terminals of the loud-speaker, but here it is not so effective, and the best position by far is across the transformer secondary. R. H. B.

Travellers on the Austrian Railway Company's express trains to and from Vienna can avail themselves of broadcast programmes from the principal European stations. Listeners are charged a fee of one Austrian shilling per hour.

IDENTIFYING LEADS

IT frequently occurs that when twisted flex wire is used as extension leads for phones or loud-speaker difficulty arises as to which of the two wires (should they both be of the same colour) should be connected to H.T. positive of both the set and phones or L.S. in order to preserve the magnets of the latter, as it is well known that if the connections are wrong there is a tendency for the magnets to become weakened.

The writer has used the following method for some time: Connect at one end of the flex your accumulator, one wire to positive and the other to negative terminals of the battery. Place the other end of the wire in some slightly acidulated water, when the usual hydrogen bubbles will be given off at the wire which is connected to the negative of the accumulator. It is then known that that wire is continuous and can be marked accordingly. The above method only takes a few moments at no cost and saves time in tracing the two wires. J. A. T.

2 T V—THE WORLD'S FIRST TELEVISION BROADCASTING STATION

IN the race to discover television several nations have been engaged. America is represented principally by C. F. Jenkins, France by M. Belin, Austria by Von Mihaly, whilst others are known to be working upon the problem in Germany, Denmark and Russia. None of these experimenters has realised the dream of seeing at a distance, for although still pictures and moving shadows have been sent by wire or wireless with varying degrees of success, these ingenious schemes have not gone far towards solving the problem of instantaneous vision of actual objects by telegraphy or radio.

The majority of systems, as readers of AMATEUR WIRELESS are aware, depend upon the peculiar properties of selenium cells. The electrical resistance of a suitably constructed cell changes with the intensity of light falling upon it, and by this means a local source of current can be made to vary in accordance with the points of light and shade on a picture and affect distant apparatus which interprets these current changes in terms of light.

Foremost among experimenters along these lines in Great Britain was Mr. J. L. Baird, who, although little heard of a few years ago, is now world-famous. For several years he experimented with selenium in the hope of solving the problem of television, and as far back as 1923 had the satisfaction of transmitting shadows of moving objects by wireless.

The story has already been told how, early this year, he demonstrated the transmission of actual moving images with light, shade and detail—the first, and so far the only, demonstration of true television ever given. But a great deal of confusion still exists as to the nature of the problem which had to be solved. It hinged almost entirely on the light-sensitive cell.

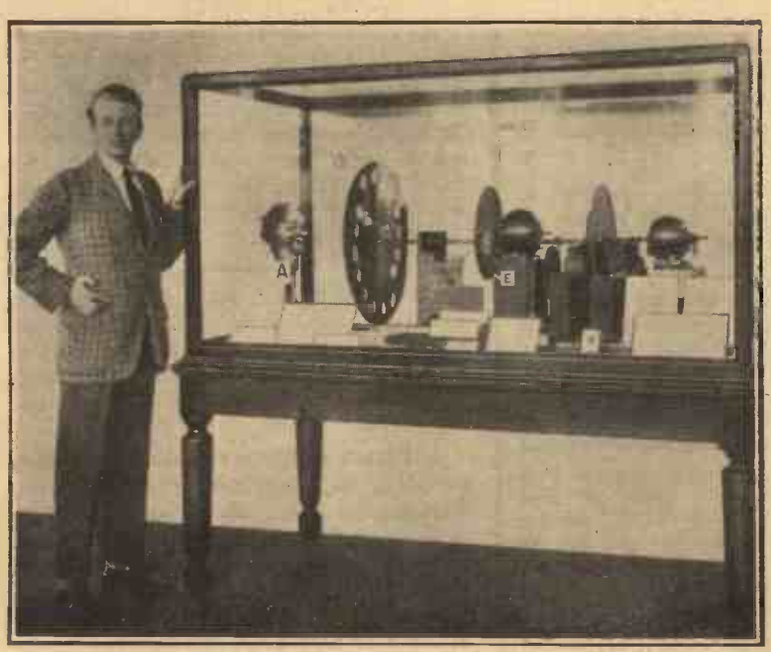
The Light-sensitive Cell

Nearly all experimenters with selenium found that whilst the measure of response to variations of light was good, there was a noticeable limit to the rapidity with which these reactions can take place, and it was generally realised that to attack the problem of television by the obvious course of rapidly surveying successive points of a picture by a light-sensitive device was not very hopeful as long as selenium was used as the responsive element. The principal feature of Mr. Baird's new system is that he does not use selenium cells at all, nor does he use the ordinary photo-electric cell, which is not sufficiently sensitive. In its place he has invented an electronic device, sensitive to variations in the intensity of light falling upon it, but which does not suffer from the time lag associated with selenium cells, and is far superior to the ordinary photo-electric cell in sensitivity.

The first television licences in the world were granted recently to Mr. Baird's two stations, one in Upper St. Martin's Lane, London, the other situated at Harrow. At present the London station is a transmitter, the Harrow station a receiver, and, except for an interval of a fortnight owing to a breakdown, "looking-in" has been in progress almost every night for some weeks between these stations on a wavelength of about 200 metres.

Not much need be said about the wireless plant at the London station, 2 T V. It is of the conventional choke-controlled type, an aerial and counterpoise being on the roof of the building. Arrangements are made at present only for transmission of the pictures of comparatively small moving objects, such as the head of a man, which is illuminated by banks of powerful lights. In his experiments Mr. Baird frequently uses ventriloquists' heads, which can be made to open their mouths and so on. The system is not limited, however, to the transmission of small pictures of this sort, but could be applied to watching large moving scenes at a distance, such as the Derby, the launching of a ship, or a football match.

The image before the transmitter is explored, point by point, by the electric eye referred to above, which is the nucleus of the system. Because of the light-sensitive properties of this device the wireless wave emitted by the aerial is modulated in accordance with the intensity of each spot of light, and at the receiving end controls the intensity of a small locally-sup-



The photograph on the left shows Mr. J. L. Baird with his early apparatus, which has been presented to the South Kensington Science Museum, whilst that on the right shows the 2 T V television transmitter.

plied spot of light which traverses the receiving screen. The movement of the spot of light at the receiver takes place in precisely the same manner and at the same rate as the exploration of the image by the electric eye at the transmitter, but it occurs at such a rate that a person "looking-in" at the receiver sees the whole image at once. The complete picture is "gone over" by the electric eye about eight times per second.

I found the house in Middle Road, Harrow, to be quite empty save for the wireless receiving apparatus in the conservatory, which was wired up to another room containing the "televisor," as Mr. Baird calls it. To outside view this apparatus consists of an ordinary-looking box 2 ft. square on the side and 1 ft. deep, and has a ground-glass screen about 6 in. square on one side.

On the occasion of my visit to Harrow, Capt. O. G. Hutchinson, business director of Television, Ltd., was transmitting from 2 T V. Perhaps the word transmitting is hardly correct, for he was merely standing before the apparatus in London smoking a cigarette, laughing and raising his hat, which we could perceive fairly clearly in the screen of the receiver.

Aural Tuning

The preliminary process of tuning-in is effected aurally, as in ordinary receiving. The modulation of the carrier-wave, which is changed into pictures at the receiving end, gives a note in the telephones which alters considerably as the scene before the transmitter varies. Mr. Baird can usually tell, merely by listening, whether Capt. Hutchinson or the ventriloquist dummy "Jim" is before the transmitter. These television images can be heard by any amateur listening-in on 200 metres after midnight or in the morning, and will be recognised as a peculiar rhythmical humming noise of changing pitch.

When these sound pictures were adjudged to be correct, Mr. Baird began adjusting the controlling knobs of the televisor, and a nebulous oval on the receiving screen gradually became recognisable as the face of Capt. Hutchinson. The sepia-tinted picture rather strained one's eyes to look at, and was subject to a distressing flicker. Nevertheless the face was recognisable and the main actions indisputably discernible.

Interference

We did not meet with much "interference" except for curious masses of black and white which passed across the screen irregularly. Mr. Baird informed me that he has traced small vertical white lines, which appear at times on the picture, to ordinary morse interference, whilst electric light mains cause horizontal lines which move up and down.

The inventor told me that no difficulty is likely to be experienced in transmitting pictures by the same carrier-wave as is used for ordinary broadcasting. The present imperfections in the received image will doubtless be remedied as soon as the various component parts of the televisor are improved.

K. P. H.

"THE BEST POSSIBLE CRYSTAL RECEPTION" (*continued from page 471*)

advantage. When the correct size of coil has been found, permanent (preferably soldered) connections should be made between the separate sections.

Alternative Circuits

Alternative circuits which can be tried with this type of tuner are shown in Figs. 5 and 6. For the circuit shown in Fig. 6 additional coils of ten turns each will be required, so as to increase the size of the main coil. If the connections between the sections of the main coil are made with bare wire, tappings can be made with spring clips.

Such a crystal set can be made quite pleasing in appearance in spite of the crude construction of the tuner. As variations of tuner are not necessary once the best setting has been found, the whole tuner can be enclosed in a cabinet, when the only parts on the panel will be the crystal detector and terminals. Whilst such a tuner can be very efficient, the importance of a good aerial and earth system and a sensitive crystal must not be forgotten. Dampness also greatly reduces efficiency, and the tuner should be kept thoroughly dry. Many readers will have experienced the improvement in reception which results from baking a coil in the

R. H. B.

AUSTRALIAN BROADCAST LICENCES

THE Australian Postmaster-General has refused a request by one of the Members of the House of Representatives to reduce the licence fee for crystal sets to £1 per annum, and has also declined to accept the fee in two instalments without the payment of the additional 2s. 6d. now demanded for that privilege.

No appreciable alteration to the regulations is contemplated, but such changes as appeared desirable will probably become effective towards the end of October. It is not proposed to make the renewals for licences for crystal sets every six months instead of one year, as at present, owing to the fact that this would involve additional charges.

The number of German licence holders has now reached a total of 1,258,199, according to the latest published figures to September 1. During the month of August an increase of 21,136 new listeners was registered.

A French amateur experimental station (F 8 D I) now regularly transmits, every Saturday evening, calibration signals on both 33 and 43 metres for the benefit of foreign "fans." Call sign is first given in morse for a period of five minutes, following which a long dash lasting sixty seconds is sent out. Times are: 17.00-17.10 G.M.T. on 33 metres; 17.15-17.25 on 43 metres.

WHA — WIRELESS HAPPENINGS ABROAD

RADIO Catalana, EAJ 13, Barcelona, were as good as their word, and have sent me a fascinating little "Certificate of Reception" for having "received our programme of the 3rd International Concert devoted to British Listeners," with the warmest thanks for my appreciative remarks, and a photograph of the "Equipo transmisor de la Radio Catalana," and although, of course, the value of souvenirs and mementoes is entirely sentimental, nevertheless I much appreciate this word of friendship direct from the land of the olive and guitar, for some of the Spanish stations really are so good, the voices of the singers so sweet and clear, that one cannot help falling in love with them. I hear that the Radio Catalana station is being enlarged and improved. *Los Catalanes son los pueblos mas industriosos de España.*

Certificates for Reception

By the way, I wonder if it would interest listeners if all European stations offered to send certificates of reception of special programmes? It would be a sort of romantic collection of "What station was that?"—when you got them all! Then the B.B.C. might offer a handsome prize, an 8-valve super-het, or some nice little thing like that, for the British listener who bags the greatest number of certificates during the year.

Many interesting topics are written upon in *Der Deutsche Rundfunk,* a remarkably good Berlin illustrated radio magazine, which no doubt programme directors in many countries carefully study. For example, is it possible for a modern violinist, even the best we have to-day, to play properly—that is to say as they were meant to be played—the solos written for the violin by such masters of the instrument as Paganini? Writing on the Paganini concert recently given at the Berlin station, a critic remarks: "Paganini, Sarasate und Kreisler, deren Werke uns Max Rostal bringt, sind hervorragendste Meister ihres Instrumentes, die zur Feder griffen, um sich Stücke zu schaffen, in denen sie ihr ganzes Können zeigen wollen." Or, in other words, these big men simply seized the pen to scratch down fireworks for the fiddle which nobody but themselves could play!

I feel very strongly with the German critic, that these gymnastic solos are never properly played and never give satisfaction to hearers, simply because they are practically impossible to be played by anybody but the man who wrote them. I delight in well-played fireworks on the violin more than anybody, but they must be almost perfectly executed before they can really please. And I think the microphone is more critical than the concert hall. Even composers are not always able to play their own compositions properly!

It is a thousand pities that Radiolo, the really excellent announcer at the Radio-Paris station, should feel compelled to resign his position, after having filled it so well for so many years, and his voice having become quite an old friend to thousands of listeners all over Europe. What are the reasons for his resignation? The Paris radio paper *Loud Speaker* has interviewed him on the subject, from which interview it is evident that Radiolo has not been well treated by the management; they refuse to give him any sort of rise to the position of director or artist-director, and they snow him over with advertisements to announce, or in other words treat him simply as a talking machine, and he can't stand it any longer!

What's In a Name?

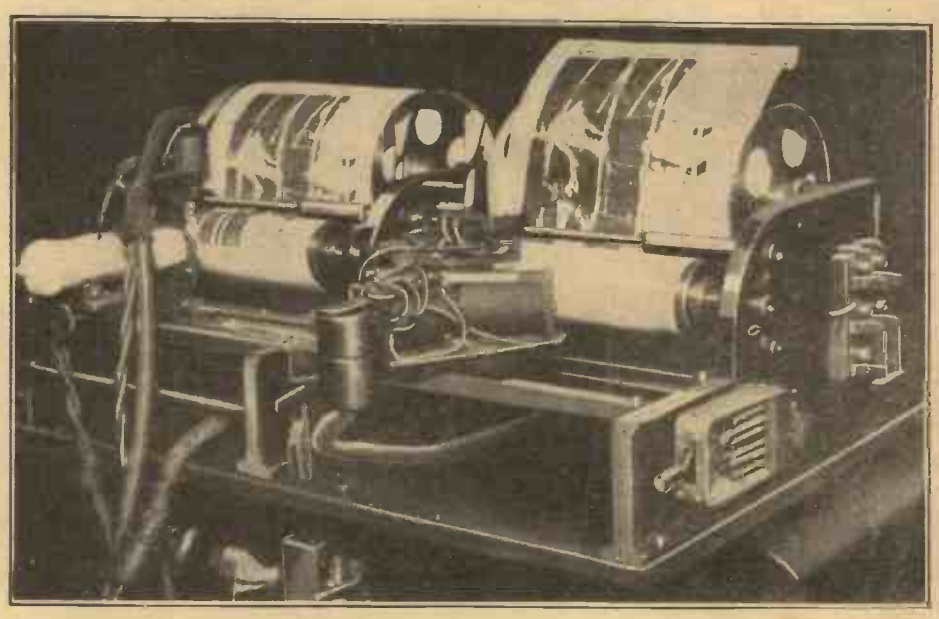
For example, there appears to have been quite a heated discussion as to whether he ought to be called an *Annonceur,* a *Presentateur,* a *Lecteur,* or by the English word, Speaker, which last term, although it has quite a classic sound to English ears, seems to have a lower signification in France, i.e., "Only a Talker!" What we want is a new international code of terms exclusive to wireless. Personally, I feel whole-heartedly with Radiolo in his fight, and hope that the authorities at Radio-Paris will have the good sense and justice not to accept his resignation.

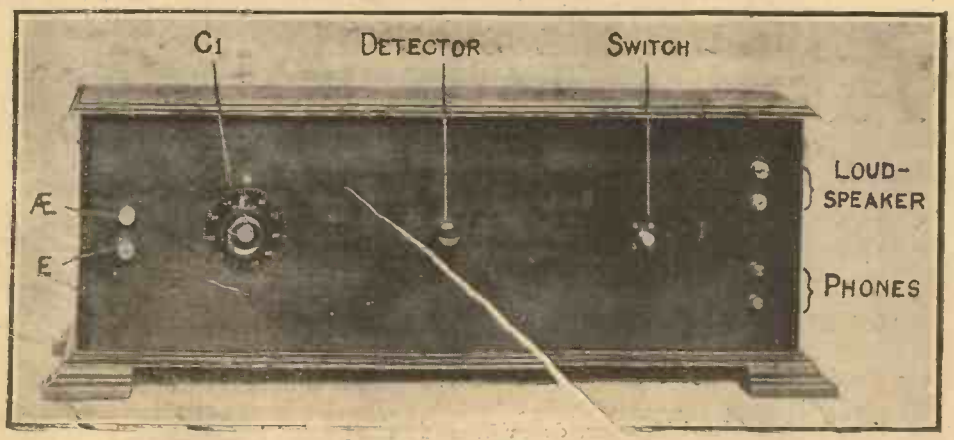
Obviously the main trouble is the advertisement craze, a thing that ought to be fearlessly stamped out of all radio transmissions all over Europe. An announcer who really is by nature an artiste and gentleman cannot be expected to stand before the microphone shouting about soap, face cream, hair restorers, gingerbread and toothpicks! At some of the German stations the distracted announcers are trying to make poems or rhymes of these "ads," but it doesn't do; it only seems to make the listener's punishment worse!—

LYONS.

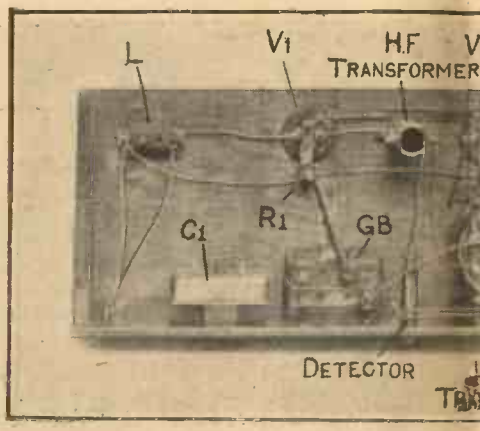
THE FIGHT PICTURES BY WIRELESS

THE short-wave transmissions from KDKA and WGY, the stations which relayed the recent Dempsey - Tunney fight in America from the actual ringside, were picked up by amateurs with varying degrees of success. There was, however, a commercial aspect of wireless which also figured prominently in the fight, and that was the wireless transmission of photographs taken in Philadelphia while the fight was in progress. By this means the English newspapers on the day after the fight were able to illustrate their accounts of the fight with actual photographs of the event. Our photograph shows the first of the fight pictures coming through from America, at Radio House, the headquarters of the Marconi Wireless Telegraphic Co., Ltd. Even in this picture the forms of the combatants can be discerned.





Photograph of Completed Receiver.



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THE "ONE-KN

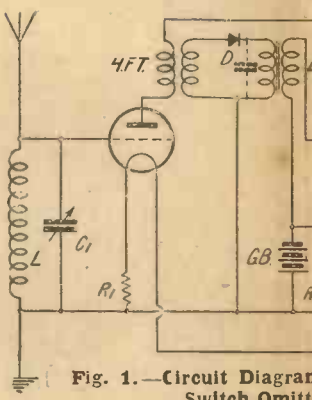


Fig. 1.—Circuit Diagram Switch Omitt

A "No-trouble" single-cont local station or Daventry, u arrangement which enables te be used

THE "One-Knob Three" brings in either the local station or Daventry with a degree of purity which will be a revelation to many. It is perhaps the simplest three-valve set to control that has yet been devised; tuning is done by means of a single variable condenser, which, once the best setting for either the local station or 5 X X has been found, can be left alone.

Eliminating Controls

There are no rheostats; there is no potentiometer; there is no reaction control; there is in fact nothing else that is adjustable but a "permanent" crystal detector (which, once it has been set, requires no further attention for months), and a switch which has three positions. This switch is seen in the photographs towards the right-hand end of the panel. If this handle is horizontal, both high- and low-tension batteries are cut out; turn the handle downwards, and the telephones are connected to one high-frequency valve and the crystal detector; turn it upwards, and the loud-speaker is brought into play, the circuit in use consisting of one high-frequency valve, a crystal detector, and two note magnifiers. Both telephones and loud-speaker are left permanently connected to their respective sets of terminals. The set is absolutely foolproof, since it is impossible to cause interference by howling, and the most complete beginner cannot go wrong in operating it.

The theoretical circuit is seen in Fig. 1, in which the switch is omitted for the sake of clearness. The tuning arrangements consist of the variable condenser C1, and the plug-in coil L. The plate of the first valve is connected to H.T. + through the primary of an aperiodic high-frequency transformer. Between the secondary of this and the primary of a low-frequency transformer a crystal detector is interposed. The second valve is coupled to the third by the choke-capacity method, which makes for remarkable purity of reproduction and a complete absence of interaction effects.

The H.F. Transformer

The high-frequency transformer seen in the photographs is a home-made one in which both the primary and the secondary contain 400 turns of No. 42 double-cotton-covered Eureka resistance wire wound upon an ebonite tube 1 in. in diameter. The primary is put on first and is covered with a layer of Empire tape before the secondary is wound over it. To protect the secondary winding it is as well to wind insulating tape over it. The optimum wavelength of this transformer is about 400 metres, and it gives excellent results upon any transmission within the limits of the normal 300-500-metre broadcast band. Those readers who do not wish to go to the trouble of making up their own aperiodic transformers can use instead Magnum plug-in aperiodic transformers obtainable from Messrs. Burne-Jones. These are exceedingly convenient, since they enable one to go from the local station to Daventry by simply changing over the coil L and the H.F. transformer.

The switch is of the dual type containing twelve points. I bought mine at a disposals shop in the Strand for a shilling, and switches of this type are readily obtainable from firms which deal in W.D. surplus goods at prices ranging from a shilling to half a crown. At first blush the very idea of a twelve-point switch may seem rather terrifying. Actually, however, the way in which it works is quite simple. To make the circuit diagram plainer I have omitted the switch in Fig. 1 and have shown in Figs. 2 and 3 how it deals first with the filaments and then with the telephone and loud-speaker connections.

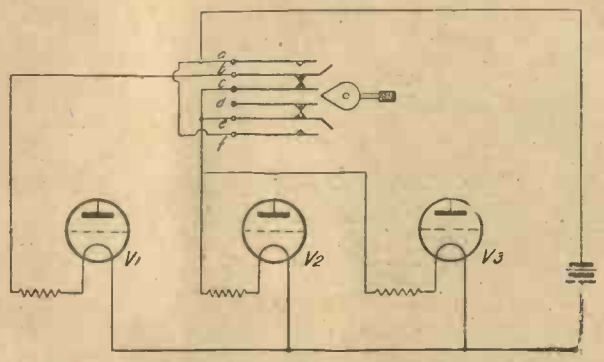
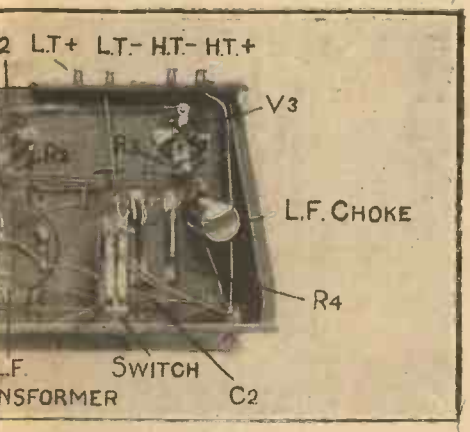


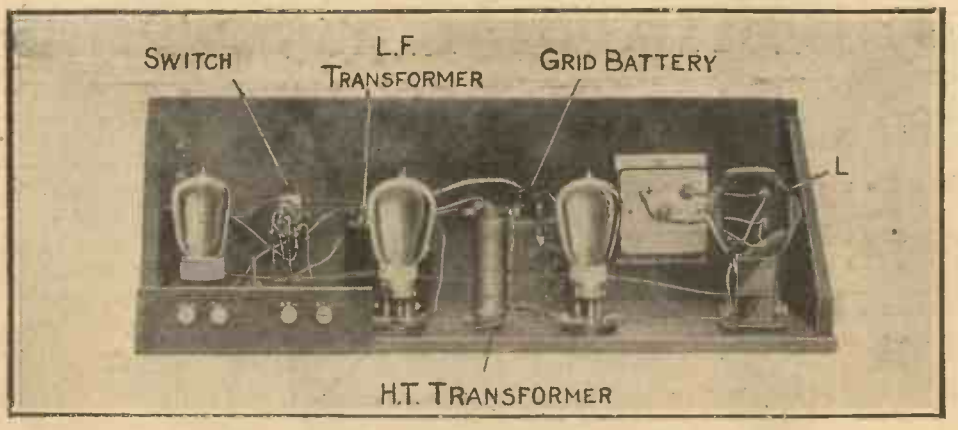
Fig. 2.—Circuit Diagram of Filament Section of Switch.

Switching Arrangements

These switches are made in two halves, insulated from one another, each of which contains six points. Fig. 2 shows the half of the switch which operates the filaments. If the handle is in the horizontal position, as shown in the drawing, leaves A and F, which are connected to the negative terminal of the filament battery, make no contact with the others. All the filaments

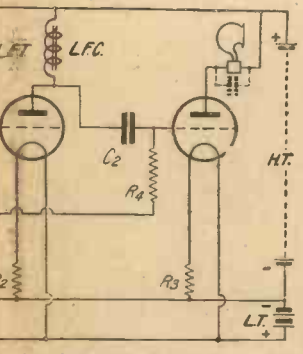


cates the General Layout.



Back View of Receiver showing Disposition of Components.

NOB THREE"



n of "One-Knob Three" with ed for Clearness.

rol Receiving set for the ith an ingenious switching elephones or loud-speaker to at will.

are therefore switched off. Now supposing that we press the handle downwards, the cam catches on the curved portion of leaf B and raises it. This breaks the contact between leaves B and C but makes contact between A and B. Since B is connected to the filament of the first valve, this valve lights up, though the other two do not. When the handle of the switch is raised, the curved part of leaf E is depressed, breaking the contact between D and E and making contact between E and F. The contact between B and C remains, and since C is connected to E, both C and E now make contact with F. This means that the filaments of all the valves are connected to L.T. – and that all light up.

Fig. 3 shows the telephone-loud-speaker side of the switch. In the horizontal position of the switch handle the high-tension battery is "out." Pressing down the switch breaks the contact between leaf 2 and leaf 3, making contact between 1 and 2. The output of the crystal detector thus passes through the telephones to earth, the circuit through the secondary of the high-frequency transformer being completed, since the latter is also connected to earth. One thus obtains by placing the switch in this position a combination of H.F. valve, crystal detector and telephones. If we raise the switch, leaf 5 is pressed down, breaking the contact between it and 4 and making contact with 6. Leaf No. 2 remains in contact with No. 3, the result being that the output of the detector passes via leaves 2 and 3 to the 1P terminal of the low-frequency transformer and thence back to the secondary of the H.F. transformer. The loud-speaker is now connected through the contact between leaves 5 and 6 to the plate of the third valve. The combination is thus H.F. valve, crystal detector, two note-magnifiers and loud-speaker.

Long-distance Loud-speaker Results

The set is particularly suited for those who are just beyond comfortable range of the local station or Daventry. The aperiodic H.F. stage brings up signals to excellent strength on the telephones and gives full loud-speaker reproduction when the three valves are in use. Actually at thirty miles from 2LO every word of speech is audible from the loud-speaker at 75 feet, and there is not the slightest trace of distortion or any kind of harshness.

Components Required

The components required are as follows:

1 Mahogany or ebonite panel 21 in. by 7 in. by ¼ in.
1 Baseboard to match, 7 in. wide.
1 Standard 21-in. by 7-in. cabinet (Camco or Picketts).
1 .001-microfarad variable condenser (Polar).
1 Permanent crystal detector (R.I.).
1 Twelve-point dual switch (Disposals).
10 Terminals.
1 Coil-holder (Burne-Jones).
3 Panel-mounting valve holders (Burne-Jones).
1 Aperiodic H.F. transformer for the broadcast band and Daventry (either home-made or Burne-Jones).
1 Low-frequency transformer 6—1 ratio (Marconi Ideal).
1 Low-frequency choke (Lissen).
1 .01 microfarad clip-in fixed condenser with clips and base (Grafton Electric Co.).
1 .5 megohm gridleak with clips and base (Grafton Electric Co.).
1 9-volt tapped grid battery (Ever-ready).
1 Small angle bracket; this is used for fixing the grid battery, which is wedged between it and the back of the panel.

Supply of Glazite wire for making connections.

[In place of the low-frequency choke, the .01-microfarad condenser and the .5-megohm gridleak, an A.J.S. second-stage choke unit may be used. This saves trouble in wiring up and will be found to give excellent results.] J. H. R.

Next week will be given actual constructional details of the set, together with a panel drilling diagram and developed wiring diagram.

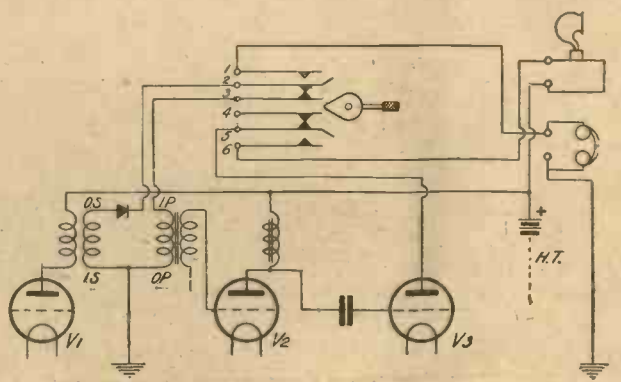


Fig. 3.—Circuit Diagram of Telephone side of Switch.

WHY GRID BIAS MATTERS

QUITE a number of amateurs are still disposed to regard the grid-biasing battery as an addition that is really unnecessary to a receiving set which contains one or more stages of low-frequency amplification. Only the other day a friend who prides himself on the simplicity of his sets showed me a two-valver—detector and one L.F.—that he had made, and mentioned, in showing off its points, that it had no grid battery and worked just as well without it as it would have done if he had fitted one. I admit that there was not much to criticise in the quality of the reproduction.

In a two-valve set of this kind the signals of even a fairly near-by station do not cause big voltage changes to reach the grid of a single low-frequency valve. Further, such a set is not used for loud-speaker work, and any small distortion that may be present is seldom very noticeable when one is using headphones. So far so good. But despite the quality of its reproduction, my friend had failed to realise that the set was *not* working so well as it might have done. The ever-useful milliammeter showed that the last valve, which was of a low-impedance type specially designed for L.F. amplification, was passing 3 milliamperes of current. The rectifier was taking .1 milliampere, so that the total drain on the high-tension battery of very small cells that he was using was 4 milliamperes.

Now when you ask a high-tension battery made of little cells to supply this amount of current the result is that it does not last you very long. Even a small saving in the output makes an enormous difference to the life of the battery. One of these small batteries of good quality will supply 2½ milliamperes of current for two hours a day for months on end; at 4 milliamperes it will not last half as long. Practical experiment proved that in the case of this two-valve set the high-tension current could be cut down to 2½ milliamperes by applying a bias of 3 volts to the grid of the second valve without reducing signal strength in any way. Before I left I had fixed up a suitable grid battery with the aid of a pocket flashlamp refill, which cost sixpence.

You can see at once how great is the economy effected. If a 12s. 6d. battery lasts only three months, you are paying 4s. 2d. a month for your high-tension supply. If by spending an extra sixpence you can make the battery last twice as long, then you get six months' working for 13s., which brings the total cost to 2s. 2d. a month. In other words, a grid battery costing about a penny a month is about as economical a piece of equipment as can be imagined for a two-valve set.

I have spoken of a two-valve set because it is the man using this type of receiver who so frequently fails to take advantage of the money-saving qualities of the grid battery. Most owners of multi-valvers realise that the grid battery is a very sound form of insurance. There are, however, still a few multi-valve men who do not bother to fit this prince of economisers.

Let me now show them what they are losing. My own receiving set is normally a four-valver, with two stages of high-frequency amplification, a rectifier and one note magnifier. A second note magnifier can be brought into circuit by means of a plug and jack when it is required to receive a weak and distant signal at loud-speaker strength. If I cut out the grid-bias battery the set will require 10 milliamperes of current when four valves are in use and sixteen with five. With proper grid bias the total consumption with four valves is but 6 milliamperes, and when the fifth is brought in this rises to nine. For a big set large high-tension batteries are required, and large high-tension batteries are expensive.

Effect on Quality

Quite apart from its economical effects, the grid battery is an absolute essential in the big set if the quality of reception is to be good. With several stages of amplification at high or low frequency, the voltages which reach the grid of the last valve are quite big. When this valve is unbiased the grid is normally at zero volts. A slight negative bias can be obtained without the use of a grid battery by placing the rheostats of the L.F. valves in the negative filament leg; but this is not sufficient to ensure first-rate reception. If speech and music are to come through with a good tone and without distortion, the grid of the last valve must be so biased that even the strongest signal does not take the working point up into the grid-current area. Should it do so, there will be a tendency to a most unpleasant kind of distortion to occur during loud orchestral passages or whenever sibilant consonants are reproduced.

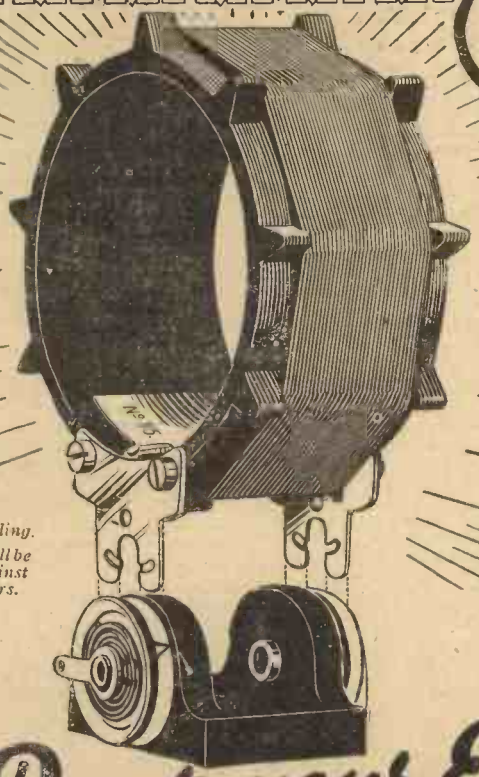
At the same time grid biasing must not be excessive. When it is overdone, the working point certainly does not rise to the grid-current area, but it may descend to the lower bend of the characteristic curve, in which case an equally vile form of distortion will take place. To make quite sure that your grid bias is correct, use your milliammeter, or borrow one from a friend if you do not possess one. Wire it into the plate circuit of the last valve, and watch its pointer when a strong signal is coming in. The pointer should remain absolutely stationary at all times. If it wobbles or kicks, then distortion is taking place. Adjust your grid-biasing voltage until the needle remains absolutely steady.

R. H.

This stunted tree is alleged to be the result of wireless-wave penetration via the iron stay-wires attached to it.

MH MH MH MH MH MH MH MH MH MH MH MH MH MH

MH REGISTERED



Pats. Pending. Action will be taken against infringers.

Rout your Enemy —H·F RESISTANCE!

Regd. Design No. 717674. Pats. Pending.

High Frequency Resistance, the dreaded enemy which crept into your Receiver during its construction, rendering it unselective and generally defeating your efforts to tune in distant broadcasting, can now be easily circumvented.
There is no secret—one glance at the

MH UNIMIC COIL

will tell you all.

The base is of special interest. As will be seen from the illustration, the connecting plates on the coil are firmly gripped between the spring connecting jaws on base, ensuring a tight contact, at the same time enabling the coil to be moved through an angle of 90°.
It is robust in construction, yet is by far the most efficient coil of its type, and is capable of numberless applications, among which are—

1. **Variable Coupling between two tuned circuits.**
2. **Variable reaction coupling.**
3. **Aperiodic aerial coupling to tuned circuit.**

In fact, it can be used in practically every H.F. circuit.

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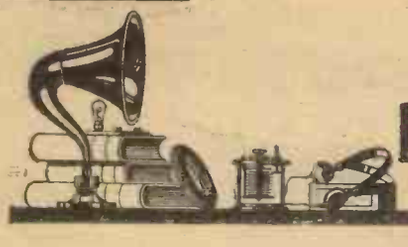
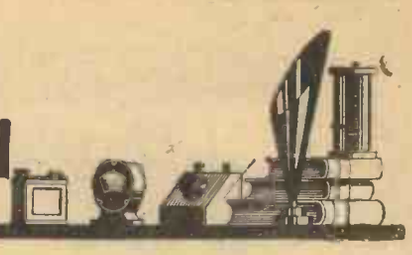


OUR INFORMATION BUREAU



RULES.—Please write distinctly and keep to the point. We reply promptly by post. Please give all necessary details. Ask one question at a time to ensure a prompt reply, and please put sketches, layouts, diagrams, etc., on separate sheets containing your name and address. Always send stamped, addressed envelope and attach Coupon (p. 508).

Storing Accumulator.

Q.—How should an accumulator be treated so as to enable it to be put away for a time without receiving any attention?—B. S. (N.W.).

A.—The acid should be poured out of the cells after the battery has been freshly charged, and should be stored in glass or earthenware jars for future use. The opportunity can then be taken to rinse out the cells thoroughly in order to get rid of any sediment, after which the cells can be filled with distilled water and the battery put away. When bringing the accumulator into use again empty out the water, refill with the original acid, give a short charge and use immediately.—J. F. J.

Grid Condenser in Transmitter.

Q.—I have noticed that in a number of transmitting circuits a grid condenser and leak are shown (though they are not given the values usually used in receivers). As no rectification is required in the transmitter, what is the object of using the grid condenser and leak?—M. K. (Macclesfield).

A.—In order that a transmitting valve may act as a generator of oscillations with the greatest efficiency it is often necessary to work the valve near the bottom bend of its characteristic curve. As high H.T. voltages are used in transmitting circuits a very large grid bias battery would be needed if the operating point were adjusted by this means. However, the grid battery can be dispensed with if a grid condenser and leak having suitable values are employed instead. When these values are suitably chosen a considerable negative charge will accumulate on the grid and so make it sufficiently negative.—B.

Making Wave-trap

Q.—I experience a great difficulty in cutting out the local station on my three-valve receiver, and would like to know how to build an effective wave-trap which can be attached and detached at will without any alteration to the set.—K. M. (Birmingham).

A.—There are several types of so-called "wave traps," of which possibly the most effective for your purpose would be an "acceptor circuit," to be connected at will across the aerial and earth terminals of your set. First of all you should see that the aerial tuning condenser is connected in parallel with the tuning coil, and then you should connect another variable condenser in series with another coil, also across the aerial and earth terminals. This second coil and condenser form the "acceptor circuit." In operation the acceptor circuit should be tuned to the wavelength of the undesired signals, which will then be cut out altogether or very greatly reduced in strength. After the desired station has been tuned in, a slight readjustment of the acceptor circuit tuning may be found necessary.—J. F. J.

The Portoset Case

Q.—I shall be obliged if you will kindly let me know where the case for the "Portoset" described in the April 24 issue of AMATEUR WIRELESS *was obtained.— M. O. W. (Clapton, E.5).*

A.—The case was obtained from Messrs. Dargues, leather merchants, Sheep Street, Rugby, Warwick.—H. W. CAMPBELL.

The Nodon Valve

Q.—Will you please explain what is a "Nodon valve"?—M. R. (Leicester).

A.—This consists of two electrodes, one of aluminium and the other either of lead or steel, immersed in a neutral solution of ammonium phosphate. Under certain conditions current can pass from steel or lead to aluminium, but not in the reverse direction. The Nodon valve can therefore be used as a rectifier of alternating current.—B.

Meaning of Q.R.M.

Q.—What do the letters Q.R.M., followed by the interrogation sign, mean?—T. B. (Colchester).

A.—This is the recognised abbreviation for "Are you suffering from interference."—B.

Machine-made High Tension

Q.—In reference to the articles under the above title appearing in Nos. 215 and 216 of AMATEUR WIRELESS, *will the author kindly state whether lap or wave winding is correct for the L.T. armature, and if possible supply a diagram?—G. T. T. (Ealing).*

A.—There is no electrical difference at all between lap and wave connections when the armature runs in a 2-pole field, as is the case in point; both are 2-circuit windings. The only difference in the appearance of the wound coils is that in wave windings the starting and finishing ends are carried straight out from the long sides of the coils for attachment to commutator segments that are approximately a full pole pitch apart. With lap connections the two coil ends are brought out side by side for connection to two adjacent commutator bars. A developed diagram of a 12-slot armature and 24-part commutator is given herewith.—A. H. A.

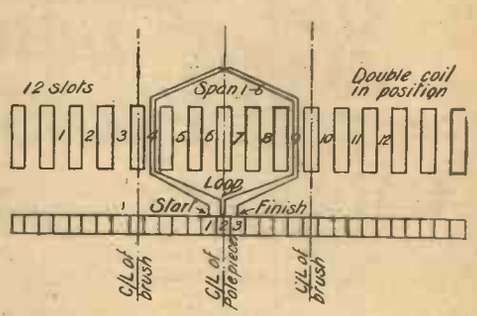


Diagram of 12-slot Armature and 24-part Commutator.

The Photo-electric Cell

Q.—Could you please tell me if the photo-electric cell responds to any particular ray of the sun's spectrum more readily than it does to the others? For example, is it particularly sensitive to ultra-violet rays?—W. A. C. (Aberdeenshire).

A.—All photo-electric cells show a maximum sensitiveness somewhere in the region of the shorter wavelengths. The maximum depends upon the metal used for the cathode and upon the material of the bulb. A potassium cell in glass shows a maximum in the visible violet, and a sodium cell in the ultra-violet. For rubidium the maximum is in the bluish-green. Allowance must be made for the feebleness of the energy in the violet and ultra-violet. For wavelengths of 5,460, 4,060 and 3,650 Angström units the specific photo-electric activity of potassium is 0.049, 1.18 and 1.83 respectively, but the glass bulb absorbs a portion of ultra-violet radiation. E. E. F. D'ALBE.

OUR WEEKLY NOTE

THE L.T. ACCUMULATOR

Many people, more especially those using bright-emitter valves, are dissatisfied with the length of time that the L.T. battery lasts after a charge. It seems to have become a matter of custom to blame the people at the charging station whenever the accumulator does not give satisfaction, but this is not always fair.

For instance, dissatisfaction is often felt when the number of hours service obtained from the battery, multiplied by the filament current of the set, falls short of the ampere-hour capacity as marked on the accumulator. If, however, the valves are rated at four volts, and a four-volt (two-cell) accumulator is used, it should be understood that the accumulator will cease to light the filaments properly some time before it is completely "run down."

Although the voltage of an accumulator remains *almost* constant until the charge is exhausted, it is bound to fall slightly when a heavy current is taken from the battery for a considerable period. In the case mentioned, there is nothing "to spare," and when the battery is, say, three parts discharged, the voltage may be, perhaps, only 3.8 when the current is being supplied to the set.

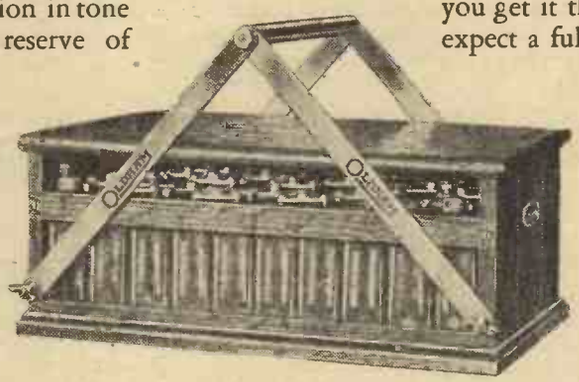
Therefore, it is always wise to use an accumulator giving a slightly higher voltage than that actually required by the valves, using the filament resistances to control the brightness of the filaments.

THE BUREAU.

A LOW-FREQUENCY AMPLIFIER

An adequate H.T. supply is more vital than you may think —

NO one would expect a railway engine handicapped by a leaky boiler to keep to its scheduled time table. You ought not to expect perfect results from any Set using a partly run-down H.T. Dry Battery. A falling off in sensitivity and a degradation in tone is inevitable. A good reserve of electricity is just as vital as a good head of steam. Many of the pitfalls in wireless are directly traceable to faulty H.T. supply. Everyone knows the noises and cracklings due to weak cells, but many of the troubles are much more subtle and not so easily traced. Such defects as a mysterious loss of 'pep' and failure to pick up distant stations—distortion—lack of volume—and so on are frequently due to a faulty H.T. battery. An H.T. dry battery starts working the day it is made—it can't be controlled. If it has been on the Dealer's shelf for a month or two before you get it then naturally you cannot expect a full voltage. Even a voltmeter isn't a safe guide because an idle H.T. Battery will always produce enough current to flick over the needle. It is on the long sustained discharge where it fails so miserably. And here is where the new Oldham H.T. Accumulator comes into its own. Use it for hours on end and the current flow won't vary a trifle.



60 Volts 50/- as above

Complete with lid and handles. Base 3/6 extra if required

40 volts £1 - 13 - 4	100 volts £4 - 3 - 4
80 volts £3 - 6 - 8	120 volts £5 - 0 - 0

A tapping point is available on each 2-volt cell.

Charge this Oldham four times a year—and forget it!

LOOK at the cleverly designed Oldham H.T. Accumulator shown above. Note that it is assembled on the unit system. Each unit consists of 20 volts. Build them up just like an expanding bookcase. 60, 80, 120 volts—just what you will. The Accumulator is always neat and tidy—fit to take its place in any room. Acid can't be spilt and when it needs re-charging a convenient carrying handle is available. Each of its big capacity cells is a miniature Oldham accumulator capable of holding its charge for months on end. Each plate is made under the same Special Activation Process which has made the name Oldham famous throughout the country. Ask your Dealer to show you one of these handsome H.T. Accumulators—don't be put off with a substitute. Nothing can take its place for none other can give you the same steady flow of power—the same freedom from sulphation and the same generous length of service.

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NEXT WEEK AT 2LO

By "THE LISTENER"

Robert Radford

Winifred Small

THE great feature of the week will be that of Sunday afternoon, when Sir John Martin Harvey and Lady Harvey, the latter known to the theatrical world as Nina de Silva, will give a programme commencing at 5.30 p.m. Sir John will broadcast (1) a scene between Vjera and Count Skariatine from Charles Hannon's dramatisation of *A Cigarette Maker's Romance*, the famous novel of F. Marion Crawford; (2) the story of Reresby, "the Rat," in Act II of *The Breed of the Treshams;* and (3) the scene between Lady Ann and Richard III from Shakespeare's tragedy. In the evening the programme will be heard from Eastbourne, where Albert Sandler and his orchestra are playing at the Grand Hotel.

On Monday, amongst the singers of the day will be heard Harold Williams, the Australian singer. Mr. Williams is a member of the British National Opera Company. Commencing at 9 o'clock, a variety programme will be given, the artistes including Teddy Brown, the leader of the Café de Paris Dance Band; Harry Gross and Dorothy Lark in burlesques; and the Sterling Brothers, entertainers.

The pianist of the week for the special recitals is Maurice Cole.

The outstanding feature of Tuesday is a performance by Cuthbert Smith, and the pianoforte solos of Maurice Cole.

For Wednesday Mr. R. E. Jeffrey has arranged to present Jerome K. Jerome's play *The Passing of the Third Floor Back*. This play was originally produced at Harrogate in 1908. A special version has, of course, had to be made for radio, and the cast includes Michael Hogan, Amy Brandon-Thomas and Irene Rooke.

A lighter atmosphere prevails on Thursday, when light music will be given during the day by the London Radio Dance Band under Sidney Firman, the Wireless Military Band under John Ansell, and later the Savoy Bands. The artistes of the evening include the famous violinist, Winifred Small; the tenor, Plunket Greene; and Edith Penville, the flautist.

The chief feature of Friday will be the performance of Gounod's *Faust* in the studio, following in the series of *La Traviata, Rigoletto* and *The Bohemian Girl*. The artistes include Parry Jones, Robert Radford, Harold Williams, Raymond Baylis, Mignon Nevada and Gladys Palmer.

On Saturday will be heard the Victor Olof Sextet, Euridice Draconi, a Greek singer, Kathleen McCormack and Ashmoor Burch. Other artistes are Madame de Walmont, Basil Maine and Mr. C. A. Lewis. At 8 p.m. the 2LO programme will give the first performance of *Holiday Memories*, written by Ernest Longstaffe. The cast includes many well-known favourites, such as Tommy Handley, Alma Vane, Miriam Ferris and Jean Allistone.

THE BIRMINGHAM WIRELESS EXHIBITION

THE Birmingham and Midlands Wireless Exhibition, organised by the *Birmingham Weekly Post,* will be opened at the Drill Hall, Thorpe Street, Birmingham, on October 5, and will remain open until October 16. A special feature will be the provision of a broadcasting studio inside the exhibition hall, from which a section of the staff from the Birmingham Broadcasting Station will transmit programmes each day. Another feature will be a competition, open to amateur constructors, for the best crystal and valve receivers.

The show will be thoroughly representative, as is evident from the following list of some of the exhibitors, which includes many London manufacturers.

S. G. Brown, Ltd., Brownie Wireless (of Great Britain) Co., Ltd., Bretwood, Ltd., Belling and Lee, Ltd., Boynton and Co., Le Breton Engineering Co., Ltd., W. Bullen, The British Ebonite Co., Ltd., H. Clarke and Co. (M/c) Ltd., Coleman and Co., S. H. Collet Manufacturing Co., D.A.S.H. Wireless Service, J. J. Eastick and Son, F. A. Hughes and Co., Ltd., Halcyon Wireless Supply Co., Ltd., H.S. Electric, Ltd., Igranic Electric Co., Ltd., F. G. Ketelbey, Lowe's Empire Motor Co., Ltd., Mayall and Co., Ltd., Midland Automobile Components. M.A.P. Co., F. H. Middleton, Omniaphone Radio Co., Philips Lamps, Ltd., Priestley and Ford, Radio Electric Stores (Christopher Webb, Ltd.), Radiocraft Supplies, Ltd., L. G. Russell, J. W. See and Sons, Spring Washers, Ltd., Spicer Manufacturing Co., Ltd., The Trader Publishing Co., Ltd., Walker Bros., E. A. Wood, Wilkins and Wright, Ltd., S. Wilding and Cole, Ltd., Wilrose and Co.

Ipswich and District Radio Society.—We have received from this society a syllabus of their winter session 1926-7. Starting October 4, and at frequent intervals until May 2, will be held a series of interesting lectures and demonstrations.

Interested readers should write to the hon. secretary, H. E. Barbrook, Esq., A.Rad.A., of 22, Vernon Street, Ipswich, for fuller details of the society's activities.

A new law has been passed in Spain forbidding the issue of news bulletins from broadcasting stations on Sundays in view of the fact that newspapers are not allowed to publish on the Sabbath.

Radio-Paris at 8 p.m. nightly gives an official time signal by one stroke of a gong at the exact hour, followed by the usual market reports and general news.

Known throughout the country by his broadcast sermons, the Rev. H. R. L. Sheppard, vicar of St. Martin-in-the-Fields, Trafalgar Square, has resigned his living because of ill-health.

RADIOGRAMS

A DRAMATIC situation was disclosed by an S O S message broadcast from 2 L O recently, in which it was stated that a man named Penn, who had been supplied with a box of pills by a Birmingham chemist, was urgently requested to see that no one took any, as, by an accident, the chemist put into them a dangerous amount of strychnine.

A broadcast announcement from 2 LO recently stated that arrangements have been made with the Meteorological Office at the Air Ministry for warnings of approaching gales to be broadcast from Daventry as occasion requires. Warnings will be broadcast after the time signal at 1 o'clock and 4 o'clock, and at the end of the weather report at 7 o'clock.

Turning up late at a meeting of the Montrose Harbour Trustees, a member complained that the town clock was behind the time, and that the town itself was also behind the time in not having the clock tuned in by wireless to keep it right.

A Radio University in Great Britain was foreshadowed by Mr. J. C. Stobart, of the British Broadcasting Company, in a recent address to the Institute of Adult Education at Trinity College, Cambridge.

Excerpts from the musical comedy *Tip-Toes,* with Miss Dorothy Dickson and Mr. Laddie Cliff, will be broadcast on October 22.

Professor L. P. Jacks, Principal of Manchester College, Oxford, will preach at St. Martin-in-the-Fields on October 10.

Mr. W. H. Reed, leader of the London Symphony and Royal Philharmonic orchestras, is to talk on the history of the violin on October 16.

The Swiss Yodelling Quartet will take part in the 2 L O programme on October 22. The Vladinoff Balalaika Orchestra will also contribute.

Work on the new Osaka (Japan) broadcasting station has already begun. A special building is in course of erection, and already three studios are under consideration, one for native orchestras, another for foreign music, and a smaller one for lectures. It is hoped to bring the station into regular operation towards the end of this year.

The B.B.C. proposes to relay concerts given by the string band of the Royal Air Force, at Holland Park Hall, on October 16, 18 and 20.

A special vocal and dance programme relayed from the King's Hall Room, Royal Bath Hotel, Bournemouth, will be broadcast by 6 B M and 5 X X on October 14.

The Belfast station will relay a Harvest Festival Service from the Belfast Cathedral on October 10.

Character studies from the works of great poets, authors and dramatists, produced in the form of short scenes, are included in the current scheme of educational transmissions to Glasgow schools.

In its six public symphony concerts to be given during the coming winter the Glasgow Station orchestra will be conducted by Sir George Henschel, Percy Pitt, Gustav Holst, Geoffrey Toye and Herbert A. Carruthers.

Church and religious broadcasts on Sunday in the West of Scotland are becoming more popular. Nearly all the principal denominations are now giving their hearty support to the B.B.C., and a strong religious advisory committee has been formed, the clerical members of which have been appointed by their respective presbyteries.

What is believed to be the largest wireless receiving set in the world is in daily use in the North Evington Infirmary, Leicester. The cost of the equipment, which was met by public subscription, was £1,200.

According to a recent statement by the B.B.C., incidental talk and explanatory matter in the body of the programmes will, in the future, be considerably curtailed; this information is to be given with the published programmes.

A special programme of Easthope Martin's music will be given on October 18 as a tribute to the composer, who died a year ago.

In a large part of Aberdeenshire fading is more noticeable with reception from the Glasgow station than with any other. It is suggested that the barrier formed by the Grampians may be responsible.

The South African Postmaster-General states that the South African "Beam" wireless station is now nearing completion. The station at the outset would be able to communicate with Britain only. Probably South Africa will have the first service in the world operating under the new system.

A small group of French amateurs, under the title of the *Radio Club du Bas Rhein*, has installed at Strasbourg a 1½-kilowatt broadcasting transmitter. Regular programmes are to be given every Tuesday and Friday night between 21.00 and 23.00 G.M.T. on a wavelength of 250 metres. The actual aerial energy is about 250 watts.

Bache Peninsula on Ellesmere Island, the most northerly police post in the world, has been brought into touch with civilisation by wireless. According to a message received recently by the Canadian National Railways, their Vancouver station, CNRV, has successfully broadcast programmes 7,000 miles into the Arctic.

The Birmingham broadcasting station will relay musical programmes from the Wireless Exhibition in that city during the fortnight October 5 to 16.

The Governments of Mexico and Cuba have entered into an arrangement for the connection of their respective telegraph systems by wireless, and the institution of a transmission service for public and private purposes. All messages must be transmitted in Spanish, no use of code being permissible. The revenues derived from the services are to be divided equally between the two states, and accounts are to be kept in United States currency.

At Calais a special device to guide ships into the harbour consists of a siren, the vibrations of which are of such high frequency as to be imperceptible to the human ear. Immediately below the siren is a wireless aerial connected with an apparatus below the water, which projects the waves of sound outwards over a very small arc of a circle. Every ship carrying a suitable receiver can pick up the sounds, and make straight for port.

Railway carriages equipped with wireless telephony receiving apparatus have now been permanently installed on the Vienna-Graz main line, and during the journey passengers are enabled to listen to both Vienna and foreign transmissions.

Listeners to the Stuttgart broadcasting station are lodging complaints with the city authorities in respect to interference with the broadcast programmes. It has been demonstrated that the interference is due to the intermittent lighting of electrical signs for advertising purposes.

(*Concluded in third column on page* 498)

£50 *for* CROSS-WORDS

THIS PRIZE MUST BE WON

A Complete Contest Every Week

The above sum of £50 is offered by this paper, in conjunction with *T.P.'s & Cassell's Weekly* and *Popular Gardening* for the correct solution to the Cross-word Puzzle given below. Should no correct solution be received, the £50 will be awarded to the NEAREST correct solution. In the event of a number of competitors sending the correct solution, or most nearly correct solution, the £50 will be divided equally.

RULES

1. The words forming this puzzle are to be found in Standard Dictionaries. The contest is complete in itself, and the sealed solution is in the keeping of the Competition Editor, and will not be opened until the competition is finally closed.

2. All coupons must be filled in with ink and in block letters. Alterations may disqualify an entry.

3. Each coupon must be accompanied by a Postal Order for sixpence, made payable to "Amateur Wireless" and crossed "& Co." The name and address of the sender, with date of posting, must be written on the back.

4. A competitor may send in any number of entries, but the printed coupon from this paper, *T.P.'s and Cassell's Weekly* or *Popular Gardening* must be used in all cases, and a Postal Order for sixpence sent for each one.

5. Should the Prize-money be divided, no competitor will be entitled to more than one share.

6. The Competition Editor will not be responsible for any entry lost, delayed in post or otherwise, and proof of posting will not be accepted as proof of delivery or receipt.

7. The decision of the Competition Editor on all matters relating to this competition is final, and acceptance of these rules must be regarded as a condition of entry, and legally binding in every respect.

8. Claims for a scrutiny must be received within seven days of the publication of the result, and accompanied by a remittance of £1, or they cannot be considered. If the claim is justified, the remittance of £1 will be returned, and the Competition Editor will have the right to re-arrange the distribution of the prize-money accordingly.

9. Except as regards claims for scrutiny, no correspondence can be entered into.

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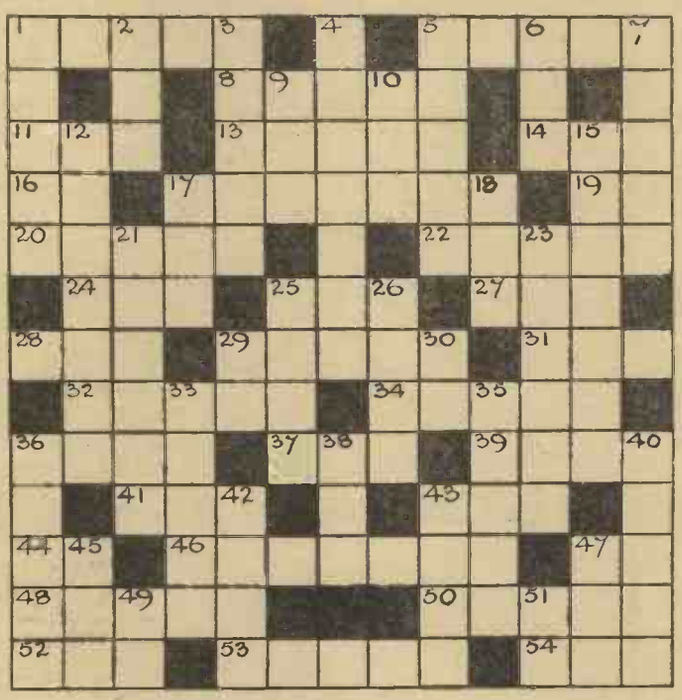

I agree to abide by the printed conditions, and to accept the Competition Editor's decision as final.

SIGNED .....

ADDRESS .....

.....

No. of Postal Order ..... "A.W."

CUT HERE

10. This competition is not open to employees of Cassell & Co., or members of their families.

11. Entries for this competition must reach us not later than first post, Thursday, October 14, addressed:—Cross-word Contest No. 1, "Amateur Wireless," La Belle Sauvage, E.C.4.

The result will be announced in an early issue.

THE CLUES

ACROSS

1. Hounds on leash.
5. Jingling noise.
8. Analyse.
11. Whole.
13. Covered with creepers.
14. Gelid.
16. King of Egypt.
17. Perfumed.
19. Positional.
20. Drags.
22. Black.
24. Morass.
25. Vestment.
27. Jewel.
28. Part of body.
29. Fold.
31. Fish.
32. Latin author.
34. Wrongs.
36. Monster.
37. Unclose.
39. Singing voice.
41. Represented.
43. Compete.
44. Inlet.
46. Parts of saddles.
47. You and I.
48. Fr.-Algerian soldier.
50. Indian soldier.
52. Ever.
53. Smallest.
54. Of it.

DOWN

1. Noise of impact
2. Cobbler's tool.
3. Heroic poems.
4. Sinuosity.
5. Yields.
6. River, Asia.
7. Character (Stalky & Co.).
9. Gabriel's salutation.
10. Place.
12. Idling.
15. Most serene.
17. Coin.
18. Old pistol.
21. Suffer from terrible disease.
23. Another character (Stalky & Co.).
25. Too.
26. To reduce.
29. River.
30. Directive.
33. Fruit.
35. Elevate.
36. Fat.
38. Caress.
40. Carries out order.
42. Appendage.
43. Endow.
45. Monkey.
47. Know.
49. Metric measure.
51. Greek letter.

RADIOGRAMS (*continued from page 497*)

The two new broadcasting studios which are being installed at Karlsruhe and Mannheim (Germany) in order to feed the Freiburg transmitter which is now in course of erection, will also be connected with the Frankfort-on-Main and Stuttgart stations.

The B.B.C. state that a two-day conference on *Broadcasting and Scottish National Life* has been arranged for October 12 and 13 in Glasgow.

Amateurs who attempted to pick up the recent American transmission of the big fight were in most cases unsuccessful as regards K D K A's transmission, although reports indicate that the 32-metre relay by W G Y was received sufficiently well to obtain the result of the fight.

As soon as fashion reporters in Paris obtain designs of the newest creations they travel by air to London, and within an hour of handing in the photographs or sketches, the pictures have reached New York by photoradiogram.

Transmission by wireless as fast as any cable is promised by the new wireless discovery of M. Verdan, the engineer of the Post and Telegraph Administration. The new system, according to M. Verdan, is as secret as the present cables, but is far cheaper, and in consequence the cost of communication will be much lower.

For the purpose of providing wireless apparatus for the local Fever Hospital, which occupies a solitary situation at Avonside, Polmont, Grangemouth, the Bing Boys Club recently organised a fancy dress parade, a chantant in the Town Hall, and a dance in the evening. The Bing Boys expect to realise £80 for this purpose.

Motor-cyclist engineers of the Wireless Association's repair patrol are now calling on members in all parts of the country, locating faults in members' wireless sets and giving advice on the repairs necessary.

It is reported that the Marconi Wireless Telegraph Co., London, has been granted from the Egyptian Government a concession for the installation of a broadcasting service for a period of twenty years.

The Lyngby (Denmark), O X E, wireless telegraphy station will shortly alter its wavelength to 3,800 metres.

For the coming winter season several U.S.A. broadcasting stations propose to transmit in parallel with their ordinary programmes on short wavelengths. On November 20, December 25, January 15, and February 26, K D K A will broadcast on 63 metres, and W B Z (Springfield) will utilise a wavelength of 47 metres on November 27, January 1 and 22, and March 5. These tests, in each instance, will be made at 15.00 G.M.T.

The Radio Circle of the Glasgow B.B.C. station has installed a four-valve receiving set, with thirty pairs of headphones, in the Glasgow Ophthalmic Institution, for the entertainment of the patients.

CHIEF EVENTS OF THE WEEK

SUNDAY, OCTOBER 10

London	Sir John Martin Harvey and Nina de Silva in Scenes from their repertoire.
Belfast	Harvest Festival relayed from Belfast Cathedral.
Birmingham	Symphony Concert.
Bournemouth	Symphony Orchestra.
Manchester	*The Gift.*

MONDAY

London	An Hour of Ketelbey's Music.
Birmingham	Birmingham Pianoforte Quartet.
Cardiff	Interlude: *Letty Laughs Last.*
Daventry	St. Hilda's Colliery Band.
Glasgow	*The Village Concert Party.*
Newcastle	*The Crier By Night.*

TUESDAY

London	Favourites from songs by Ralph Vaughan Williams.
Aberdeen	Will Seymour's *Bubbles* Concert Party.
Cardiff	Excerpts from famous Operatic Love Scenes.

WEDNESDAY

London Cardiff	The Philharmonic Piano Quartet. *For France,* an episode of the Franco-Prussian War.
Glasgow	National Broadcasting Conference.
Leeds-Bradford	*The Philosopher and the Lady,* Song Cycle.
Nottingham	Nottingham Philharmonic Society, John Henry.
Plymouth Swansea	Anglo-French Night. Protean Interlude: *The Poacher.*

THURSDAY

Aberdeen	Second of new series of Thumb-nail Sketches.
Dundee	*The Idol of Jade.*
Manchester	Old 3rd Cheshires' Military Band.

FRIDAY

London	*Faust.*

SATURDAY

London	*Briny Breezes Calling.*
Birmingham	*The Powder Puff.*
Bournemouth	Birthday Programme.
Glasgow	*Studio Snags,* Radio Burlesque.
Manchester	*The Violin in Dancing Mood.*
Newcastle	'Cello Recital by Beatrice Eveline.

THE G.R.C. RECEIVER COMPETITION

VISITORS to the National Radio Exhibition at Olympia had the opportunity of entering a competition organised by the General Radio Co., Ltd., of Radio House, 235, Regent Street, London, W.1. All those who placed orders with this firm for one of their two- or three-valve sets during the period of the exhibition were eligible.

One of the technical staff of AMATEUR WIRELESS undertook to draw the lucky slip from a box containing slips representing the total number of customers during the exhibition. We have pleasure in announcing that the fortunate customer is L. O. Hill, Esq., of 134, Russell Avenue, Wood Green, N.22. As the winner he therefore receives a General Radio Aristocrat receiving set, which was one of the largest and most expensive receivers on view at the exhibition.

The Aristocrat receiver truly lives up to its name. It is a handsome piece of "period" furniture, not only because it is a wireless cabinet, but because the entire arrangement is suggestive of the "Radio age." It is a six-valve set, with an effective loud-speaker range of approximately 300 miles. Tuning is accomplished by the rotation of a single dial, and when once tuned all that is required is the mere pressure of a small silver button.

The New Wavelengths

SIR,—In connection with the forthcoming changes in wavelength of all European broadcast stations, in accordance with the Geneva plan, we are led to hope that reception from distant stations will be rendered a more practical proposition.

From the point of view of heterodyning, caused by the carrier waves of stations not separated by 10 kilocycles, these hopes may be realised. But what of the incessant morse interference, which all too frequently jams out an otherwise perfectly clear distant station? No new wavelength allocations for broadcasting stations can obviate this nuisance.

What is required is that these morse stations, which seem to wander cheerfully around 400 and 300 metres, be compelled to stick to 600 metres, or at some specified wavelength clear of the 200- to 500-metres wave-band. Only in this way can we expect to realise our hopes of a "clean" ether.—J. B. (S.W.2).

Curing a Fault

SIR,—Acting upon the good advice given from time to time in AMATEUR WIRELESS regarding the "spring cleaning" of wireless sets during the summer months, I commenced operations about the middle of June, and by the end of the month I had given my wireless outfit a thorough overhaul, and then I did something which entailed a considerable amount of self-sacrifice. I scrapped my four bright emitters, which had been in use for nearly three years, and I invested in four dull-emitters. On connecting up I found that a great improvement in signal strength had been effected, and at 10.30 p.m., when we were taken over to the Savoy Hotel, my wife advised me to switch off in case our neighbours should report me to the police for creating a breach of the peace.

A week later I noticed with dismay that my set had developed a fault which hitherto I had never observed. When switching on, signals came in at normal strength, but within fifteen minutes they had faded away to about half; tuning was very flat and the set refused to oscillate. Batteries were tested on load and found to be in good working order. The aerial and earth were carefully examined, and finally the valves were withdrawn from their sockets, and all connections were carefully tested, but I failed to locate the fault. I tried one valve, and although signals were weak, they were steady, and sharp tuning could be effected. Detector and low-frequency also gave satisfactory results, but no sooner had I added a stage of high-frequency than the fading reappeared. I immediately suspected the H.F.T.C., and on replacing it by a spare one the fading disappeared. The faulty condenser was thereafter taken in hand, and while I was scrutinising it for a possible fault, I observed an almost imperceptible film of corroded matter formed on the top of the narrow ebonite bush which separates the spindle of the moving plates from the metal frame of the condenser. I removed the deposit, cleaned and oiled the bushing, and replaced the condenser; the fault disappeared, and since then I have enjoyed good reception.—C. W. M. (Lerwick).

Reception of Dempsey-Tunney Fight

SIR,—The following account of how and under what conditions I heard the Dempsep-Tunney fight may be of interest to your readers.

Before this fight many well-known wireless critics were drumming into the public's ears that it was hopeless to expect to hear anything of the fight on a receiver with less than four valves; but on my Reinartz short-wave receiver with two valves I heard practically every announcement during the fight.

At 12.30 a.m. I tried for the American long-wave stations (250-400 metres), but owing to very bad conditions and disturbance from Northolt and several other high-power stations, not a sign of any of the most powerful of the American broadcasting stations could be heard, so I decided to listen for the short-wave transmission from the General Electric Co.'s station W G Y.

At 12.45 a.m. a faint carrier wave, heard on 32 metres, proved to be W G Y, and distinct music could be heard.

By 1.30 a.m. the strength had greatly increased, and I heard the announcement in the unmistakable American drawl that I was listening to W G Y broadcasting from the ringside at Philadelphia.

A fight was then in progress between John Adams and —— (the name was missed through bad fading). The gong was heard between each round, and the announcer described each blow.

At 2.50 a.m. (9.40 p.m. American time) I heard the announcement that Dempsey and Tunney were about to enter the ring and the great fight about to start. W G Y's announcer said that this fight was being broadcast from a chain of thirty-six stations, and the fight, round by round, would be heard by millions throughout the world.

It was now 2.55 a.m., and the gong went for the first round, and, blow by blow, we heard how the fight proceeded.

At 3.45 a.m. the fight was over and Tunney had won on points and so ended a great broadcasting success.

I should like to mention that my aerial is only 30 ft. high and conditions were bad for the reception of American stations; but I am sure that anyone who possessed a short-wave set could tune in this fight, as W G Y's short-wave transmissions are in my opinion the most reliable to receive in the world, and can be received any night.—G 5 T D (Harrow).

BROADCAST TELEPHONY

NOTE.—*In the following list of transmissions these abbreviations are observed: con. for concert; lec. for lecture; orch. for orchestral concert; irr. for irregular; m. for metres; and sig. for signal.*

GREAT BRITAIN

The times given are according to Greenwich Mean Time.

London (2LO), 361 m. 1-2 p.m., con.; 3.15-4 p.m., transmission to schools; 3.30-5.45, con. (Sun.); 4.15 p.m., con.; 5.15-5.55, children; 6 p.m., dance music; 7-8 p.m., time sig., news, music, talk; 8-10 p.m., music; 9.0, news (Sun.); 10 p.m., time sig., news, talk, special feature (Mon., Wed., Fri.). Dance music daily (exc. Sundays) from 10.30 until midnight.

Aberdeen (2BD), 495 m. **Belfast** (2BE), 440 m. **Birmingham** (5IT), 479 m. **Bournemouth** (6BM), 386 m. **Cardiff** (5WA), 353 m. **Glasgow** (5SC), 422 m. **Manchester** (2ZY), 379 m. **Newcastle** (5NO), 404 m. Much the same as London times.

Bradford (2LS), 310 m. **Dundee** (2DE), 315 m. **Edinburgh** (2EH), 328 m. **Hull** (6KH), 335 m. **Leeds** (2LS), 321.5 m. **Liverpool** (6LV), 331 m. **Nottingham** (5NG), 326 m. **Plymouth** (5PY), 338 m. **Sheffield** (6FL), 306 m. **Stoke-on-Trent** (6ST), 301 m. **Swansea** (5SX), 482 m. **Daventry** (25 kw.), high-power station, 1,600 m. Special weather report, 10.30 a.m. and 10.25 p.m. (weekdays), 9.10 p.m. (Sun.); 11.0 a.m., light music (exc. Sat. and Sun.); relays 2LO from 4 p.m. onwards, own con. on Mon. Dance music daily (exc. Sun. and Tues.) till midnight; on first Friday in each month until 2 a.m.

IRISH FREE STATE.

Dublin (2RN), 397 m. Daily, 7.30 p.m. Sundays, 8.30 p.m. until 10.30 p.m. Frequently relays sporting matches on Sundays, 5.30.

CONTINENT

The Times are according to the Continental system; for example, 16.30 *is* 4.30 *p.m., and* 08.00 *is* 8 *a.m. G.M.T.*

AUSTRIA.

Vienna (Radio Wien), 582.5 m. and 531 m. (5 kw.). 11.00, con. (almost daily); 14.30, con.; 18.25, news, weather, time sig., con.; 21.00, dance (Wed., Sat.).

Graz, 402 m. (750 w.). Relay from Vienna. Also own con. (Wed.), 19.10.

Klagenfurt, 456 m. (750 w.). Testing.

BELGIUM.

Brussels, 487 m. (1.5 kw.). 17.00, orch. (Tues., Thurs., Sat. only), news; 20.00, lec., con., news. Relay: Antwerp, 265 m. (100 w.).

CZECHO-SLOVAKIA.

Prague, 372 m. (5 kw.). Con., 18.00-22.00, daily.

Brunn (OKB), 521 m. (3 kw.). 18.00, con. (daily).

Koszice, 2,020 m. (2 kw.).

Bratislava, 300 m. (500 w.). Testing.

DENMARK.

***Copenhagen** (Radioraadet), 347.5 m. (700 w.). Sundays: 09.00, sacred service; 15.00, con.; 19.00, dance. Weekdays: 19.00, lec., con., news; dance to 23.00 (Thurs., Sat.).

Ryvang, 1,150 m. (1 kw.). Sundays: 08.00, sacred service.

*Relayed by Odense (810 m.), Sorö (1,150 m.).

FINLAND.

Helsingfors (Skyddskar), 520 m. (500 w.).

***Tammerfors**, 368 m. (250 w.).
***Jyvaskyla**, 561 m. (100 w.).
***Pori**, 254.2 m. (100 w.).
***Oulu**, 233 m. (100 w.).
* Relay Helsingfors.

GRAND DUCHY OF LUXEMBURG.

Radio Luxemburg (LOAA), 1,200 m. Con.: 14.00 (Sun.), 21.00 (Thurs.).

FRANCE.

Eiffel Tower, 2,650 m. (5 kw.). 06.40, weather (exc. Sun.); 07.15, 08.00, physical exercises; 11.00, markets (exc. Sun. and Mon.); 11.20, time sig., weather; 15.00, 16.45, Stock Ex. (exc. Sun. and Mon.); 18.00, talk, con., news; 19.00 and 23.10, weather; 21.00, con. (daily). Relays PTT, Paris; 07.15, 08.00 (daily), also on Sat., 21.10-23.00.

Radio-Paris (CFR), 1,760 m. (about 3 kw.). Sundays: 12.45, con., news; 16.30, Stock Ex., con.; 20.15, news, con. or dance. Weekdays: 10.40, news; 12.30, con., markets, weather, news; 16.30, markets, con.; 20.00, time sig.; 20.15, news, con. or dance.

L'Ecole Sup. des Postes et Télégraphes (PTT), Paris, 458 m. (800 w.). 07.15, 08.00, physical exercises (exc. Sun.); 20.30, lec. (almost daily); 21.00, con. (daily).

Le Petit Parisien, 333 m. (500 w.). 21.15, con. (Tues., Thurs., Sat., Sun.).

Radio L.L. (Paris), 350 m. (250 w.). Con. (Mon., Wed., Thurs.), 20.30.

Radio-Toulouse, 432 m. (2 kw.). 17.30, news (exc. Sun.); 20.45, con.; 21.25, dance (daily).

Radio-Lyon, 280 m. (1.5 kw.). 20.20, con. (daily). Temporarily closed.

Strassburg, 250 m. (250 w.). 21.00, con. (Tues., Fri.).

Radio Agen, 297 m. (250 w.). 12.40, weather, Stock Ex.; 20.00, weather, Stock Ex.; 20.30, con. (Tues., Fri.).

***Lyon-la-Doua**, 480 m. (1 kw.). Own con., 20.00 (Mon., Wed., Sat.).
***Marseilles**, 351 m. (500 w.).
***Toulouse**, 260 m. (500 w.).
***Bordeaux**, 411 m.
***Grenoble**, 588.2 m. (500 w.).
* Relays of PTT Paris.

Montpelier, 240 m. (200 w.). 20.45 (weekdays only).

Angers (Radio Anjou), 300 m. (250 w.). Daily: 20.30, news, lec., con.

Bordeaux (Radio Sud-Ouest), 332 m. Con., 21.00 (Mon., Fri.).

Mont de Marsan, 400 m. (300 w.). Con. (weekdays only), 20.30.

Algiers (N. Afr.) (PTT), 310 m. (100 w.). 22.00, con. (Mon., Thurs.).

Ste. Etienne (Radio Forez), 220 m. (100 w.). Testing.

Casablanca (Morocco), 305 m. (600 w.). 19.00, con.

GERMANY.

Berlin, on 504, 571 and 54 m. (4 kw.). 08.00, sacred con. (Sun.); 11.55, time sig., news, weather; 17.30, orch.; 19.30, con., weather, news, time sig., dance music until 23.00 (Sat., Sun., Thurs.). Relayed on 1,300 m. by Königswusterhausen (1,300 m.) and Stettin (241 m.).

Königswusterhausen (LP), 1,300 m. (8 kw.). 10.30-11.50, con. (Sun.); 14.00, lec. (daily); 19.30, relay of Berlin (Vox Haus) con. (daily). 2,525 m. (5 kw.), Wolff's Buro Press Service: 05.45-19.10. 2,880 m., Telegraphen Union: 07.30-18.45, news. 4,000 m. (10 kw.), 06.00-20.00, news.

Breslau, 418 m. (4 kw.). 11.00, con. (daily), Divine service (Sun.); 16.00, con.; 18.00, lec.; 19.30, con., weather, time sig., news, dance (relays Berlin). Relay: Gleiwitz, 250 m.

Frankfort-on-Main, 470 m. (4 kw.). 07.00, sacred con. (Sun.); 15.00, con. (Sun.); 15.30, con.; 19.00, lec., con., weather. Dance: relays Berlin. Relay: Cassel, 273.5 m.

Hamburg, 392 m. (4 kw.). Relayed by Bremen (277 m.), Hanover (297 m.), Kiel (234.5 m.). Sundays: 06.25, time sig., weather, news, lec.; 08.15, sacred con.; 12.15, con.;

(*Concluded in second column of page* 504)

"BROADCAST TELEPHONY" *(continued from page 502)*

17.00, con.; 18.15, sports, weather, con. or opera, dance. Weekdays: 04.45, time sig., weather; 06.00 and 06.30, news, weather; 11.55, Nauen time sig., news; 13.00, weather, con.; 15.15, con.; 17.00, relays Berlin; 18.00, lec.; 18.55, weather and con.; 21.00, dance (Sun., Thurs., Sat.).

Königsberg, 464 m. (4 kw.). 08.00, sacred con. (Sun.); 15.30, con.; 16.00, con. (Sun.); 18.30, lec.; 19.00, con. or opera, weather, news, dance (irr.). Relay: Danzig, 272.7 m.

Leipzig, 452 m. (4 kw.). Relayed by Dresden (294 m.). 07.30, sacred con. (Sun.); 19.15, con. or opera, weather, news, cabaret or dance (not daily).

Munich, 486 m. and 204 m. (4 kw.). Relayed by Nuremberg (340 m.). 10.30, lec., con. (Sun.); 15.00, orch. (Sun.); 15.30, con. (weekdays); 17.30, con. (weekdays); 18.15, lec., con. (Sun.).

Muenster, 410 m. (1.5 kw.). Relayed by Elberfeld (259 m., 750 w.), Dortmund (283 m.). 10.45, Divine service; 11.00, news (Sun.); 18.40, news, weather, time sig., lec., con.

Norddeich (KAV), 1,800 m. 23.00 and 03.00, weather and news.

Stuttgart, 446 m. (4 kw.). 10.30, con. (Sun.); 15.30, con. (weekdays); 16.00, con. (Sun.); 17.30, time sig., news, lec., con. (daily); 20.15, time sig., late con. or cabaret.

HOLLAND.

Hilversum (HDO), 1,050 m. (5 kw.). Sundays: 10.00, sacred service; 14.10, con.; 16.40, church service; 19.40, weather, news, con. Weekdays: 16.30, con.; 19.50, news, con.

HUNGARY.

Buda-Pesth (Csepel), 560 m. (2 kw.). 16.00, talk, music; 19.00, con. or opera; dance nightly.

ICELAND.

Reykjavik, 328 m. (700 w.). Con., 19.30.

ITALY.

Rome (IRO), 425 m. (3 kw.). 09.30, sacred con.; 16.30, relay of orch. from Hotel di Russia; 16.55, news, Stock Ex., jazz band; 19.30, news, weather, con.; 21.15, late news.

Milan, 320 m. (1 kw.). 20.00-23.00, con., jazz band (nightly).

LATVIA.

Riga, 475 m. (1.2 kw.). Con. daily, 20.00-21.00.

NORWAY.

Oslo, 382 m. (1.5 kw.). 18.15, news, time, lec., con.; 21.00, time, weather, news, dance relayed from Hotel Bristol, Oslo (21.30-23.00, Sun., Wed., Sat.).

Bergen, 358 m. (1 kw.). 18.30, news, con., etc.

***Riukan,** 445 m. (50 w.).

***Porsgrund,** 405 m. (100 w.).

* Relays Oslo.

POLAND.

Warsaw, 480 m. (2 kw.). Daily: con., 10.00-12.00; 14.00-22.00.

RUSSIA.

Moscow (RDW), 1,450 m. (12 kw.). 16.55, news and con.; 22.00, chimes from Kremlin.

(Popoff Station), 1,010 m. (2 kw.). 18.00, con. (Tues., Thurs., Fri.).

SPAIN.

Madrid (EAJ6), 392 m. (1 kw.). Daily: con.

Madrid (EAJ7), 373 m. (1.5 kw.). Con. daily. Closes 00.30 (Mon., Wed., Sat.).

Madrid (EAJ4), 340 m. (1 kw.). 16.00, con. The Madrid stations are again working to a rota, varying time of transmissions daily.

Barcelona (EAJ1), 325 m. (1 kw.). 17.00-21.00, news, lec., con. (Sun.); 18.00-23.00 (daily).

Barcelona (Radio Catalana) (EAJ13), 462 m. (1 kw.). 19.00-23.00, con., weather, news.

Bilbao (EAJ9), 415 m. (500 w.). 19.00, news, weather, con. Close down 22.00.

Bilbao (Radio Vizcaya) (EAJ11), 418 m. (500 w.). 22.00-24.00, con. (daily).

Cadiz (EAJ3), 357 m. (550 w.). 19.00-21.00, con., news. Tests daily (exc. Sun.), 24.00.

Cartagena (EAJ15), 335 m. (500 w.). 20.30-22.00, con. (daily).

Seville (EAJ5), 353 m. (500 w.). 21.00, con., news, weather. Close down 23.00.

Seville (EAJ17), 300 m. (500 w.). 19.00-22.00, con. (daily).

San Sebastian (EAJ8), 346 m. (1.5 kw.). 17.00-19.00, 21.00-23.00 (daily).

Salamanca (EAJ22), 405 m. (1 kw.). 17.00 and 21.00, con. (daily). Closes down 23.00.

SWEDEN.

Stockholm (SASA), 430 m. (1½ kw.). 10.00, sacred service (Sun.); 17.00, sacred service; 18.00, lec.; 20.15, news, con., weather. Dance (Sat., Sun.), 20.45.

Relays.—Boden (SASE), 1,200 m.; Eskilstuna, 250 m.; Falun (SMZK), 370 m.; Gothenburg (SASB), 288 m.; Gefle, 208 m.; Joenkoeping (SMZD), 199 m.; Karlsborg (SAJ), 1,365 m.; Karlscrona (SMSM), 196 m.; Kristinehamm (SMTY), 292 m.; Karlstadt (SMXG), 221 m.; Linkoeping, 467 m.; Malmo (SASC), 270 m.; Norrkoeping (SMVV), 260 m.; Orebro, 237 m.; Ostersund, 720 m.; Sundsvall (SASD), 545.6 m. (1 kw.); Trollhattan (SMXQ), 322 m.; Umea, 215 m.

SWITZERLAND.

Lausanne (HB2), 850 m. (1½ kw.) (temp.). 19.00, lec., con. (daily).

Zurich (Hongg), 513 m. (500 w.). 10.00, con. (Sun.); 16.00, con. (exc. Sun.); 19.15, lec., con., dance (Fri.).

Geneva (HB1), 760 m. (2 kw.). 19.15, con. (weekdays). No transmission on Sun.

Berne, 435 m. (1.5 kw.). 09.30, organ music (exc. Sat.); 15.00, 19.30, con.

Basle, 1,000 m. (1½ kw.). Con. daily, 19.30.

"IN SEARCH OF SELECTIVITY" (*continued from page 474*)

(*a*) Whether the interference comes from one direction only, and may therefore be overcome by changing the form or direction of the aerial, and (*b*) whether our receiving system is such that we are able to render it sensitive only to predetermined signal impulses.

As regards the first (*a*), it is not proposed to enter into this question in this article. We are mainly concerned with the obtaining of all-round selectivity on a non-directional aerial, which comes under (*b*).

A Common Tuning Arrangement

The common and most usually adopted tuning arrangement is shown in Figs. 2, 3 and 4. Strictly speaking, the arrangement is only semi-tuned. The aerial vibrates to all signals, according to their intensity or location, and we render the aerial more or less sensitive to signals on given wavelengths by loading the aerial with inductance or capacity. To what extent the aerial will be sharply tunable will depend a great deal upon the amount of resistance and capacity there is in the circuit.

An aerial having a high resistance is very flat in tuning. If the earth connection is bad (and most amateur earths are) tuning will be very flat, and taking 2 L O as an instance, that station may be heard on a wavelength as high as 1,000 metres ten miles from his aerial. It will be impossible to tune him out in order to hear other stations. The earth resistance must be considerably decreased by such means as adding extra earth plates or soldering the lead direct to the water-pipe at a point where it runs to earth or, if deemed more suitable, a good counterpoise used.

A Good Earth

A common fallacy is that the water-pipe constitutes an infallible earth. Whilst the direct-current ohmic resistance of such an earth sytem may be low, its high-frequency resistance in the aerial circuit may be very high, and it is often far better to combine a garden earth immediately under the aerial with the water-pipe earth. A few experiments will soon determine whether or not an improvement in the sharpness of the tuning may be effected by this means.

The next point to be considered is the coil at L1. If this is of the bare-wire low-loss variety, flat tuning may at once be expected. Those troubled with excessive interference would be well advised to refrain from using low-loss coils when tuning by means of the circuits shown in Figs. 2, 3 or 4. A very bad example of lack of selectivity was recently brought to the writer's notice, and 50 per cent. of the trouble was caused by using a low-loss bare-wire coil with the circuit shown by Fig. 2. Bare-wire coils have a minimum amount of self-capacity, and if selectivity is desired with the circuit under discussion a certain amount of capacity is desirable. A coil wound with No. 36 d.s.c. or even No. 40 d.s.c. wire will considerably increase selectivity, albeit at a slight sacrifice in signal strength.

Where interference is not experienced and only the local station is desired, low-loss coils in conjunction with the circuits shown are very desirable, but the arrangement is fatal for the reception of long-distance stations when the local station is working.

The condenser C1 (Fig. 2) is the next matter for consideration. A low-loss square-law condenser always appears to be an aid to selectivity. Such condensers, however, are somewhat expensive, and should the reader desire to spread out his stations on the dial, so as to keep them at respectable distances one from the other, a condenser made by Messrs. Lissen, Ltd., is recommended. This is the Lissen mica dielectric condenser, and it makes for remarkably easy tuning of stations situated close together.

A Recommended Circuit

Fig. 5 illustrates a good selective tuning circuit. In this circuit the coil L1 may be an ordinary single-layer coil, and the coil L2 may with advantage be a low-loss coil preferably tuned with a low-loss condenser C2. The condenser C1 may be any type commonly used. The coupling of the coils one to the other is variable, and selectivity increases with the distance of the coils L1-L2 from each other, although a slight drop in signal strength is also noticeable. As the surface area of the coil L2 is but small, its picking-up propensities are limited to a very small area, and it will only be sensitive to the signal impulses which pass through the aerial coil to which it is coupled. In addition, a closed or tuned circuit is very selective, and generally will only receive signals within a very narrow margin of tuning. If the tuning condenser C2 is a square-law low-loss and the coupling is kept loose, the circuit will be found to be very selective. The aerial circuit must, of course, be dealt with in the manner already indicated for the semi-tuned circuit. A. J. C.

(*To be concluded*)

In order to celebrate the opening of the new relay broadcasting station at Klagenfurt (Austria) in October next, the local authorities have decided to organise a radio exhibition during that month. In a similar manner an exhibition will be held at Innsbruck a few weeks previous to the inauguration of the new relay transmitter which is to serve that district.

TRADE BREVITIES

LEWCOS low-loss plug-in coils, Glazite connecting wire, and multi-way battery leads are of special interest in the attractive 17-page catalogue just received from The London Electric Wire Co. and Smiths, Ltd. Their address is Playhouse Yard, Golden Lane, London, E.C.1.

The Dubilier Condenser Co. (1925), Ltd., of Ducon Works, Victoria Road, North Acton, W.3, have sent us a lavishly illustrated 28-page booklet dealing with their varied products.

A 35-page catalogue well worth a perusal is that of Radio Instruments, Ltd., of 12, Hyde Street, New Oxford Street, W.C.1. Of special interest is a description of the R.I. Push-Pull Power Transformer.

One of the most interesting sections of the new Burndept catalogue is section 3, dealing with their range of valves. Chief of interest among these is perhaps the Ethotron rectifying valve, which is the British version of the well-known Raytheon tube of America. Another valve is their dull-emitter for charging H.T. accumulators from A.C. mains. Other well-arranged sections of this catalogue deal with the many and varied products of this firm.

The Brown budget for September will be found of interest to the radio dealer and salesman.

The new Brown catalogue just issued contains information regarding the new Brown Disc Loud-speaker and the Crystal Amplifier, in addition to the usual well-known lines for which this firm is famous. Their address is Western Avenue, North Acton, W.3.

Igranic Electric Co., Ltd., have sent us an ingenious multi-circuit folder which, by different methods of folding, gives a variety of circuit diagrams.

In an 8-page booklet received from A. H. Hunt, Ltd., of Croydon, Surrey, there is illustrated a large selection of electrical measuring instruments such as would prove useful to the wireless amateur.

Divided up into convenient sections, the new Burndept catalogue will be found unusually interesting. Amongst the large range of literature issued by this company are two booklets which, we think, will find more than general interest. These are publications Nos. 100 and 106, being entitled respectively "Power for Your Radio Set" and "The Burndept All-wave Constructional Super-heterodyne." The address of Burndept Wireless, Ltd., is 13 and 15, Bedford Street, Strand, W.C.2.

Particulars of the Gambrell Mains receivers are the subject of several pamphlets which have been received from Gambrell Bros., Ltd., of 76, Victoria Street, London, S.W.1. To help the firm's distributors to the trade and public they have introduced a dealers' price list, which includes the prices of the complete range of productions, and is obtainable on request.

MORE RADIOGRAMS

The Birmingham and Midlands Wireless Exhibition, which is being held at Birmingham from October 5 to 16, has attracted a large number of entries by manufacturers. Features include the provision of a studio in the exhibition hall, from which a section of the staff of the Birmingham station will transmit a programme each day.

A two-day conference on "Broadcasting and Scottish National Life" has been arranged for October 12 and 13 in Glasgow. Religion and education are to be particular topics of discussion, and representatives of public bodies from all parts of the country have signified their intention of attending. Sir John Gilmour, the Scottish Secretary, is to preside at the concluding public meeting, at which Sir H. Walford Davies will speak.

Five Simple Wireless Sets is the title of a book just published by the Radio News Bureau, Ltd., of 50-51, High Holborn, London, W.C.1. This is intended to be the first of a series of home-wireless handbooks, and should appeal to the novice who is desirous of constructing his first wireless set.

Described and explained by J. H. Watkins, this book contains detailed instructions for building three types of crystal receiver and two types of valve amplifier. Each description is accompanied by a wiring diagram, circuit diagram, and under-panel photograph.

"Mortar: and How the Amateur Should Make and Use It" is the title of a well-illustrated article appearing in the current issue of "The Amateur Mechanic and Work" (3d.), and gives instructions on using this material in bricklaying, covering lathed partitions, etc. Other articles appearing in the same number are: "A Tray with Embroidered Panel," "Small Adjustable Tap Wrenches," "Ailments of the Motor-cycle Two-stroke Engine," "Hints and Kinks Illustrated," "Field-magnets for Small Electric Motors," "Making a Loud-speaker with Paper Horn," "A Shaving Cabinet with Pivoted Mirror," "Making a Combined Mitre-board and Cramp," "Learning Photography," etc.

ADVERTISEMENT INSTRUCTIONS for "Amateur Wireless" are accepted up to first post on Thursday morning for following week's issue, providing space is available.

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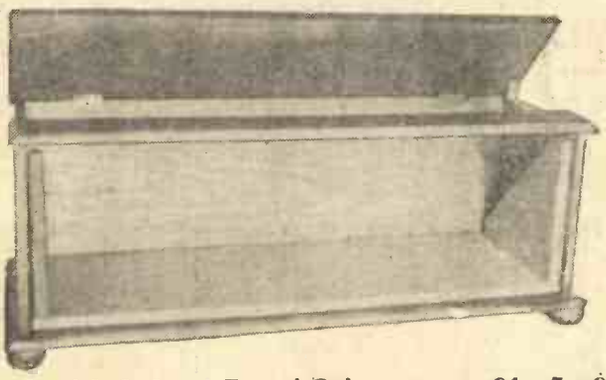

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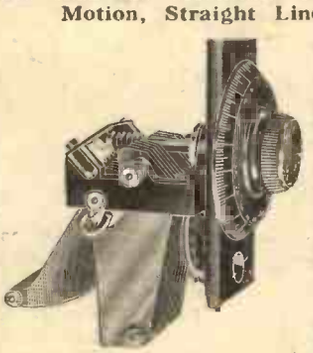

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A NEW PRACTICAL GUIDE TO WIRELESS

Part 1

Written by Staff of "Amateur Wireless"

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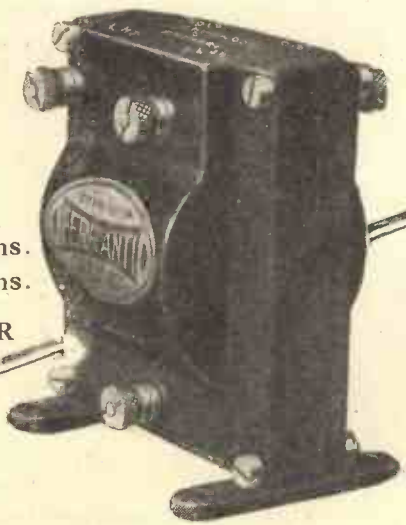


A NEW PRACTICAL GUIDE TO WIRELESS

In simple language, telling the beginner everything necessary for Broadcast Reception

Edited by

BERNARD E. JONES

Editor, "Amateur Wireless," "Wireless Magazine"

With Many Illustrations

CASSELL & COMPANY, LTD

London, Toronto, Melbourne and Sydney

INDEX

A NEW
PRACTICAL GUIDE TO WIRELESS

What Broadcasting Can Give You.—Before anyone commits himself to the trouble and expense of installing a wireless receiver in his home it is only natural and, indeed, reasonable, for him to inquire as to the exact extent of the benefits and advantages to be derived from so doing.

First and foremost, of course, he will be enabled to listen to the programmes broadcast by the stations of the B.B.C., or at least by those of them which lie within the range of his receiver.

The quality and variety of these programmes are unrivalled. The resources of the B.B.C. are practically unlimited. And as for subject matter anything that can be rendered in terms of sound can be broadcast, and *is* broadcast, provided that it is sufficiently entertaining or interesting.

The B.B.C. are the first to realise the extreme difficulty of drawing up programmes which will please everybody. Tastes differ so widely. But if they do not succeed in pleasing everybody *all* the time, they certainly *do* succeed in pleasing the great majority of their vast audiences *most* of the time.

Composition of Programmes.—The variety of the programmes is almost limitless. All kinds of vocal and instrumental music, important speeches by prominent men, entertaining and interesting talks, topical information and news, these are but a very few of the subjects included in the regular programmes. Even the waves of the sea breaking on the beach at some popular resort, and the noises of the animals at the Zoo, have been broadcast.

And as for quality, the highest talent in the country is available to the B.B.C. It is quite a common thing for a hundred or more artistes to be given auditions in order to pick out two or three who will actually be allowed to broadcast.

There is scarcely a singer, pianist, or other musician of note in this country who has not broadcast sometime or other and who will not do so again. And, besides the many occasions on which these artistes have performed in a broadcasting studio, many are the operas and plays which listeners have been enabled to hear while they were actually in progress in a theatre or opera house.

Then again, there must be few people who have been listening regularly for the past year or two to whom the voices of the King, the Prince of Wales, and other members of the Royal Family, as well as of the leading churchmen, statesmen, scientists, authors, etc., are not familiar.

Further Possibilities.—As we have said, the chief object of the B.B.C. is to provide entertainment, but this by no means exhausts the possibilities of broadcasting. For instance, news and information of public importance can be more efficiently and completely distributed by the B.B.C. than by any other organisation.

It must be admitted that the present news service leaves something to be desired, but this is due solely to the opposition of the newspapers and in no way to any lack of enterprise on the part of the B.B.C. However, it cannot be doubted but that this opposition will become less strenuous as time goes on.

An Example.—As an example of what the B.B.C. can do in the way of distributing news, when it is given the chance to do so, look at what happened during the last general strike. For the first few days the publication of newspapers was suspended, and even later on it was possible for them only partially to resume. The "strike editions" of the newspapers were mere shadows of their former selves, often consisting of but a single sheet.

And yet, from the very beginning of the trouble, the B.B.C. provided all those who took the trouble to listen with complete and accurate details of the position at frequent intervals. There can be no doubt whatever that the remarkably good order and lack of bloodshed experienced throughout this critical period was due in large measure to the activities of the B.B.C. With such a complete and accurate news service, unfounded and alarming rumours were discredited almost as soon as they were put into circulation.

Other Uses.—On other occasions the police authorities have taken advantage of broadcasting to publish a description of a missing person or "wanted" criminal (with successful results in many cases). Even more frequently the relatives or friends of a person who has been taken suddenly ill, or who has met with an accident, have been informed of his whereabouts by means of broadcasting when it would have been impossible for a telegram to have reached them until the next day.

To sum up, the owner of a wireless receiving set is assured of a continuous supply of excellent programmes, limited in variety only by the capabilities of his set. He is enabled virtually to be present at many important and interesting ceremonies, in that he is enabled to hear the actual voices of the speakers simultaneously with the speeches being delivered. He is assured of never being entirely without news even should the newspapers fail, and, should a loved one be travelling in some distant part of the country, he knows that he or she will always have a ready means of communication at all times should ill befall.

The Broadcasting System.—At present the B.B.C. is operating nine main stations, which are situated at Aberdeen, Birmingham, Bournemouth, Cardiff, Glasgow, London, Manchester and Newcastle-on-Tyne. Each of these stations is capable of being received clearly on a simple crystal set used in conjunction with a moderately good aerial system up to a distance of thirty miles. There are also a high-power station at Daventry, with a crystal range of a hundred

Frequency x 10,000	*Wavelength*	*Station*	*Country*	*Actual Power (watts)*
51	588·2	Vienna	Austria	750
,,	,,	Linkoeping	Sweden	250
,,	,,	Grenoble	France	500
52	577	Madrid (EAJ 6)	Spain	1,000
,,	,,	Joenkoeping	Sweden	25
53	566	Berlin	Germany	1,500
,,	,,	Orebro	Sweden	250
,,	,,	Saragossa	Spain	—
,,	,,	Bloemendael	Holland	100
54	555·6	Buda-Pesth	Hungary	2,000
55	545·6	Sundsvall	Sweden	1,000
56	535·7	Munich	Germany	4,000
57	526·3	Riga	Latvia	1,200
58	517·2	Vienna	Austria	5,000
59	508·5	Antwerp	Belgium	100
60	500	Zurich	Switzerland	500
,,	,,	Helsingfors	Finland	500
,,	,,	Karlstad	Sweden	250
61	491·8	Aberdeen	Great Britain	1,500
,,	,,	Birmingham	,, ,,	1,500
62	483·9	Berlin	Germany	4,000
63	476·2	Lyons (PTT)	France	1,000
64	468·8	Elberfeld	Germany	750
65	461·5	Bergen	Norway	1,000
66	454·5	Boden	Sweden	1,000
67	447·8	Paris (PTT)	France	500
68	441·2	Brünn	Czecho-Slovakia	300
69	434·8	Bilbao	Spain	500
70	428·6	Hamburg	Germany	4,000
71	422·6	Rome	Italy	3,000
72	416·7	Stockholm	Sweden	1,500
73	411	Berne	Switzerland	1,500
74	405·4	Glasgow	Great Britain	1,500
75	400	Mont de Marsan	France	300
,,	,,	Cadiz (EAJ 3)	Spain	550
,,	,,	Warsaw	Poland	1,500
,,	,,	Koszice	Czecho-Slovakia	750
,,	,,	Aalesund	Norway	250
,,	,,	Bremen	Germany	750
,,	,,	Frankfort a/M	,,	4,000
76	394·7	Toulouse (Radio)	France	2,000
77	389·6	Manchester	Great Britain	1,500
78	384·6	Stuttgart	Germany	4,000
79	379·7	Madrid (EAJ 7)	Spain	1,500
80	375	Oslo	Norway	1,500
81	370·4	Graz	Austria	750
82	365·8	2LO (London)	Great Britain	3,000
83	361·4	Breslau	Germany	4,000
84	357·1	Cardiff	Great Britain	1,500
85	353	Prague	Czecho-Slovakia	5,000
86	348·9	Seville (EAJ 5)	Spain	500
87	344·8	Paris (Pt. Parisien)	France	500
88	340·9	Copenhagen	Denmark	700
89	337	Naples	Italy	1,000
90	333·3	Reykjavik	Iceland	500
,,	,,	Nuremberg	Germany	750
91	329·7	Belfast	Great Britain	1,500
92	325·1	Leipzig	Germany	4,000
93	322·6	Dublin	Ireland	1,500
94	319·1			

miles, and eleven relay stations at Bradford, Dundee, Edinburgh, Hull, Leeds, Liverpool, Nottingham, Plymouth, Sheffield, Stoke-on-Trent and Swansea, which can each be well received within five miles distance on a crystal set.

Distribution of Stations.—It will be seen that these stations are not distributed symmetrically over the map of the British Isles. Rather were the sites chosen to bring the greatest possible number of people using simple apparatus within range of at least one of the stations. Thus each of the main stations is situated in a large city which is itself in the centre of a thickly populated area. The same may be said of the relay stations on a smaller scale, while the high-power station is located in what might be described as the centre of industrial England.

Besides the British stations, there is an enormous number of Continental ones within range of not very elaborate apparatus. France is very plentifully supplied, as are also Spain and Germany. Broadcasting is now firmly established throughout the whole of Europe. In fact, the recent conference at Geneva, at which the new wavelengths were allotted, was called chiefly because of the surprising way in which the number of European broadcasting stations has increased during the last year or so.

List of Stations.—A list of the more important European stations (including the British stations), together with the power used and the new wavelengths (as from October 15, 1926), is given in this book.

Advantage of Knowing "How it Works."—Whether those who are taking up wireless for the first time decide to build their own sets or not, they will not obtain the full amount of pleasure that their receiver is capable of giving them unless they have some idea of how it works.

Even if they are not in the least interested in the scientific side of wireless they will find it very annoying if they have to forgo an interesting programme while an expert is sent for to remedy a very trifling defect. Then again, a lack of elementary knowledge may prove very expensive. Suppose, for instance, that one or two of the leads become detached from their terminals. An attempt to put them back may result in several costly valves being destroyed if a mistake is made.

The knowledge required in order to enable a receiver to give of its best, and to deal with the simple troubles which will occur from time to time, is not necessarily profound. Of course, the deeper into the subject that the listener penetrates the more pleasure he will derive, but, having once obtained a working knowledge the listener may proceed just as much or as little further as he pleases.

An Illustration.—To illustrate the above remarks, consider any owner of a gramophone. However little he is interested in mechanical devices, he knows that the record is rotated by a clockwork motor driven by a spring. He also knows that the spring will break if wound up too tightly. He is aware that for good reproduction it is necessary for the needle to have a sharp point, and that this point soon wears down. Accordingly he changes the needle as required.

He may fancy that he knows no-

Frequency x 10,000	*Wavelength*	*Station*	*Country*	*Actual Power (volts)*
95	315·8	Milan	Italy	1,000
96	312·5	Newcastle-on-Tyne	Great Britain	1,500
97	309·3	Marseilles	France	500
98	306·1	Bournemouth	Great Britain	1,500
99	303	Muenster	Germany	1,500
100	300	Bratislava	Czecho-Slovakia	500
101	297	Agen	France	250
,,	,,	Hanover	Germany	750
,,	,,	Carthagena	Spain	500
,,	,,	Jyvaskyla	Finland	100
,,	,,	Leeds	Great Britain	200
102	294·1	Dresden	Germany	750
,,	,,	Bradford	Great Britain	200
,,	,,	Trollaattan	Sweden	250
,,	,,	Bilbao (EAJ 11)	Spain	500
,,	,,	Liége	Belgium	100
,,	,,	Innsbrueck	Austria	500
103	291·3	Lyons (Radio)	France	1,500
104	288·5	Dundee	Great Britain	200
,,	,,	Edinburgh	,, ,,	200
,,	,,	Hull	,, ,,	200
,,	,,	Liverpool	,, ,,	200
,,	,,	Nottingham	,, ,,	200
,,	,,	Plymouth	,, ,,	200
,,	,,	Sheffield	,, ,,	200
,,	,,	Stoke-on-Trent	,, ,,	200
,,	,,	Swansea	,, ,,	200
105	285·7	Reval	Esthonia	500
106	283	Dortmund	Germany	1,500
107	280·4	Barcelona (EAJ 1)	Spain	2,000
108	277·6	Caen	France	200
,,	,,	Barcelona (EAJ 13)	Spain	1,000
,,	,,	Sevil'e	,,	500
109	275·2	Angers	France	250
,,	,,	Madrid (EAJ 4)	Spain	1,000
,,	,,	Eskilstuna	Sweden	250
,,	,,	Zagreb	Jugo-Slavia	250
110	272·7	Cassel	Germany	750
,,	,,	San Sebastian	Spain	1,500
,,	,,	Noorkoping	Sweden	250
113	265·5	Brussels	Belgium	1,500
115	260·9	Gothenberg	Sweden	1,000
118	254·2	Kiel	Germany	750
119	252·1	Montpellier	France	200
,,	,,	Stettin	Germany	750
120	250	Gleiwitz	,,	750
122	245·9	Toulouse (PTT)	France	500
124	241·9	Koenigsberg	Germany	4,000
125	240	Helsingfors	Finland	250
126	238·1	Bordeaux	France	500
131	229	Malmo	Sweden	1,000
133	225·6	Belgrade	Jugo-Slavia	1,000
134	223·9	Leningrad	Russia	1,000
137	219	Kovno	Lithuania	—
138	217·4	Luxemburg	Luxemburg	250
142	211·9	Kiev	Russia	250
147	204·1	Gefle	Sweden	250
,,	,,	Salamanca	Spain	500

thing about how the gramophone works, but in reality he is in possession of sufficient working knowledge to manipulate the machine properly.

Electricity. — Turning back to the subject of wireless reception, everybody will know that "electricity" has something to do with it. Just what, we will see later. For the present let us get some idea of what electricity is.

Until quite recently even the greatest scientists had very vague ideas on the subject. They imagined electricity to be something which could be made to flow along wires, but they had no means of finding out what this "something" was, or even of detecting the direction of the flow.

They knew that when an electric current flowed in one direction it produced certain effects, and when the current was reversed the opposite effects were produced. But they could not determine whether a certain effect was produced when the current was flowing from right to left or from left to right.

A Guess.—Accordingly they made a guess at the matter and ascribed certain effects to the flow of current in a particular direction. They called the end of the wire from which they assumed the current to flow the "positive" end, and they termed the other end of the wire the "negative" end.

Later Knowledge. — Unfortunately, when a little more had been found cut about electricity, it was seen that the guess had been wrong. It was discovered that an electric current did, in reality, consist of a "flow." They found that it consisted of a movement of extremely minute particles which they called "electrons."

The electrons, however, flowed from what had been called the negative end of the wire towards the positive end.

It is very unfortunate that the original guess happened to be wrong, and it has led to a great deal of confusion. The terms "positive" and "negative" were so firmly established that no attempt was made to reverse their applications, as might otherwise have been the easiest way of putting matters right.

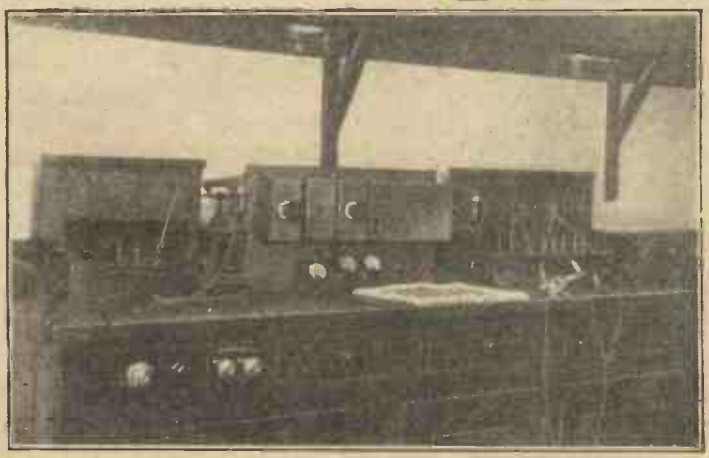
A Way Out.—Instead a system was resorted to which will be most clearly understood by those who are familiar with algebra. The terms "positive" and "negative" were retained with their original significance. The idea of the current flowing from positive to negative was also retained. This current was called a "positive" current.

This positive current was assumed to be equal to a negative current of the same intensity flowing in the opposite direction. This latter current, which does flow from negative to positive, was, of course, the flow of electrons. Hence electrons are regarded as particles of negative electricity.

All this sounds very involved and complicated, but it was the easiest way out from a mathematical point of view. It is necessary for the beginner to understand the position, however, as he will generally hear of the current flowing from positive to negative, though in some cases apparently the reverse will be stated. When the current is said to flow from negative to positive he will know that it is a flow of negative electrons to which reference is made.

(Left)
The Station Orchestra in the Studio.

Inside a Main B.B.C. Station.



(Above)
Switchboard and Generator Controls.

(Left)
The Amplifying Apparatus.

Electrical Units.—There are rules governing the amount of current in given circumstances, but they are not hard to learn. The electrons always encounter some resistance to their passage through a wire, and as some means had to be available for stating the amount of the resistance a suitable unit had to be found. This was called the ohm.

The unit that is used in describing the amount of current which flows is the ampere. Now it is obvious that the amount of the current, or number of amperes, in any given case will be determined by the pressure behind the current and by the amount of resistance which has to be overcome. The unit of pressure is the volt. These units have so been chosen that a pressure of one volt enables a current of one ampere to pass through a resistance of one ohm.

It therefore follows that the current, measured in amperes, which will flow in any given conductor can be found by dividing the number of volts pressure by the number of ohms resistance. This rule, which is very important, is known as Ohm's law. As an example of its application, when ten volts are applied across a resistance of two ohms the current will be five amperes; thus $\frac{10}{2} = 5$.

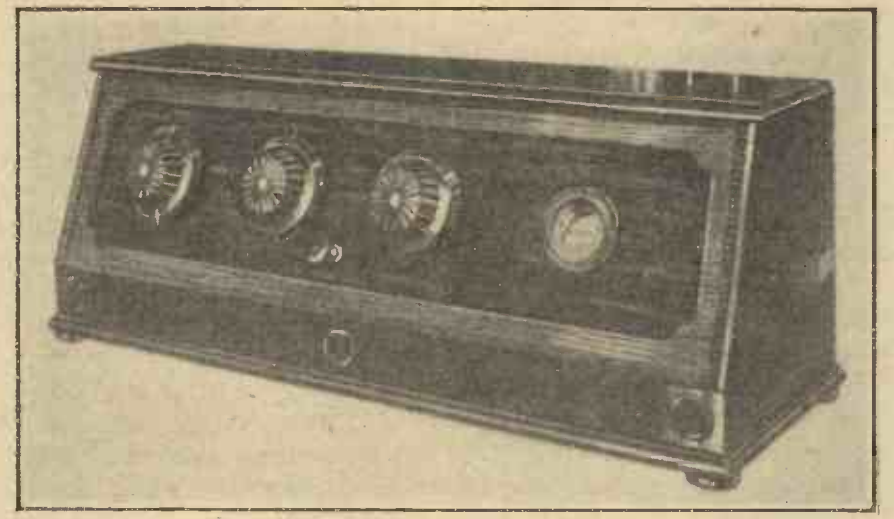
Various Methods of Connection. — An electric circuit, of course, consists of a number of instruments and pieces of apparatus joined together by wires or other conductors. Every electric conductor possesses a certain amount of resistance. These resistances may be connected up in various ways to form circuits.

Suppose we have three pieces of apparatus A, B, and C, each possessing a resistance of three ohms. They may be connected up so that the current flows first through A, then through B, and lastly through C. The pieces of apparatus form a series of resistances through which the current must flow. They are said to be connected "in series," and the total resistance in the case mentioned would be nine ohms.

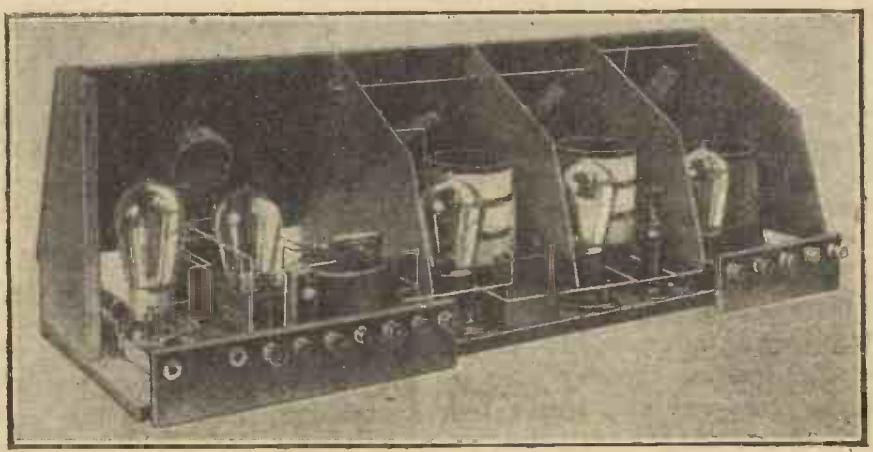
Instead of being connected in series the three resistances can be so arranged that the current divides into three branches, a third of the current flowing through each resistance. The path available for the current will therefore offer a less resistance to the passage of the current than would be the case were only one of the resistances in circuit—the total resistance would be only one ohm. The resistances would then be connected "in parallel."

D.C. and A.C. — There are two kinds of electric current, known respectively as direct and alternating current. Direct current flows always in the same direction, and may be either steady or fluctuating. Alternating current, on the other hand, reverses its direction periodically at regular intervals. The number of times that it flows in one particular direction per second is termed the "frequency" of the current. Both kinds of current are met with in wireless work.

There are two important properties met with in an electric circuit in which alternating current (or A.C.) is flowing which are not so evident when direct current (or D.C.) is used. These



"1927 FIVE"—A RECEIVER THAT IS REALLY UP TO DATE.—Over 60 stations at loud-speaker strength have been received with ease and speed with this remarkable receiver, which is the subject of fully explanatory articles in the October and November, 1926, issues of the "WIRELESS MAGAZINE." Its many features stamp it as being absolutely up to date. Its circuit is new; its selectivity outstanding; four or the whole five valves can be used at will by merely moving a plug—there are no switches; a system of metallic screening prevents interaction between the various parts of the set, and it cannot radiate and interfere with other listeners. The Technical Staff of the "WIRELESS MAGAZINE" designed, built and tested it, and the articles in that publication leave no detail unexplained.



are known as "inductance" and "capacity."

Inductance. — Inductance may be regarded as the inertia of the current. When a voltage or pressure is applied to a circuit the current does not reach its maximum value immediately, but builds up more or less gradually. Similarly, when the pressure is removed the amount of current flowing dies down more or less slowly, and does not drop abruptly to zero.

As mechanical inertia is not noticed when a heavy body is moving at a uniform speed, but only when it is sought to start, stop, or alter the speed at which the body is moving, so is inductance not very much in evidence when a steady direct current is flowing. As alternating current, however, is constantly starting, increasing in strength, dying away again, starting in the opposite direction, etc., inductance is important when dealing with this kind of current.

Increasing Inductance.—The greater the inductance the more slowly will the current reach a maximum, and, having reached it, the more slowly will it die away. Every conductor possesses inductance, but a wire when formed into a coil has a much greater inductance than it would have if stretched out straight. So when we want a lot of inductance we use coils of wire. The inductance can be still further increased without using more turns on the coil by inserting in the coil a piece of soft iron.

Capacity.— If inductance is akin to mechanical inertia, capacity acts in much the same way as a mechanical spring. Its effects are noticed when it is attempted to make a current flow through a circuit that does not consist of a continuous series of conductors. It is obvious that the electrons which form the current cannot pass the point at which the conducting medium is broken, and if electrons do move in the conductor they must pile up at one side of the gap, while at the same time they will be moving away from the other side. The surplus of electrons will be on the negative side of the gap (as electrons are particles of negative electricity), and the shortage of the electrons will be on the positive side.

If the pressure which caused this unequal distribution of the electrons in the conductor is removed the electrons will, if free to do so, regain their normal distribution throughout the conductor. The effect will be as though a spring had been stretched and, when the stretching force had been removed, the spring had returned to its normal condition.

Condenser.— If, instead of merely breaking the circuit at one point, each of the broken ends was provided with a large metal plate and the two plates were placed very near together and facing each other, the above effects would be greatly increased. The two plates and the insulator (the air) between them would form a piece of apparatus called a "condenser." The bigger the plates and the nearer together the greater would be the effect.

Storing Energy.—It is possible to store in a condenser a certain amount of energy in the form of an uneven distribution of electrons which tends to readjust itself, and this capacity for storing energy is called the "capacity" of the condenser.

In commercial condensers often more than two plates are used. Generally there are two sets of plates spaced alternately. This has the same effect as increasing the size of the two single plates, and increases the capacity of the condenser. If one set of plates is movable with respect to the other set the capacity of the condenser will be variable and the instrument will be called a variable condenser.

It is now possible to imagine what will happen when an alternating current is flowing in a circuit which contains both a coil and condenser—inductance and capacity. The inductance opposes the rise of the current and also its fall. During the rise of the current energy is stored in the condenser, which is returned to the circuit when the current flow dies away. Accordingly, if the original cause of the current ceases to exist current will still flow backwards and forwards in the circuit for an appreciable time until the resistance of the circuit absorbs all the energy stored in the condenser.

For when electrons are flowing from the overcharged condenser plate the inductance will not let the current cease when the normal distribution of electrons throughout the circuit has been reached. It will make the current go on flowing for a time, with the result that what was previously the positive condenser plate will become the negative plate and vice versa.

The Principles of Wireless Communication.—Wireless communication is possible because if a certain kind of electric current is made to flow in an elevated wire, one end of which is earthed while the other end is left free, similar currents will, under suitable conditions, be caused to flow in another elevated wire situated some distance away.

The currents used for this purpose are of a high-frequency alternating nature. That is to say, the currents change their direction at regular intervals, flowing first in one direction and then in the opposite direction. As they flow alternately in each direction they are called alternating currents, and as the frequency with which they flow in any one direction is very high (of the order of a million times a second for short wave broadcasting) they are termed high-frequency currents, or, more usually, H.F. currents. Another name for them is oscillatory currents.

Waves in the Ether.—The currents flowing in the elevated wire, or transmitting aerial, cause waves in the "ether" (a hypothetical medium which is presumed to permeate all space), which waves are radiated from the transmitting aerial, whence the alternative name for wireless—radio. These waves have the property of reproducing in a receiving aerial high-frequency or oscillatory currents corresponding to the currents which produced the waves.

The currents in the receiving aerial are, of course, much weaker than the original currents, and the greater the distance between the two aerials the greater the difference in strength.

Continuous Waves. — It will be seen, then, that when a broadcasting station is in operation a constant stream of "wireless" waves is radiated by its aerial. The frequency of these waves (that is, their distance apart) is constant, depending upon the fre-

quency with which the aerial is charged and discharged.

The amplitude of the waves (the energy represented by them) is not, however, constant. It varies continually. It is controlled by the sound-waves produced by the speech, music, or whatever is being broadcast.

As the electric currents produced in the receiving aerial correspond exactly in form (though, of course, they are much weaker) to the currents in the transmitting aerial, it will readily be seen how the wireless transmission of speech or music becomes possible.

A powerful sound-wave at the transmitting end will produce a correspondingly powerful effect in the receiver, a weaker sound-wave will produce a weaker effect, and so on. If at the receiving end an instrument is provided which is capable of translating the electrical impulses due to the received waves into sound of proportional amplitude, sound-waves will be produced at the receiving end which correspond exactly (except, perhaps, in volume) to the original sound-waves in the transmitting studio.

What is Needed for Reception.—The essential requirements for wireless reception are not many. Firstly, an aerial system is necessary, and this must be provided with means of making it responsive to the desired station and no other. Otherwise with the 200 odd European stations all working at the same moment it would be impossible to receive anything intelligible at all unless the receiver had such a short range that only one station lay within it. Again, if different stations are to be received at will arrangements must be made for altering the responsitivity of the aerial system to that station desired at the moment.

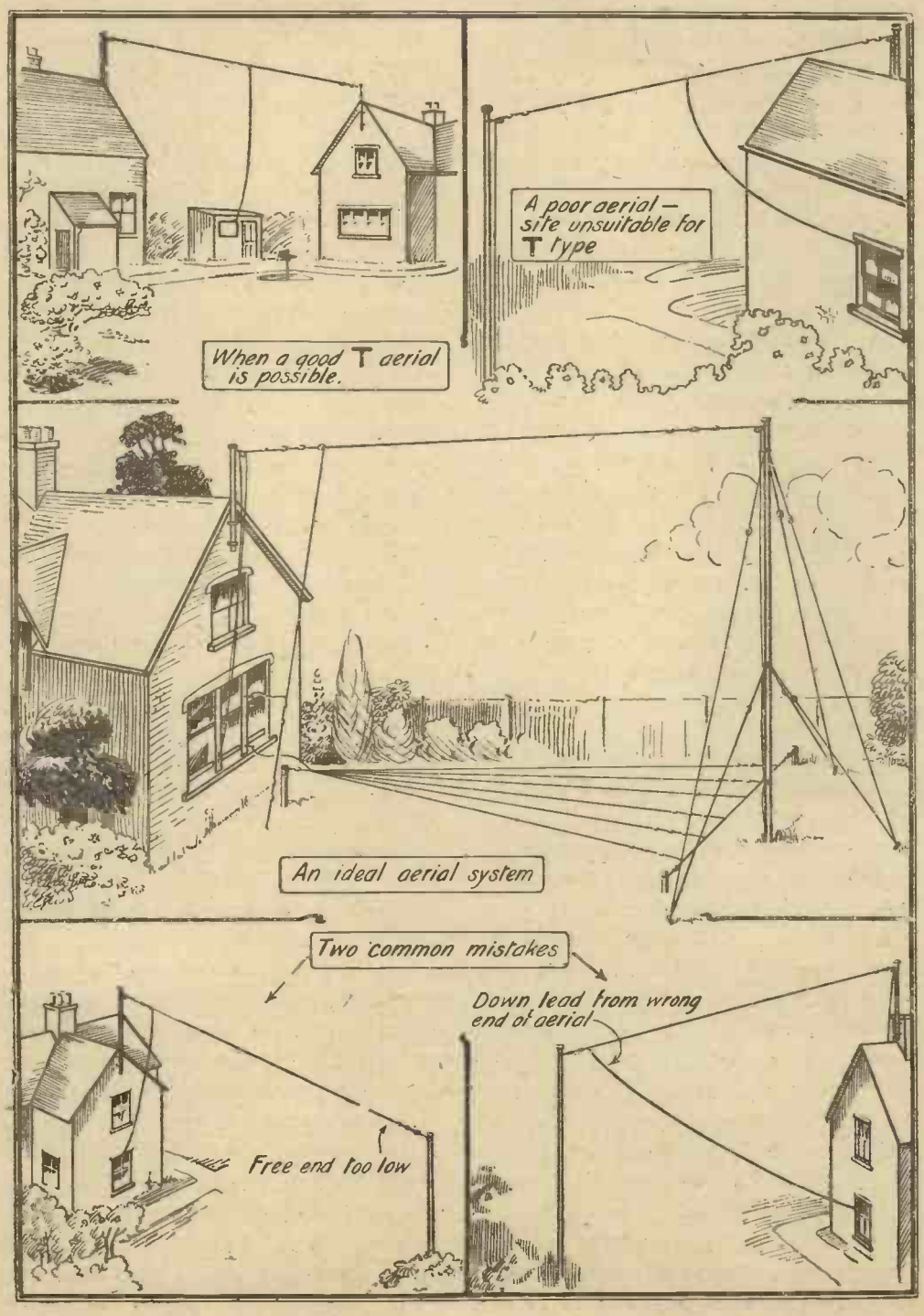
Having provided an aerial system which will respond to the station required, an instrument must be provided which is capable of translating the currents flowing in it into the form of sound-waves. The telephone receiver is such an instrument.

Need for a Rectifier.—Before, however, the electric currents due to the incoming waves can be applied to the telephones they must undergo a change of form. As they appear in the receiving aerial they are high-frequency alternating currents. That is, they are continually changing their direction with great rapidity—we have seen that this may be as often as two million times a second.

The telephones, however, cannot respond to currents having a frequency greater than a few thousands a second, and, even if they could do so, the human ear could not appreciate such high-frequency sound-waves.

Moreover, it must be borne in mind that the frequency to which we wish the telephones to respond is not that of the wireless waves, but of the sound-waves produced in the transmitting studio. That is to say, the telephones must respond to the variations in amplitude of the incoming waves taken as a whole.

What we have to do is to rectify the currents due to the received signals before applying them to the telephone receiver. Rectification means the turning of a current which continually changes its direction into a current which flows always in the same direction. It can be accomplished either by reversing the direc-


When a good T aerial is possible.
A poor aerial — site unsuitable for T type
An ideal aerial system
Two common mistakes
Free end too low
Down lead from wrong end of aerial

tion of each alternate impulse of the alternating current or by suppressing each alternate impulse. The latter method is the more simple to carry out.

Nature of Rectified Current.—As the amplitude of the currents flowing in the receiving aerial is constantly varying the rectified current will not be a steady one. It will flow always in the same direction, but its amplitude will rise and fall in accordance with the variations of amplitude of the high-frequency alternating current flowing in the aerial.

We have, as a result, a varying direct current for application to the telephone receiver, the frequency of the variations corresponding exactly to the frequency of the sound-waves at the transmitter. The telephone is admirably suited to deal with a current varying at this frequency, and it is consequently capable of reproducing the broadcast programme.

Essential Requirements. — In order to receive wireless signals, therefore, the essential requirements are: an aerial system, some means of adjusting the responsitivity of this to waves of a particular frequency (the apparatus for doing this is called the "tuner"), a rectifier, and telephones. We can now proceed to consider each of these essential parts in detail.

The Aerial System. — The aerial system consists of the overhead wire (usually called the "aerial"), the tuner, and the earth wire. One end of the aerial is free, the other end being connected to one side of the tuner. The earth wire is run from the other side of the tuner to a metallic object buried in the ground or to a system of wires erected below the aerial. This combination forms the aerial system.

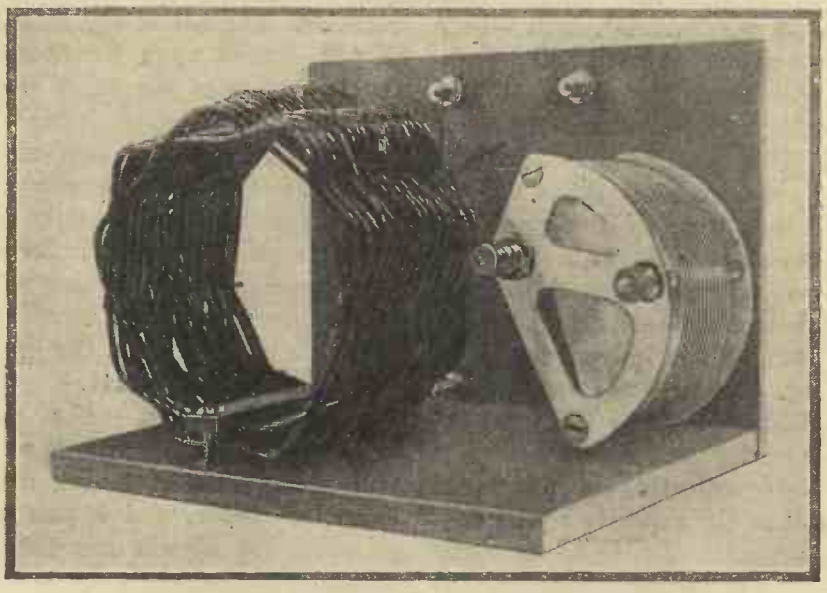
The method of erecting the overhead wire or aerial is very important, as it is this part of the aerial system which is responsible for picking up the energy from the transmitting station. The better the aerial the more energy will be picked up. For best results with a receiving set, therefore, it is essential to have a good aerial.

Importance of Height. — As the proportion of energy picked up by a receiving aerial increases with its height, the aerial should be as high as possible consistent with other conditions. The Postmaster-General, however, will not allow the total length of the aerial (irrespective of the number of parallel wires used) to exceed 100 feet, measured from the aerial terminal of the set to the far end of the aerial.

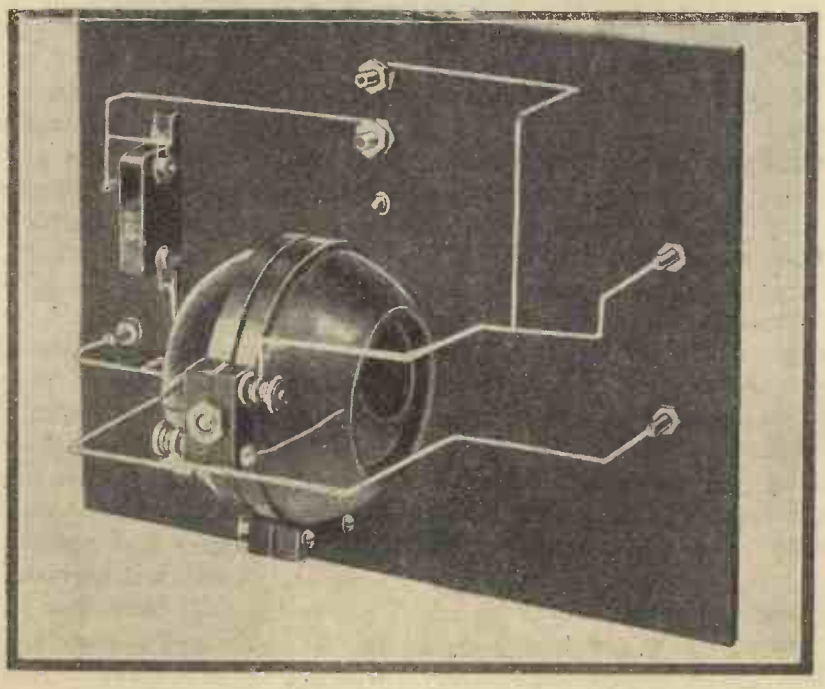
The aerial, however, is only a part of the aerial system. It acts as one plate of a condenser, a number of wires run parallel to and beneath the aerial (or else the earth itself) acting as the other plate. In either case this other plate is termed the "earth," even though the wires forming it (often called a counterpoise) are actually carefully insulated from the ground.

These two condenser plates—the aerial and earth—are connected one to either side of an arrangement termed the tuner. Aerial, earth, and tuner are known collectively as the aerial system.

The Tuner. — The tuner usually consists of an inductance coil (just a coil of wire) and a condenser (two sets of metal plates separated by an insulator, often air) connected either in



Interior of Crystal Set tuned by Coil and Variable Condenser.



Back-of-panel View of Variometer-tuned Crystal Set.

series or in parallel with each other, the values of one or both being variable at will within certain limits.

A simpler tuning device is the variometer. This consists of two inductance coils connected in series and so arranged that their relative positions can be varied at will. It is therefore possible to make the magnetic fields of the two coils assist each other, oppose each other, or act independently of each other. The various arrangements give different values to the total inductance of the variometer.

By suitably adjusting the inductance of the coil or the capacity of the condenser, or both, the aerial is made suitable to receive waves having the frequency of those transmitted by the station it is desired to receive. As it is more usual in this country to speak of the wavelength than of the frequency of these waves, it should be explained that one is dependent on the other.

Velocity, Frequency, and Wavelength. —The velocity or speed of the waves is constant (it is 186,000 miles or 300,000,000 metres per second). The distance apart of the crests of the waves is therefore determined by the frequency with which they are emitted. In fact, the wavelength (usually measured in metres) is equal to the velocity (300,000,000 metres) divided by the frequency. For instance, a frequency of one million is equivalent to a wavelength of 300 metres.

Now when the aerial circuit is adjusted (by means of the tuner) so as to receive waves having a particular frequency or wavelength it will more or less reject waves having other frequencies. The extent to which it does so will depend upon the nearness of the frequency of the other waves to the frequency to which the aerial system is adjusted, and also upon the characteristics of the aerial system.

The greater the power of the receiver to select one particular station from among others emitting waves of frequencies nearly the same as that to which it is adjusted the greater is the selectivity of the set.

Simple Receivers. —The simplest type of receiver consists of an aerial with some form of tuning device, a crystal detector, and a pair of telephones. The signals from the desired station are picked up by the aerial, in which they cause H.F. or oscillatory currents to flow. These high-frequency alternating currents are then rectified by the crystal, and the resulting fluctuating direct current is utilised to work the telephones.

Rectification. —The manner in which the crystal performs the apparently obscure operation of rectifying is, in one sense, remarkably simple. It was long ago discovered that certain mineral crystals had the property of offering a greater resistance to current passed through them in one direction than when the current was passed through them in the opposite direction. In some cases this almost amounted to the crystals being conductors when the current was flowing in one direction and non-conductors when the current was reversed.

It was at once clear that such crystals could be used as rectifiers of H.F. currents by the simple expedient of passing such currents through them. When this was done every alternate

half-cycle of current was more or less suppressed, only the half-cycles in one particular direction getting through to any great extent.

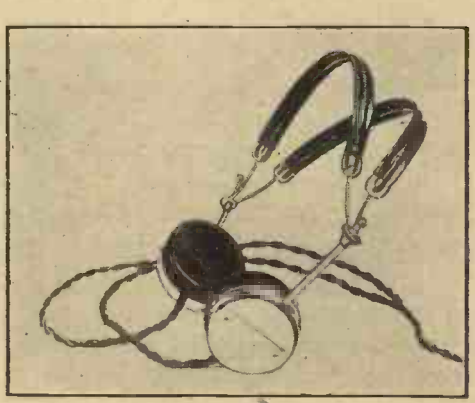
Brown A.2-type Phones.

It has now been found that synthetic crystals can be manufactured which behave in the same way as the natural crystals previously used, and these synthetic crystals often possess greater sensitivity than the natural crystals. The method of using the crystal, however, remains unchanged. A large contact area must be provided on one part of the crystal and a contact of very restricted area on another part. It is apparently at the latter point that rectification actually takes place.

Mounting Crystal.—In practice the crystal is partly embedded in a special alloy (Wood's metal) having a low melting point (heat is injurious to the rectifying properties of crystals). A contact having a very small area is made by lightly touching a point on the crystal with the end of a very fine wire, commonly known as a catwhisker. All points on the surface of the crystal are not equally sensitive, and the catwhisker must be moved about until a certain point is found that gives good results. The pressure of the catwhisker on the crystal is also usually critical (and nearly always very light), but the right adjustment is readily noted in practice, as when it is found the desired station will be heard at good strength in the telephones.

The Construction of a Telephone Receiver.—A telephone receiver is a remarkably simple and, at the same time, a remarkably sensitive piece of apparatus. It is capable of giving an appreciable response to extremely minute currents. Its purpose is primarily to translate the energy of the currents into sound-waves, in order to create which it is provided with a flat, thin sheet of metal called the diaphragm.

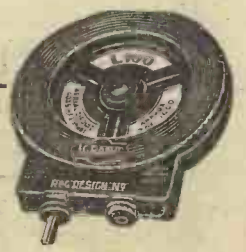
This diaphragm is composed of a special soft iron with high magnetic permeability. This means that it is readily acted upon by a magnetic field.



Sterling Lilliput Phones.

In the telephone the diaphragm (which is circular) is clamped firmly around its periphery, or outer edge, between the cap and case of the

22



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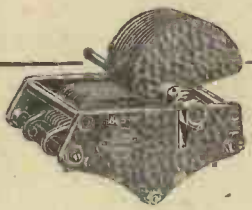

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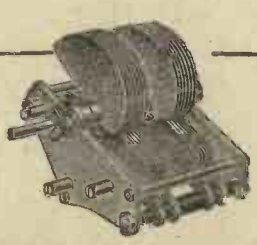

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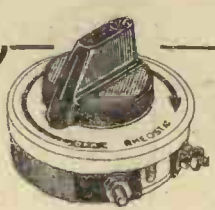

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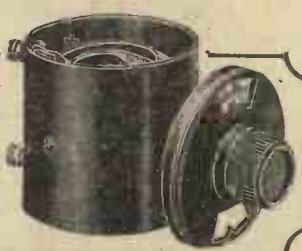
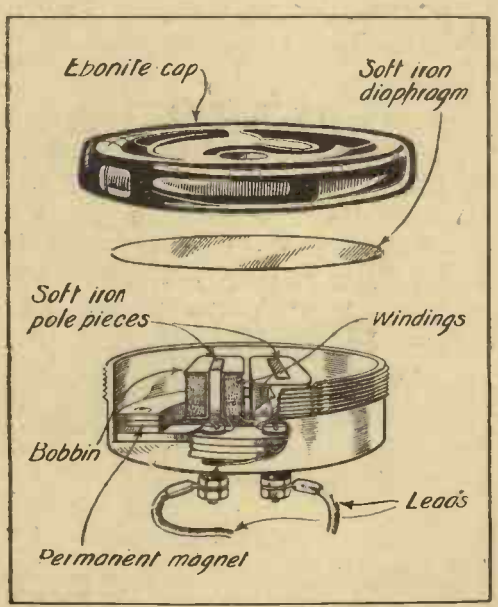


ear-piece. Inside the cap is a flat permanent magnet arranged with its plane parallel to that of the diaphragm.

This magnet is provided with two soft iron pole-pieces at right-angles to it, the ends of the pole-pieces farthest from the magnet being very close to, but not quite touching, the under-surface of the diaphragm. Wound



The Construction of a Phone Ear-piece

round each of the pole-pieces is a coil of very fine wire, and the two coils are connected in series.

Resistance of Windings. — The object of using fine wire is to get a great number of turns into the restricted space available. The use of fine wire has the disadvantage of giving the coils a high resistance, but this cannot be helped.

The actual number of turns is decided by the voltage and amperage of the current available for working the telephone. It must be understood that the same magnetic effect is obtained by using a certain current and number of turns as by using twice the current and half the number of turns, or by using half the current and twice the number of turns.

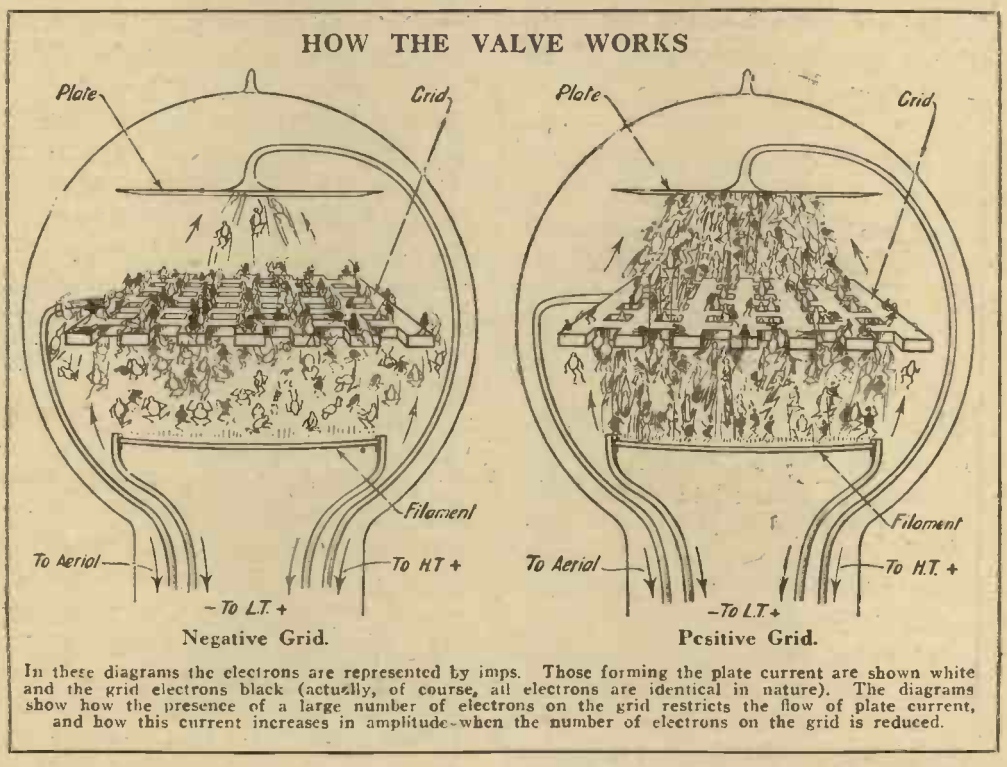
When fewer turns are used the wire may be thicker, and telephones for different purposes have different resistances. Hence it is usual to speak of phones in terms of the resistance of their windings. As in wireless reception the available current is generally very small, high-resistance phones are usually most suitable. But it should be remembered that their suitability depends not upon their resistance, but upon the number of turns of wire their coils contain.

How the Telephone Receiver Works. —To return to the manner in which the telephone receiver functions. First of all, the effect of the permanent magnet, acting through the pole-pieces, is to pull the diaphragm downwards in the centre (the edge not being free to move). When the rectified signals flow through the windings to reinforce the field of the permanent magnet the diaphragm will be pulled still farther towards the pole-pieces, and when the signal current falls away the total magnetic field will be reduced and the diaphragm will spring back, owing to the fact that it has been kept in tension.

Thus when an alternating current, or a varying direct current, is passed through the phone windings the diaphragm will vibrate, provided that the alternations or variations do not take place with such rapidity that it is unable to respond to them.

Use of Amplification.—We have now described briefly the various parts of the simplest and cheapest type of wireless receiver. Receivers such as this are in use all over the country, and are giving satisfaction to many thousands of owners. Their great disadvantage, however, is that the range over which they can receive broadcast transmissions is distinctly limited. It does not usually exceed thirty miles from a main station or five or six miles from a relay station. The high-power station at Daventry is, of course, a different proposition, and should be well received at distances up to a hundred miles.

Another disadvantage is that with a crystal set, however near it is situated to the transmitting station, it is essential to wear headphones during reception. In order to work a loudspeaker (which is nothing more or less than an out-size in telephones capable of making itself audible over a considerable area) much more power than can be delivered by the best of crystal sets is necessary.



In these diagrams the electrons are represented by imps. Those forming the plate current are shown white and the grid electrons black (actually, of course, all electrons are identical in nature). The diagrams show how the presence of a large number of electrons on the grid restricts the flow of plate current, and how this current increases in amplitude when the number of electrons on the grid is reduced.

To enable us to obtain either greater range or greater power than is provided by the unaided crystal set we have recourse to amplification.

So that to obtain greater range the oscillatory currents produced in the receiving aerial must be amplified, or magnified, before being applied to the rectifier, as all known forms of rectifier require a certain minimum amount of energy to be applied to them before they operate efficiently.

Amplifying Before and After Rectification.—Amplifying the oscillatory currents before rectification, however, cannot provide the requisite power to enable a loud-speaker to be worked, as all rectifiers used in wireless are limited as to the maximum amount of energy with which they can deal. The only method of obtaining sufficient power for a loud-speaker is to magnify the low-frequency currents after the signals have been rectified.

In order to distinguish these two kinds of amplification or magnification, the first kind is usually referred to as H.F. amplification and the second kind as L.F. amplification. These terms are very appropriate in view of the high and low frequencies of the currents concerned. Another term for H.F. amplification is radio-frequency (or R.F.) amplification, while amplification at low frequencies is sometimes referred to as audio-frequency amplification.

Three-electrode Valve. — Amplification at both high and low frequencies is made possible by the use of the thermionic valve. This consists essentially of a glass bulb from which all the air has, as far as is possible, been withdrawn, and which contains three electrodes. It is accordingly often called a three-electrode valve to distinguish it from valves having different numbers of electrodes which are used for other purposes.

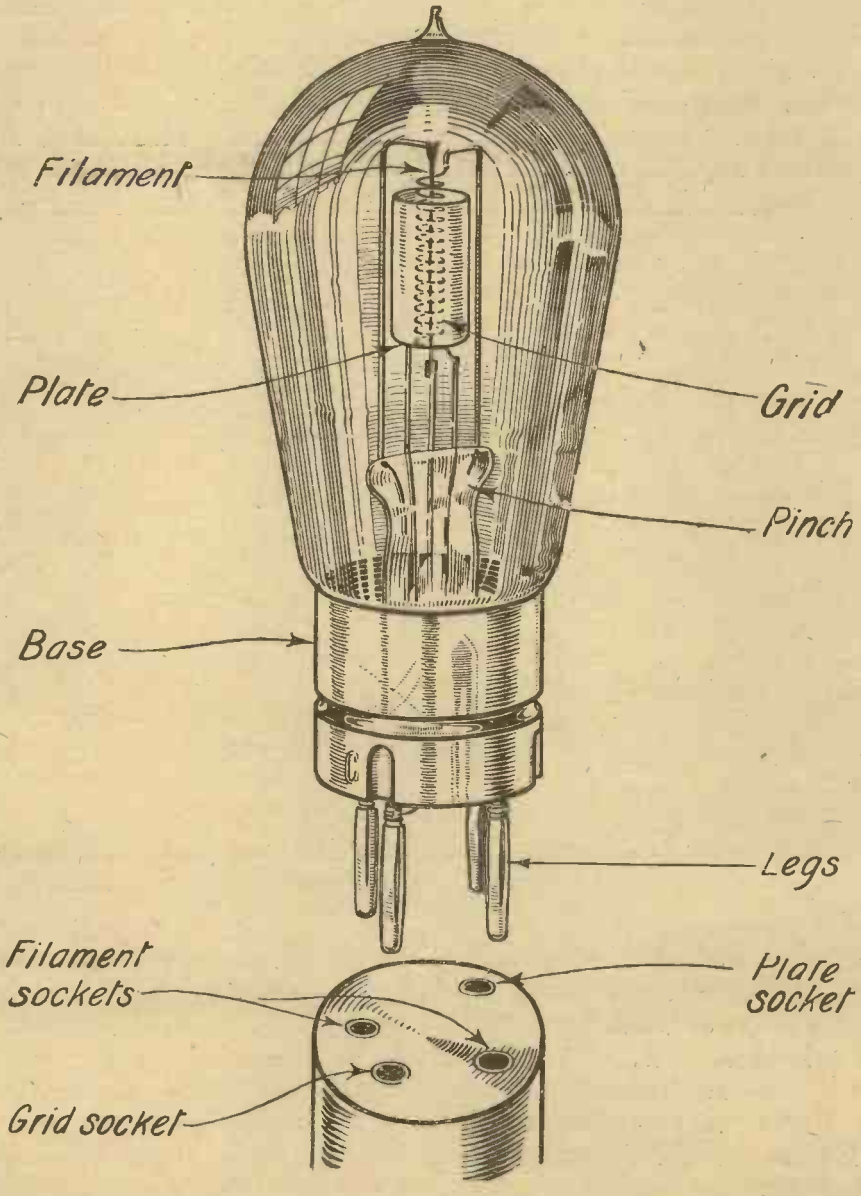
One of these electrodes consists of a metal filament capable of being raised to a red-hot or white-hot temperature by the passage of an electric current through it. Another electrode is called the plate, because in the early valves it took the shape of a flat plate of metal. Nowadays it is more usually in the form of a cylinder enclosing, and concentric with, the filament.

The third electrode is situated between the other two. When the plate really was a flat plate this third electrode took the form of a wire mesh, and is still called the grid. In modern valves the grid is generally a spiral of wire concentric with, and placed between, the filament and plate.

Although the valve has only three electrodes, four connections will be found on the outside of the valve, as a connection must be provided to each end of the filament. These four connections are usually in the form of four pins, mounted on the base of the valve, which plug into corresponding sockets in the valve-holder (which is mounted on the set). Both pins and sockets are irregularly spaced, so that it is impossible to insert the valve into its socket incorrectly.

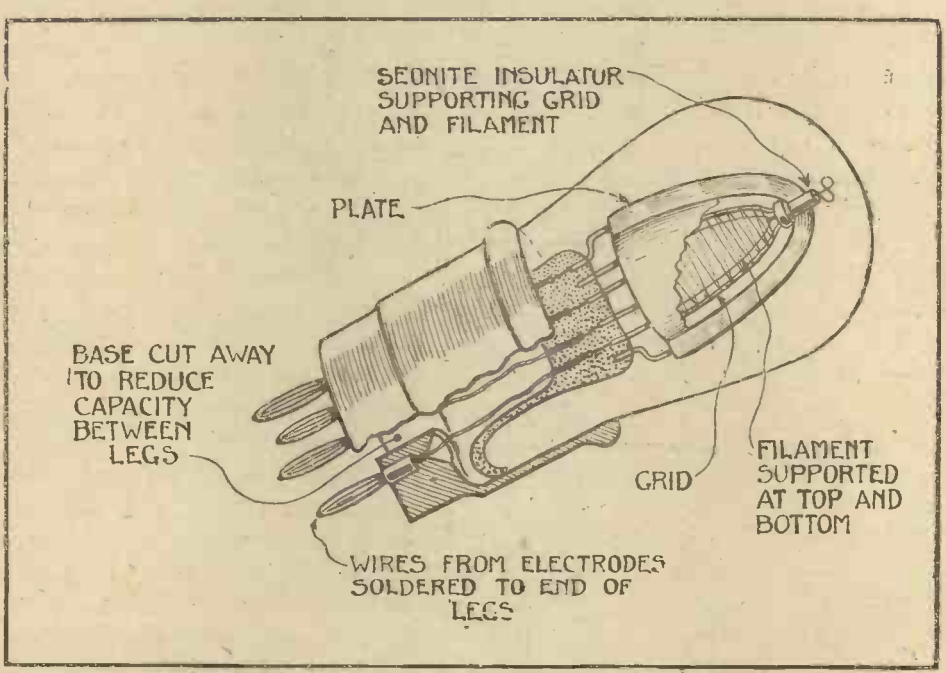
Heating the Filament. — When the valve is in use a suitable battery (having a voltage not usually exceeding six) is connected across the ends of the filament through a variable resistance. The heating effect of the current which flows through the filament raises the temperature of the latter. The heating effect of an electric current upon a conductor depends upon the magnitude of the current and the resistance of the conductor. The resistance of the filament is practically constant, but the amount of current flowing through it is controlled by altering the value of the variable resistance inserted in series with filament and battery. This resistance is termed the filament resistance.

THE VALVE AND ITS PARTS



This illustration shows the construction of a typical valve. The filament, grid, and plate are supported clear of each other within the glass bulb, from which all air is withdrawn. Leads from the three electrodes are taken through the "pinch" to the unevenly-spaced legs.

The setting of the filament resistance, therefore, determines the temperature to which the filament is heated. When the temperature of the filament has been sufficiently raised electrons are thrown off from the filament wire. In some cases the filament consists entirely of metal, when the temperature required to enable sufficient electrons to be liberated is very high. This is a disadvantage both from the point of view of the life of the valve (which is exactly as long as the life of the filament) and the amount of current required to heat the filament to the necessary high temperature.



Most valves have cylindrical grids and plates; the above Valve (Cossor) is an example with hood-shaped grid and plate.

Dull-emitting Filaments. — Therefore in many valves certain earths are incorporated in the filament or the filament is coated with certain oxides, which processes enable the filaments to be run at a much lower temperature than would otherwise be the case. This both lengthens the life of the valves and reduces the amount of current taken from the filament battery.

Valves of the first-mentioned type are called bright-emitter (or B.E.) valves and the others dull-emitter (or D.E.) valves in reference to the working brightness of the filament in each case.

The electrons, being particles of negative electricity, will be attracted by any object in their vicinity which is positively charged in accordance with the well-known law, which applies both to electricity and magnetism, that like repels like, while unlikes attract each other in proportion to the strength of the charges.

H.T. Battery. — The positively charged object in this case is the plate, between which and the filament is connected externally a high-tension (or H.T.) battery, so-called to distinguish it from the low-tension (or L.T.) battery, which provides the heating current for the filament.

The H.T. battery is connected with its positive end to the plate and its negative end to the filament, thus making the former very positive with respect to the latter.

Positive and Negative Currents.— The electrons thrown off from the filament are attracted by the positive plate, to which they flow. This means that a current is set up between the filament and plate. This current is, however, a current of electrons (or a current of negative electricity), and is equivalent to an equal flow of positive electricity in the opposite direction.

This flow of positive electricity does not really exist in the thermionic valve; but, in spite of this fact, the plate is sometimes referred to as the anode (meaning the electrode at which current enters), while the filament is also known as the cathode (or electrode at which the current leaves). All this is rather puzzling, but in the study of how the valve works it is better to concentrate the attention upon the electron flow which really takes place and to forget all about the hypothetical positive flow. It must be remembered, however, that negative electricity flows from negative to positive.

Plate Current. — We have now established within the valve a flow of electricity in one direction only—from filament to plate. What use is this to us? The valve is so valuable as an amplifier because it is found that a very slight alteration of the potential of the grid, situated between the filament and the plate, causes a comparatively great change in the volume of the current flowing between filament and plate (this current being generally termed the plate or anode current).

Effect of Grid Potential.—If the signals to be amplified are applied between the grid and filament they cause the potential of the former to vary with respect to the latter. When the grid becomes positive it helps the electrons to reach the plate, but when it is made negative it tends to restrain them from so doing.

When signals are applied to the valve in the manner described, therefore, the anode or plate current is varied in accordance with the signals. Moreover, these variations in the plate current are, under suitable conditions, much greater than the variations in the signals current which produce them. The valve is especially valuable in that there is no appreciable lag in its action. The response of the plate current to the signals is practically instantaneous.

Valve as H.F. Amplifier.—To use the valve as a H.F. amplifier, in order to increase the range of a crystal set, the apparatus is arranged as follows. The aerial and tuner are left unaltered, but instead of the crystal and phones being connected across the tuner the grid of the valve is connected to the aerial side of the tuner and the filament to the earth side. The oscillatory currents flowing in the tuner

therefore cause the necessary fluctuations of potential between the filament and the grid. In the plate circuit of the valve, between the plate and the positive side of the H.T. battery, is inserted another tuned circuit consisting either of a coil and condenser or a variometer, which is exactly tuned to the frequency of the signals in the grid circuit. Across this second tuner is placed the crystal and phones, so that the oscillatory currents are rectified by the former and made audible by the latter in the usual way. The difference is that instead of the original signals being applied to the crystal it is the amplified signals which are so applied.

Valve as L.F. Amplifier.— When the desire is not to increase the range of the set, but to make the stations already within range more distinctly audible in the phones, or to increase the strength of the signals so that a loud-speaker may be worked, the connections of the crystal set to the tuner are not interfered with. Instead, the phones are removed from the terminals of the crystal set and their place is taken by the primary of a step-up transformer. The secondary of this transformer is connected between the grid and filament of the valve.

The oscillatory currents, due to the received waves, are then rectified by the crystal in the same way as before, but instead of the rectified current flowing through the windings of the telephones they are passed through the transformer primary instead. They emerge from the secondary stepped up in voltage (but down in current, which, however, does not matter, as it is only the potential of the grid which counts) and are so applied to the valve.

The telephones are connected in the plate circuit of the valve, and it is consequently the amplified L.F. currents which operate these.

Valve as Reflex Amplifier.—If desired, it is possible to use two valves in conjunction with a crystal set—one as H.F. amplifier and the other as L.F. amplifier. In such a case both the range and volume of the set will be increased.

A more economical way is to use one valve only as both H.F. and L.F. amplifier. We then make use of dual, or reflex, amplification, and this is undoubtedly the most economical way of using a single valve and a crystal.

There are many ways of combining the H.F. and L.F. circuits in a reflex set, but only one of the more popular need be described here. The aerial tuner is connected across the grid and filament of the valve, but between the earth side of the tuner and the filament is inserted the secondary of the L.F. transformer. A circuit, tuned to the H.F. oscillations, is included in the plate circuit of the valve, and across this circuit are the crystal and transformer primary in series with each other. The phones are in the plate circuit of the valve, between the tuned H.F. circuit and H.T. positive.

How Signals are Dealt With.—The incoming signals operate the valve as a H.F. amplifier passing across the secondary of the transformer through a small condenser connected in parallel with it for the purpose. After being amplified by the valve the H.F. signals are rectified by the crystal and flow through the transformer primary.

Name and Type	Filament Volts	Filament Current	Anode Volts	Use
Amplion A.M.G. 2/25	2	·25	120	G.P.
„ A.M.L. 2/30	2	·3	120	P.A.
„ A.M.R. 2/9	2	·09	120	R.A.
„ A.M.G. 6/9	6	·09	120	G.P.
„ A.M.L. 6/25	6	·25	120	P.A.
„ A.M.R. 6/9	6	·09	120	R.A.
„ A.M.S. 6/100	6	1·0	360	P.A.
Benjamin S.P. 18/R.	1·6–1·8	·3	120	P.A.
„ S.P. 18/G.	1·6–1·8	·3	120	G.P.
„ S.P. 18/B.	1·6–1·8	·09	60–120	R.A.
„ S.P. 55/B.	5·5	·09	60–120	R.A.
„ S.P. 55/R.	5·5	·25	120	P.A.
„ D.E. 55	5·5	·09	120	G.P.
B.S.A. G.125	·85–1·1	·25	30–60	G.P.
„ C.125a	·85–1·1	·25	30–60	G.P.
„ H.125	·85–1·1	·25	15–30	H.F.
„ H.125a	·85–1·1	·25	15–30	H.F.
„ G.225	1·7–2·2	·25–·28	60–120	G.P.
„ P.425	3·5–4·4	·25–·28	130	P.A.
„ P.425a	3·5–4·4	·25–·28	130	P.A.
„ P.612	5·4–6·6	·12–·14	130	P.A.
B.T.H. B.2	5	·7	40–120	G.P.
„ B.3	1·8	·35	20–60	G.P.
„ B.4	6	·25	40–120	P.A.
„ B.4H.	6	·25	60–120	H.F.
„ B.5	2·8	·06	20–80	G.P.
„ B.5H.	2·8	·06	20–80	H.F.
„ B.6	2·8	·12	40–120	P.A.
„ B.7	6	·06	40–120	P.A.
„ B.11	6	·5	200	P.A.
„ R.	4	·7	40–100	G.P.
Burndept H.L. 565	4–5	·65	30–90	G.P.
„ H.L. 213	1·8–2	·13	30–90	G.P.
„ L. 240	1·8–2	·4–·45	120	P.A.
„ H.L. 310	2·8–3	·1	30–90	G.P.
„ H. 310	2·8–3	·1	40–60	H.F.
„ H.L. 425	3·5–4	·22–·25	30–120	G.P.
„ H.L. 512	4–5	·12	40–90	G.P.
„ H. 512	4–5	·12	45–60	H.F.
„ L. 525	4–5	·25	90–150	P.A.
„ L.L. 525	5·0	·25	90–170	P.A.
Cleartron C.T. 03	3	·08	30–100	G.P.
„ C.T. 08+	3	·15	60–120	P.A.
„ C.T. 15	1·8–2	·15	30–100	G.P.
„ C.T. 15+	2	·3	60–120	P.A.
„ C.T. 25	5	·25	30–150	G.P.
„ C.T. 25+	5	·5	6–180	P.A.
„ C.T. 25B.	5	·25	8–200	R.A.
Cosmos S.P. 18/R.	1·6–1·8	·3	120	P.A.
„ S.P. 18/G.	1·6–1·8	·3	120	G.P.
„ S.P. 18/B.	1·6–1·8	·09	80–120	R.A.
„ S.P. 55/B.	5·5	·09	60–120	R.A.
„ S.P. 55/R.	5·5	·25	120	P.A.
„ D.E. 55	5·5	·09	120	G.P.
„ A. 45	4·5	·65	120	G.P.
„ D.E. 11	1·1	·25	20–120	G.P.
Cossor P. 1	4–4·5	·7	30–120	G.P.
„ P. 2	4–4·5	·7	30–120	H.F.
„ P. 3	4–4·5	·175	30–120	P.A.
„ W. 1	1·6–1·8	·3	50–150	G.P.
„ W.2	1·6–1·8	·3	30–120	H.F.
„ W.3	1·6–1·8	·5	50–150	P.A.

The L.F. currents produced in the secondary then act upon the grid of the valve through the aerial tuning coil, which passes the L.F. impulses as though it were merely a straight piece of wire. Finally, the amplified L.F. currents flowing in the plate circuit of the valve act upon the telephones.

Of course, it should be understood that more than one H.F., L.F. or reflex valve may be included in a set, but the latter becomes very difficult to operate if more than one H.F. valve is employed, and much more so when the number of reflex stages is extended.

The Valve as a Detector. — The thermionic valve, in addition to its usefulness as an amplifier, is used as a detector or rectifier (two words usually meaning much the same thing). When so used it is, from many points of view, much more satisfactory than a crystal. For one thing the sensitivity is greater, but, more important than this, it is perfectly stable in operation. There is not the need for constant adjustment, as is the case when a crystal is used, in order to maintain maximum sensitivity.

Characteristic Curve. — There are two methods of using the valve as a detector. The oldest and most easily understood consists of making use of one of the bends of the "characteristic curve." This curve is a graph showing how the anode current varies with alterations of the grid voltage.

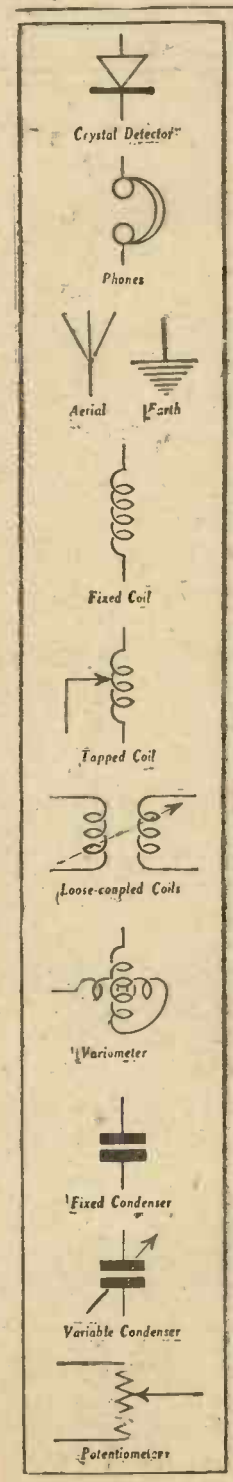
A little thought will show that this curve cannot be indefinitely long. The beginning of the curve will represent the point at which the grid is just sufficiently negative to prevent entirely the flow of electrons from the filament. The curve does not then, of course, exist, but if the grid is made the slightest bit more positive the anode current will at once make its appearance. This point is called the lower bend of the curve.

The upper bend is reached when the grid has been made sufficiently positive to enable all the electrons being emitted by the filament to reach the plate. Any further increase in the positive potential of the grid cannot then have any effect on the anode current, and the curve consequently stops travelling upwards at this point and continues in a horizontal line.

Anode Rectification.—If the valve is worked at either of these points it is obvious that only half of each alternation applied to the grid can have any effect on the anode current. When worked on the bottom bend those halves of the alternations which make the grid positive will enable anode current to flow; while when the upper bend is used the negative half-alternations will be effective, as they will cause reductions in the value of the anode current. When a valve is used in either of these ways "anode rectification" is said to be employed, with reference to the fact that the bends on the anode—current-grid—volts curve are utilised. The potential of the grid is suitably adjusted by means of a potentiometer.

Grid Rectification.—Anode rectification is now seldom used, as "grid rectification," or the leaky grid condenser method, is found to give stronger results. In this method use is made of the fact that when the grid is made positive with respect to the

Name and Type	Filament Volts	Filament Current	Anode Volts	Use
Cossor WR.1	1·6–6	·3	30–120	G.P.
„ WR.2	1·6–6	·3	30–120	H.F.
„ Point One (Fed Top)	1·8	·1	120	H.F.
„ Point One (Plain Top)	1·8	·1	120	G.P.
„ Stentor Two (Green Top)	1·8	·15	150	P.A.
Economic Dextraudion	2	·35	40–75	G.P.
„ „	3	·06	40–75	G.P.
„ „	4	·06	40–75	G.P.
„ „	3	·12	60–120	P.A.
„ Xtraudion	4	·4	60–120	G.P.
Ediswan R.	4	·75	20–100	G.P.
„ A.R. (Red Line)	4	·75	30–80	H.F.
„ A.R. (Green Line)	4	·75	30–80	G.P.
„ A.R.D.E. (Red Line)	1·8–2	·3	20–100	H.F.
„ A.R.D.E. (Green Line)	1·8–2	·3	30–100	G.P.
„ A.R. 06 (Red Line)	2·5–3	·06	20–100	H.F.
„ A.R. 06 (Green Line)	2·5–3	·06	20–100	G.P.
„ D.R.2	1·8–2	·1	40–80	D.
„ G.P.2	1·8–2	·1	60–120	G.P.
„ G.P.4	3·5–4	·15	60–120	G.P.
„ R.C.2	1·8–2	·1	80–120	R.A.
„ P.V.2	1·8–2	·15	80–120	P.A.
„ P.V.4	3·5–4	·35	60–120	P.A.
„ P.V.5 D.E.	5	·25	50–150	P.A.
„ P.V.6 D.E.	1·8–2	·1	80–120	P.A.
„ P.V.8 D.E.	3	·12	60–120	P.A.
Louden F.1	5·5	·4	40–80	L.F.
„ F.2	5·5	·4	40–80	H.F.
„ F.3	5·5	·4	40–80	D.
„ L.E.R.1	2	·2	40–80	L.F.
„ L.E.R.2	2	·2	40–80	H.F.
„ L.E.R.3	2	·2	40–80	D.
„ F.E.R.1 (4v.)	4	·1	40–80	L.F.
„ F.E.R.2 (4v.)	4	·1	40–80	H.F.
„ F.E.R.3 (4v.)	4	·1	40–80	D.
„ F.E.R.1 (6v.)	6	·1	40–80	L.F.
„ F.E.R.2 (6v.)	6	·1	40–80	H.F.
„ F.E.R.3 (6v.)	6	·1	40–80	D.
„ P.E.R.1 (4v.)	4	·2	60–200	L.F.
„ P.E.R.2 (4v.)	4	·2	60–200	R.A.
„ P.E.R.1 (6v.)	6	·2	60–200	L.F.
„ P.E.R.2 (6v.)	6	·2	60–200	R.A.
Marconi R.5V	5	·7	30–120	G.P.
„ D.E.R.	1·8	·35	30–80	G.P.
„ D.E.2 L.F.	1·8	·12	20–80	L.F.
„ D.E.3	2·8	·06	20–80	G.P.
„ D.E.4	3·8	·3	20–120	L.F.
„ D.E.5	5–6	·25	20–120	P.A.
„ D.E.5a	5–6	·25	120	P.A.
„ D.E.5b	5–5	·25	60–150	R.A.
„ D.E.6	1·8–2	·5	60–120	P.A.
„ D.E.7	1·8	·4	6–15	*
„ D.E.8 L.F.	5·6–6	·12	20–100	L.F.
„ D.E.8 H.F.	5·6–6	·12	20–120	H.F.
„ L.S.5	4·25–5·25	·8	60–400	P.A.
„ L.S.5a	4·25–5·25	·8	60–400	P.A.
„ L.S.5b	4·25–5·25	·8	60–400	P.A.
„ D.E.V.	3	·2	20–60	H.F.
„ D.E.Q.	3	·2	20–60	D.
„ V.24	5	·75	20–60	H.F.
„ Q.X.	5	·75	20–100	D.
„ F.E.3	4	·7	6–15	*



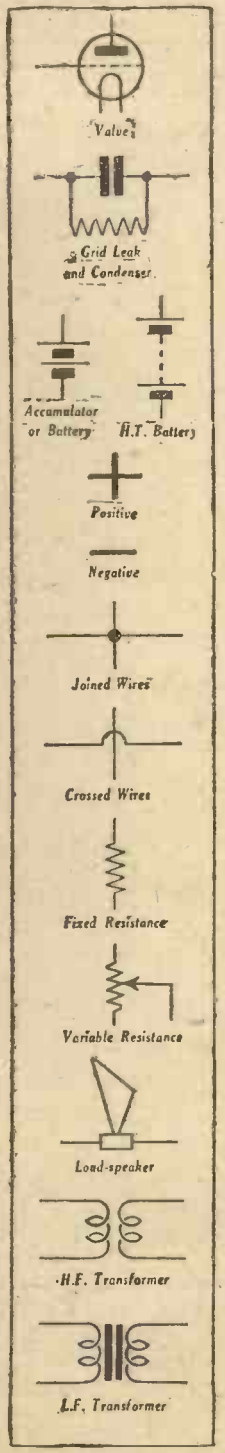
filament it acts, on a small scale, as an anode in that a certain number of electrons are attracted to it. In other words, a current can flow between the filament and the positive grid in one direction but not in the other.

Hence rectification is simply attained by applying the oscillatory currents to the valve in such a way that they are rectified by the one-way conductivity of the space between filament and grid.

Grid Condenser and Leak.—This is not all, however. In series with the grid of the valve is connected a condenser usually having a value of .0003 microfarad, and the rectified signals are used to charge this condenser. The side of the condenser next to the grid of the valve will be negatively charged, as it is negative electricity which is reaching the grid. In this manner a group of H.F. oscillations is enabled to produce a cumulative effect, enabling a much bigger change in the grid potential to be obtained than if each oscillation affected the grid potential separately.

It should be noted that this latter method of rectification causes the anode current to be reduced below normal, but it is sufficient for our purpose if we produce *variations* in the current. It does not matter whether these variations represent increases or decreases of the current.

As the grid would become more and more negative, until the anode current was entirely stopped if the charge on the condenser were allowed to increase indefinitely, some means of releasing this charge at a suitable rate must be provided. Accordingly a high resistance, usually of two million ohms (two



Name and Type	Filament Volts	Filament Current	Anode Volts	Use
Mullard Ora A	3·4–3·8	·6–·7	30–90	G.P.
„ Ora B	3·4–3·8	·6–·7	30–70	H.F.
„ R.A.	3·6–4·0	·6–·7	50–150	G.P.
„ S.3	3·6	·65	15–50	G.P.
„ S.5	3·6	·65	15–50	D.
„ S.6	3·0	·2	25–10	R.A.
„ Wecovalve	·8–1·1	·25	15–50	G.P.
„ D.3 H.F.	2·0	·3	50–125	H.F.
„ D.3 L.F.	2·0	·3	30–100	L.F.
„ D.3 Det.	1·6–2·0	·3	20–100	D.
„ D.06 H.F.	3·0	·06	50–125	H.F.
„ D.06 L.F.	3·0	·06	30–100	L.F.
„ D.06 Det.	2·5–3·0	·06	20–100	D.
„ D.F.A.0	3·5	·35	50–100	P.A.
„ D.F.A.1	5·5	·2	50–100	P.A.
„ D.F.A.2	3·5	·2	50–100	P.A.
„ D.F.A.3	5·5	·06	50–100	P.A.
„ D.F.A.4	5·5	·2	50–250	R.A.
„ H.F.	3·2–3·8	·6	30–90	H.F.
„ L.F.	3·2–3·8	·6	30–90	L.F.
„ D.G.	3·4–3·8	·6–·7	0–30	*
„ P.M.1 H.F.	1·8	·1	50–100	H.F.
„ P.M.1 L.F.	1·8	·1	50–100	L.F.
„ P.M.2	1·8	·15	50–100	P.A.
„ P.M.3	3–3·7	·1	50–100	G.P.
„ P.M.4	3–3·7	·1	50–100	P.A.
„ P.M.5	5–6	·1	50–100	G.P.
„ P.M.6	5–6	·1	50–100	P.A.
„ D.P.425	3·8	·25	50–150	P.A.
Nelson Multi A	4	·45	30–100	G.P.
„ „ D.E.2	1·8	·35	30–80	G.P.
„ „ D.E.06	2·8	·06	30–80	G.P.
„ „ D.E.A.	2·6	·18	30–80	G.P.
„ „ D.E.5	5	·1	30–80	G.P.
„ „ D.E.5B.	5	·1	30–80	G.P.
Osram (*see* Marconi)—				
Radion A.2	3·6–4·0	·25	30–90	H.F.
„ G.P.	3·6–4·0	·48	30–80	G.P.
„ D.E.34	1·6–2·0	·34	20–80	G.P.
„ D.E.06	3·0	·06	20–90	G.P.
„ D.E.06 H.F.	3·0	·06	20–80	H.F.
„ Pyramid 1	5·5	·34	60–100	P.A.
„ „ 2	4	·34	40–120	P.A.
„ „ 3	3·7–4	·18	40–120	P.A.
„ „ 4	2	·7	40–120	P.A.
„ Non-ring H.F.	2·7–3	·06	40–120	H.F.
„ „ L.F.	2·7–3	·06	40–100	L.F.
Six-sixty S.S.1	3·7	·66	50–100	G.P.
„ S.S.2	2	·3	50–125	H.F.
„ S.S.2a H.F.	1·8	·1	50–100	H.F.
„ S.S.2a L.F.	1·8	·1	50–100	L.F.
„ S.S.3 H.F.	3·0	·06	50–125	H.F.
„ S.S.3 L.F.	3·0	·06	30–100	L.F.
„ S.S.4	5·0	·25	50–125	P.A.
„ S.S.5	5·5	·06	50–100	P.A.
„ S.S.6	5	·25	75–125	R.A.
„ S.S.7	3·7	·1	30–100	P.A.

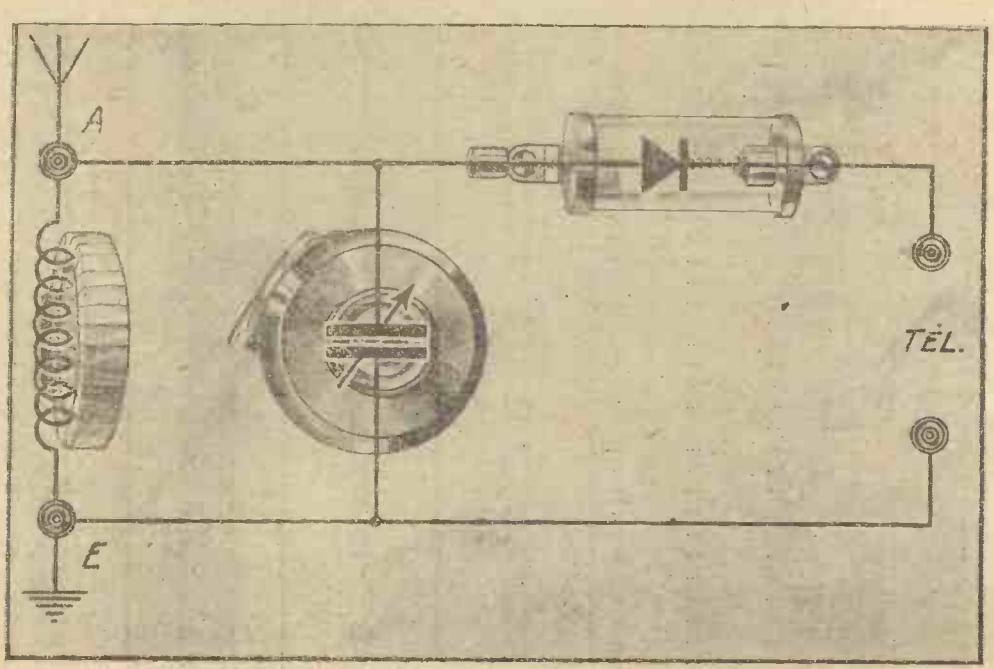
NOTE.—G.P.=General Purpose. H.F.=High-frequency Amplifier. L.F.=Low-frequency Amplifier. D=Detector. R.A.=Resistance Amplifier. P.A.=Power Amplifier. * = 4-electrode.

megohms), is connected either across the condenser or between grid and filament of the valve. Through this resistance the charge is allowed to leak away, and this resistance is appropriately called the grid leak.

Reaction.—One advantage of using the valve, instead of the crystal, as detector is very important. It lies in the possibility of making use of what is known as reaction. We have already established the fact that the valve is, first and foremost, an amplifier, and even when used as a detector a certain amount of amplification takes place.

This means that the signals in the plate circuit of the valve are of considerably greater amplitude than those in the grid circuit, to which they correspond. As the plate circuit signals represent a greater amount of energy than the grid circuit signals, it is possible to transfer some of the plate circuit energy back into the grid circuit in order to reinforce the signals there.

This is done simply by coupling the two circuits together either magnetically or electro-statically—either by coupling two coils, one in each circuit, together, or by connecting suitable points in the two circuits by means of a variable condenser. Occasionally both methods are used simultaneously.



An illustration showing how the circuit diagram and wiring diagram of a set correspond. It shows the components of a simple crystal set—coil, variable condenser, crystal detector and four terminals—mounted on a glass panel. The lay-out is one that might be used in an actual receiver. Super-imposed on the individual pictures of the components are the conventional wireless signs used in circuit diagrams to represent components. These symbols, when joined up by the black lines, form the circuit diagram of the set, the lines also corresponding to the actual wiring of the receiver. We have, then, a combined circuit and wiring diagram.

Effect of Reaction.—The effect of applying reaction is to counteract, to some extent, the losses in the grid circuit occasioned by resistance. If reaction is carried far enough the effect of the resistance will be completely neutralised, in which case oscillations, once started, will continue indefinitely. The valve is then said to be oscillating. As a matter of fact, it is by means of oscillating valves that the high-frequency currents are produced which cause the electro-magnetic waves to be radiated from the transmitting aerial.

Reaction, though it is a great advantage for purposes of reception, should never be carried so far that any of the receiving valves oscillate. This would make clear reception impossible, and would, moreover, cause waves to be radiated from the receiving aerial which would interfere with other receivers over a very wide area.

Although reaction is usually taken from the plate circuit of the detector valve, it is also possible to couple the plate and grid circuits of a H.F. valve together for the same purpose. This is a useful method of obtaining reaction when a crystal detector follows a H.F. valve.

How to Read Circuit Diagrams.—It is very easy to follow a wiring diagram. Here all the components are shown in plan and are easily recognisable. The various leads are shown by lines connecting the different components together.

It is not more difficult to read a cir-

cuit diagram when once the symbols representing the components have been thoroughly memorised, but the signs for the components are not necessarily arranged in the exact positions which they occupy in the set, but are so disposed that the nature of the circuit will be as clear as possible. In the set, and in its wiring diagram, a wire might be run from point A to point B and thence to C and D, but in the circuit diagram it might be more convenient to show A and D connected together and also B and C, and then to show a connection between the lead that connects A and D and that which joins B and C. It all comes to the same thing. These four points are all connected together, and it would not make any difference if the exact sequence of connecting up in the set were altered.

How to Take Up Wireless.—If the reader has gone steadily through the book as far as this point he will have gained some idea of the functions of the main components of wireless receiving sets and the way in which they are carried out.

This will enable him to take an intelligent interest in any apparatus he may subsequently acquire, and will greatly add to the pleasure he will derive from listening to broadcast programmes.

Obtaining Licence.—We will suppose that he now wishes to make a beginning in wireless. The first thing he should do, even before erecting an aerial, is to obtain a licence. This he can obtain over the counter of any post office on payment of ten shillings, and it will be valid for twelve months from the end of the month preceding that in which it is taken out.

Having obtained his licence, he can now proceed to erect the aerial system. The aerial, as previously mentioned, should not exceed one hundred feet in length from the end of the down lead to the insulator at the free end. This limit does not apply to the actual length of wire allowed (to which there is no limit laid down), but to the length of the aerial taken as a whole.

Of course, in the case of a single-wire aerial the length of wire will be the same as the length of the aerial, but we can use two, three, four, or any number of 100-foot wires connected in parallel.

The aerial should be as high as possible and as long as the space available will allow, subject, of course, to the hundred-foot limit.

Erecting Aerial.—The end of the aerial farther from the house should be the higher end, and the down lead, if an inverted L aerial is used, should be taken from the lower or house end. An acute angle between the down lead and flat-top portion of the aerial should be strictly avoided.

There should, if possible, be no bend

The second part of this book, to be presented as a gift with "Amateur Wireless" published on Oct. 21, will contain much valuable information, including Designing and Constructing Sets—The choice of valves—The choice of H.T. and L.T. batteries—Care and Maintenance of accumulators—Eliminating batteries and utilising the A.C. or D.C. lighting mains instead.

in the flat-top portion, and if the aerial can be made eighty or more feet long a single wire will generally be best to use. In the case of shorter aerials two wires may be employed. They should be spaced at least six feet apart, and should not be joined except at the lead-in insulator. They should therefore have separate down leads.

The inverted L aerial is the best for amateur use, as a T aerial, for best results, should have the two arms electrically equal. This is seldom possible, as such semi-conductors as buildings, etc., are not often symmetrically disposed beneath the aerial. Other types of aerial are still less suitable, and the L type should be adhered to wherever practicable.

The insulation of the aerial wire must be very thoroughly carried out. It is also important to keep all parts of the wire, including the down-lead, as far away from any walls, drain-pipes, etc., as possible.

The Earth.—The aerial forms only a part of the aerial system, acting as one plate of a condenser, the other plate of which is equally important. This other plate is termed the "earth," though in many cases there is no actual connection to earth at all.

In fact, the most efficient "earth" is a counterpoise. This consists of what might be described as another aerial erected below the first. To be really effective it should contain more wires than the aerial itself, and should be placed immediately beneath the

aerial. The counterpoise should be rather longer than the aerial. It should be run parallel with the surface of the ground and at as little distance above it as is convenient.

The Counterpoise.—When a counterpoise is employed the wires forming it should have a larger capacity to earth than have the wires of the aerial.

Also, when a counterpoise is used the effective height of the aerial is represented by the distance between aerial and counterpoise. This should naturally be made as great as practicable. The insulation of the wires forming the counterpoise is every bit as important as that of those forming the aerial itself.

If a counterpoise complying with the above conditions for efficiency is not a practicable proposition owing to the restricted space available or other reasons, recourse must be had to a connection with the actual ground.

Connection with Ground. — It is highly important that the connection between the end of the earth-wire and the ground should be as good as it is possible to make it. This can be accomplished by attaching the end of the earth-wire to a large sheet of metal (copper or zinc for preference, never iron) which is buried in a vertical position immediately below the aerial. The upper edge of the metal plate should be two or three feet below the surface. This will usually make a very good earth, especially when the ground is damp.

A simpler method of making the earth connection is to solder the earth-wire to a main water-pipe as near as possible to the point at which it emerges from the ground. Whatever type of earth connection is used the earth-wire should be as short as possible, have a low resistance, and be extremely well insulated throughout its entire length.

The same rules with regard to the efficiency of the aerial and earth apply no matter what type of set is to be used.

Choosing Sets.—Having erected a good aerial and made a good earth connection, the next point to be considered is a very difficult one, namely, what type of set is to be used and whether it is to be bought or made.

Several things must influence the decision which must finally be made by the person concerned. Some of the points to be taken into consideration, without any attempt to arrange them in order of relative importance, are as follow:—The amount of money

to be spent. Whether the desire is to begin with simple apparatus or to start straight away with a powerful set. Whether the reception of broadcast programmes is the sole object, or whether pleasure is likely to be obtained from carrying out experimental or constructional work.

In AMATEUR WIRELESS and the WIRELESS MAGAZINE all types of sets are being regularly described with such minute detail that it is scarcely possible to make a mistake. Even should one be made, or any difficulty experienced, there are the Post Reply Services of these two periodicals which will provide a solution of the trouble.

Advantages of Making.—Of the two methods of acquiring a set it is far cheaper to build it oneself, as the cost of the labour in assembling is therefore saved—sometimes a very considerable item.

Then again, most people would derive added pleasure from a set giving good results from the fact that they alone have been responsible for its construction.

On the other hand, if a new set, made by a well-known firm of manufacturers, is bought complete there is the satisfaction of knowing that everything which years of experience in construction can suggest has been done to make the set efficient, reliable and easy to operate.

The Type of Set.—The question of the type of set is intimately bound up with the question of circuits. Cir-

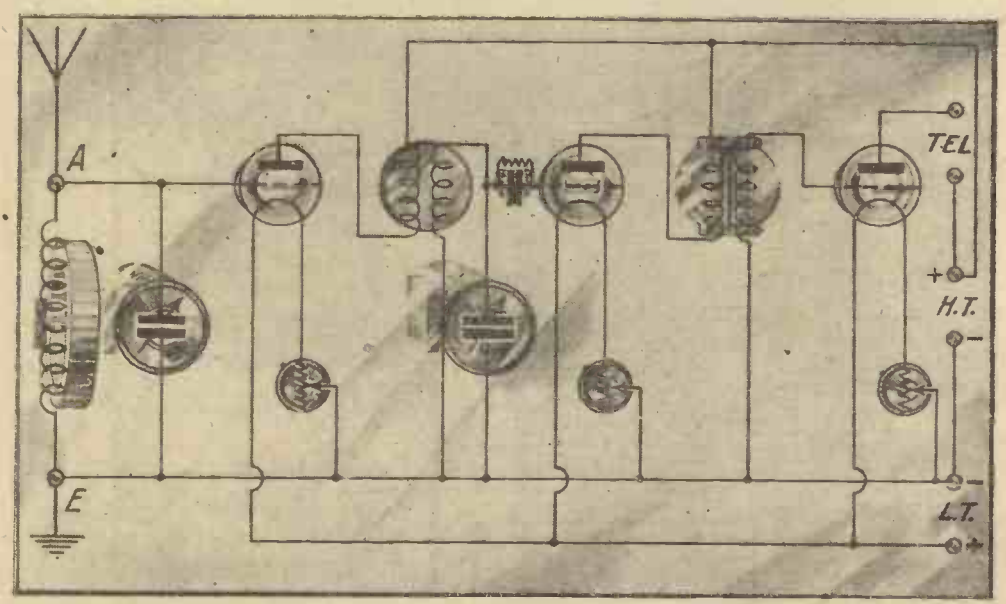
cuit diagrams show, in a simplified form, the method of connecting the various components together. The components are not shown in full detail, but are, instead, represented by convenient symbols. How to read circuit diagrams has already been explained in previous pages.

The first thing to be taken into account is the work the set will be required to do. Will it be sufficient if only the local station and Daventry can be received on the phones? If so, a simple crystal set will usually meet the case. In others, a one-valve set, the valve acting as detector and employing reaction, may be required.

If only the local and high-power stations are required, but they must work a loud-speaker, a crystal set with two L.F. amplifying valves, or a three-valve set consisting of detector and two L.F. valves, should meet the case.

Supposing that headphone reception will satisfy the user, providing that he can receive a great number of stations both near and distant, no L.F. stages of amplification will be needed. One or two H.F. stages will, however, be essential, and may be followed by either a valve or crystal detector.

All-round Set. — Finally, for all-round results with a loud-speaker both H.F. and L.F. amplification must be employed. It may be pointed out that the use of a crystal as rectifier is not usually worth while except in the case of very simple receivers.



Similarly, this illustration shows both the wiring and the circuit diagrams of a much more elaborate receiver—a popular three-valver. The first valve (H.F. amplifier) is transformer-coupled to the detector valve, which is coupled to the final (L.F.) valve by a transformer of a different type. The plates, grids, and filaments will readily be recognised; so will the two windings of each of the transformers. The black line between the windings of the L.F. transformer indicates the presence of an iron core. The small semi-circles in certain of the wires or leads indicate that these leads are not connected to the wire which they cross.

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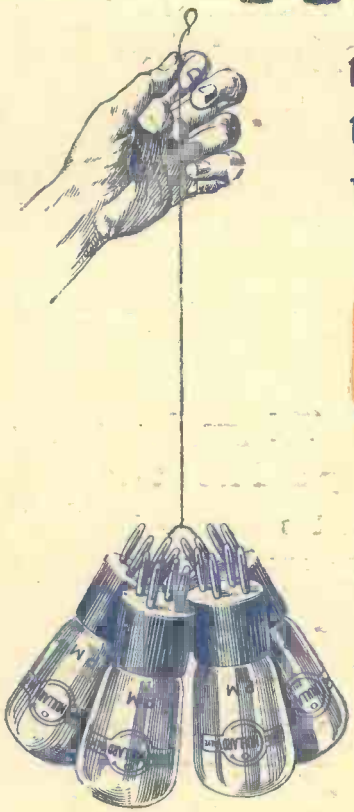

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