Wireless Weekly. April 7th, 1926.

243

3d.

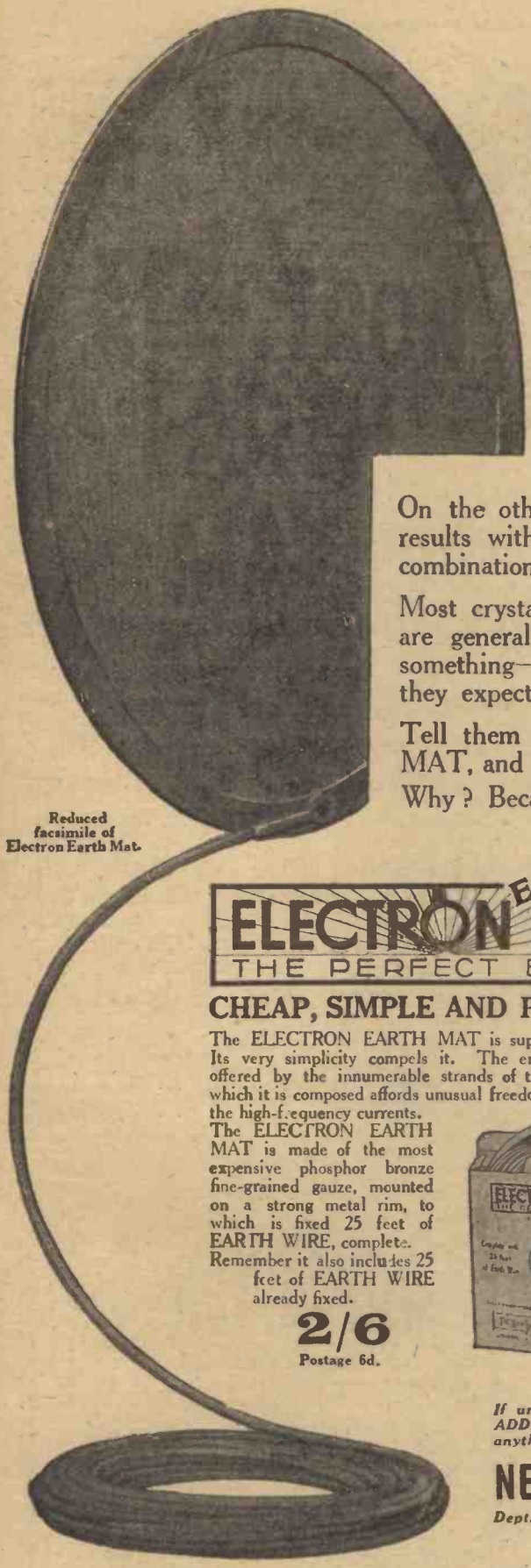
Wireless Weekly

Vol. 8. No. 8.

THE 100% VALVE PAPER

FLEXIBILITY in RECEIVING EQUIPMENT

By H. BRAMFORD



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Wireless Weekly

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EDITED BY

JOHN SCOTT-TAGGART

F.INST. P., A.M.I.E.E.

Technical Editor:

J. H. REYNER, B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

CONTENTS

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Put any BURNDEPT SUPER VALVE to the test

WE are quite willing to abide by your decision as to the merits of Burndept Super Valves. Test them on your set. Carefully compare the performance and you will then understand why we so confidently guarantee every Valve.

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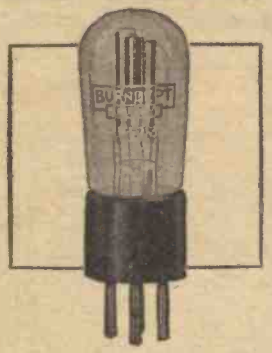

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There are eight valves in the Burndept range and each Valve is designed for a specific purpose. Of special interest are the Burndept dull-emitter valves for use with 2 volt and 4½ volt dry batteries. They are robustly constructed and possess the unique characteristic of being absolutely non-microphonic.

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L. 240
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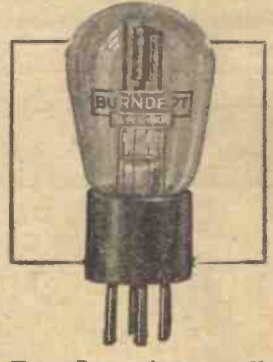

Type L.240 is a small power valve of low impedance and consequently should be used for one or two stages of low frequency amplification when distortionless loud speaker reproduction is desired. A 30 ampere-hour battery will run one of these valves for 75 hours. This valve is 3½ ins. overall in height and has a maximum bulb diameter of 1⅜ ins.

No. 1001. Type L. 240. Power Valve. 2 volts, 0.40 amp. Emission 15 ma. Amplification factor 5.2. Impedance 8,000 ohms. H.T.: 100 v. (grid-4½ v.)

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Flexibility in Receiving Equipment

By H. BRAMFORD

The "unit" system of receiver construction has had a certain vogue, and possesses the attraction of adaptability. Its untidiness, however, is against it, a drawback which is overcome in this equipment in a manner which retains the neat appearance of a cabinet receiver.

AS a departure from the more conventional type of wireless receiver, such as is built up with a definite circuit, the instrument about to be described has been designed upon what may be termed semi-unit lines. Four panels, complete with base-boards, are provided, each panel thus representing, when completed, a complete definite section of a circuit. These panels may be used in conjunction with each other in various ways or may be substituted for other panels as may be desired.

Neat Appearance

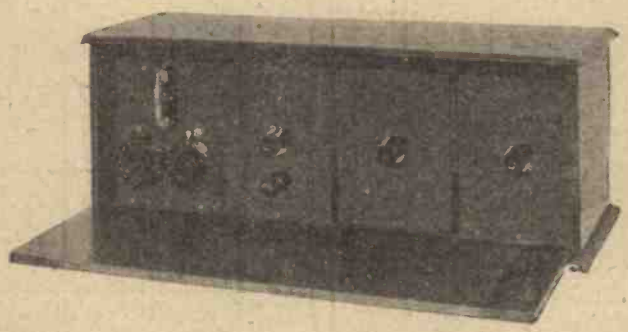
The whole of the panels are enclosed in a neat cabinet of special design, and the instrument, when completed, presents, therefore, a pleasing and tidy appearance. All the components, etc., are also well protected from damage from external sources. A receiver of this type should appeal to those constructors who wish to indulge in progressive experimental work, or to those who wish to advance in successive stages. It is also suitable for those who desire to have a good receiver of continuous interest, and at the same time wish to make *periodical* financial outlay, instead of one collective expense.

Order of Panels

The progressive order of the four panels to be described in this article is as follows:—

1. Tuner with crystal detector. "Panel A."
2. Valve detector. "Panel B."
3. First stage of low-frequency amplification. "Panel C."
4. Second stage of low-frequency amplification. "Panel D."

The uses to which each of these panels may be put, independently, or in conjunction with one another, will be described in order of rotation.



The front of the receiver lets down to expose the panels.

All the connections required for linking up the various panels are made by means of flexible leads passing between the units, each lead being equipped with Clix plugs, Clix sockets to receive the plugs being provided upon the base-board of each individual panel. The whole of this arrangement is inside the cabinet; therefore, once the desired circuit is fixed up the instrument is permanently ready for use.

Spare panels may be made for future use, which the writer hopes to describe at a later date. It must be remembered, however, that, using the panels together with the cabinet specified, only four panels at a time may be used, which will involve the use of three valves.

Tuner Panel

The first panel to be considered is the tuner with crystal detector, "Panel A." The material necessary for this unit will be as

Flexibility in Receiving Equipment—*continued*

follows. Those, however, who may wish to depart from those makes actually specified may do so, but in this case it is advisable to adhere to the make of variable condenser and two-way coil holder suggested in view of the fact that these were specially chosen for panel space.

One two-way coil holder (Woodhall).

One .0005 variable condenser (Utility).

One crystal detector (Service).

One ebonite panel, measuring 8 in. x 6 in. x $\frac{3}{16}$ in. (Radion).

One baseboard measuring 6 in. x $6\frac{1}{8}$ in. x $\frac{3}{8}$ in. (Camco).

Eight Clix sockets (Autoveyors).

Two dial indicators. (Decko.)

Glazite for wiring (London Electric Wire Co.).

Three $\frac{3}{4}$-in. wood screws.

Special all-enclosed cabinet to take all four panels. (Camco.)

Construction

Little need be said as regards the actual construction of this panel, as details of the drilling, together with dimensions, are clearly indicated in the drawing, which shows the front of all four panels respectively in their progressive positions.

this diagram the flexible leads, which are equipped with Clix plugs, are connected to the preceding panels by means of the sockets mounted upon each baseboard. One of the circuits described later in the article is actually shown linked up. This should be quite clear to the reader, as each plug is labelled to indicate its colour.

Circuit

The theoretical circuit, Fig. 2, shows, as before, in diagrammatic form, all the four panels as they appear in progression. This diagram should be helpful for following out the various circuits which may be obtained, and also for wiring-up purposes, if used in conjunction with Fig. 3.

Details are given in Fig. 4 of the construction and method of mounting, upon each of the four baseboards, of the ebonite strips, each of which is provided with eight Clix sockets. These are used for the purpose of receiving the Clix plugs from neighbouring panels.

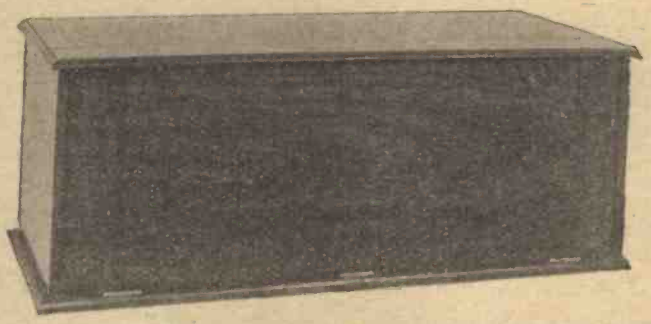
Operation

Having constructed this panel, we are able to proceed at once to use it as a crystal receiver. The connections for linking up a simple direct-coupled crystal circuit would be as follows:—

Aerial to Clix socket 3, of panel A.

Earth to Clix socket 5, of panel A.

'Phones to Clix sockets 4 and 5, of panel A.



The set is entirely self-enclosed, and differs greatly from the early type of unit set.

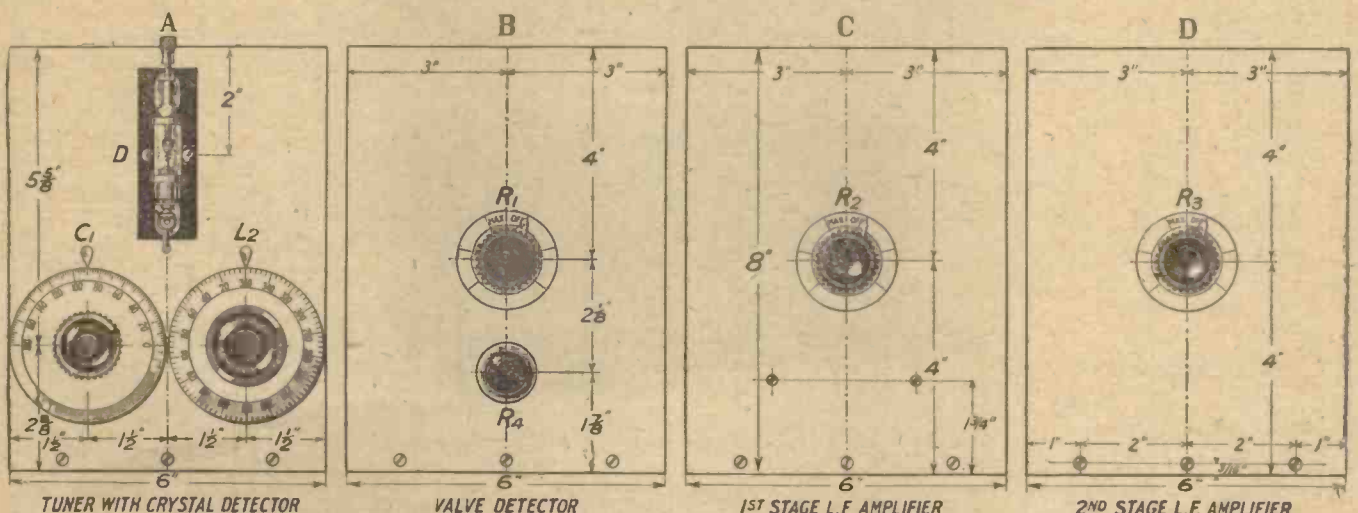


Fig. 1.—The panels are all of the same dimensions and there is very little drilling to be done.

The assembly of the panels in each case will also be followed from this diagram. The details of the assembly on the back of the panel and also all the connections to be made upon each panel are clearly indicated in Fig. 3, which also shows all four panels in order of sequence.

It must be remembered that in

It should be remembered that the aerial, earth and 'phone leads should all be equipped with Clix plugs, each connecting to the above-mentioned sockets, direct to the interior of the receiver.

Valve Detector Panel

The material actually used for

Flexibility in Receiving Equipment—*continued*

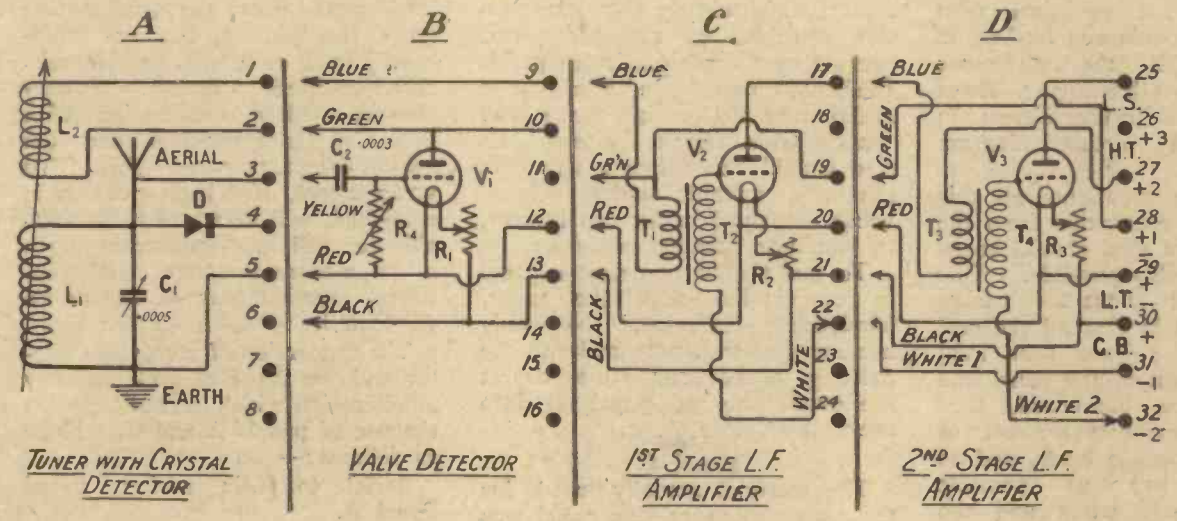


Fig. 2.—This circuit diagram will serve as a key when wiring up different circuits.

the construction of the valve detector panel "B" was as follows:—

One anti-microphonic valve holder (Magnum).

One filament resistance, 30 ohms (Peerless).

One variable grid-leak (Bretwood).

One fixed condenser, .0003 (Wates Bros.).

One ebonite panel measuring 8 in. × 6 in. × $\frac{3}{16}$ in. (Radion).

One baseboard measuring 6 in. × 6$\frac{7}{8}$ in. × $\frac{3}{8}$ in. (Camco).

Eight Clix sockets (Autoveyors).

Five Clix plugs with bushes, blue, green, yellow, red, black (Autoveyors).

Glazite for wiring (London Electric Wire Co.).

3 $\frac{3}{4}$-in. countersunk wood screws.

Construction

The construction of Panel "B" will be a simple matter if reference is made, as before, to the details and dimensions given in Figs. 1 and 3. The wiring should be closely followed from the drawing, which is self-explanatory. All the

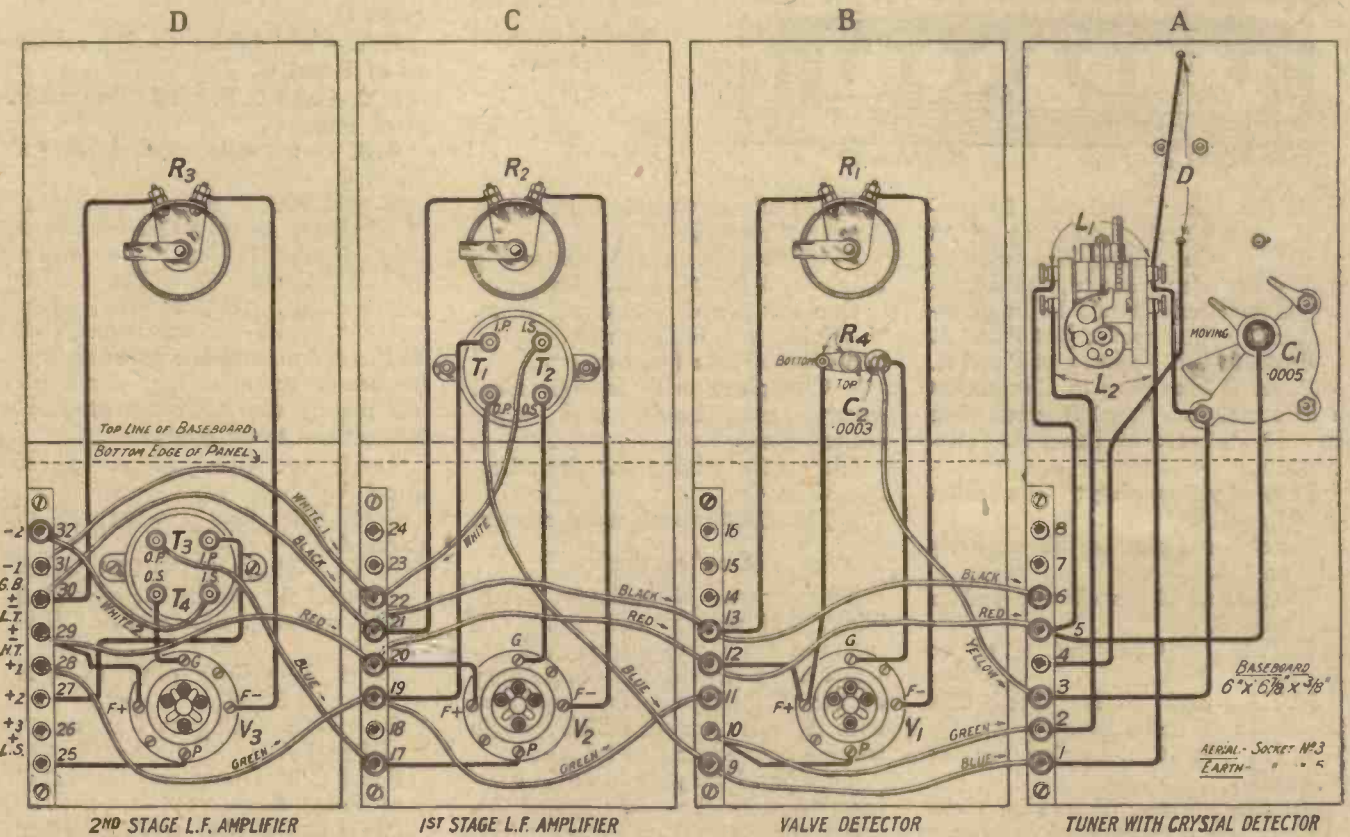


Fig. 3.—Stiff wire is used for the permanent connections and flex for the links between the units.

Flexibility in Receiving Equipment—*continued*

flexible leads are equipped with Clix plugs and coloured bushes, in accordance with the directions given in the drawing. These details are also further shown in the theoretical circuit diagram Fig. 2.

It should be mentioned at this point that the connection from the grid-leak to the grid should be as short as is feasibly possible. One particular point about the wiring of these panels is that all the stiff wire connections have been kept close to the back of the panel and well on to the baseboard, thus allowing a maximum amount of room for the flexible leads, and as little interference as possible between the stiff wires and the actual components.

Operation

To use the valve detector panel B it will be necessary to precede it with the tuner panel A. To connect up a circuit employing direct aerial coupling, using the valve as a detector with reaction, the following connections should be made :—

Aerial to Clix socket 3 of Panel A.

Earth to Clix socket 5 of Panel A.

Panel B blue plug to Clix socket 1 of Panel A. Panel B green plug to Clix socket 2 of Panel A. (Reversible.)

Panel B yellow plug to Clix socket 3 of Panel A.

Panel B red plug to Clix socket 5 of Panel A.

'Phones to Clix sockets 9 and 11 of Panel B.

H.T.+ to Clix socket 11 of Panel B.

H.T.– and L.T.+ to Clix socket 12 of Panel B.

L.T.– to Clix socket 13 of Panel B.

For the purpose of making these various connections, close reference should again be made to Figs. 2 and 3, which clearly show the relative positions of the plugs and sockets upon each particular panel. It should be mentioned here that in addition to the aerial, earth and 'phone leads, all the battery leads also should be equipped with Clix plugs, a suitable colour scheme being employed in the use thereof, to eliminate possible confusion.

To use the valve detector panel in conjunction with the tuner, eliminating reaction, the only necessary alteration to make to the existing connections is to insert the green plug of panel B into socket 1 on panel A.

Panel C

The material actually used for the construction of this panel was as follows :—

One anti-microphonic valve holder (Magnum).

One filament resistance, 30 ohms (Peerless).

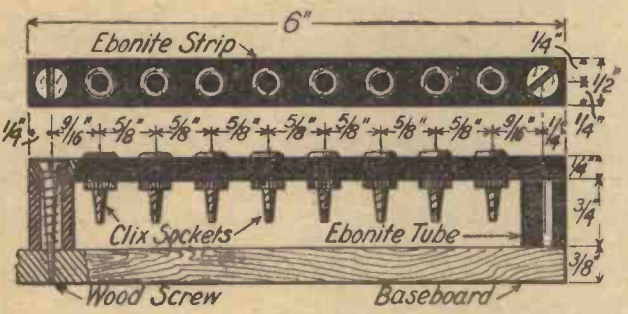


Fig. 4.—The sets of Clix sockets are mounted on strips of ebonite.

One Concert Grand L.F. transformer (Eureka).

One ebonite panel measuring 8 in. × 6 in. × 3/16 in. (Radion).

One baseboard measuring 6 in. × 6 7/8 in. × 3/8 in. (Camco).

8 Clix sockets (Autoveyors).

5 Clix plugs with bushes, blue, green, red, black, and white (Autoveyors).

Glazite for wiring (London Electric Wire Co.).

3 3/4-in. countersunk wood screws.

Construction

The process of drilling, assembling, and wiring will easily be followed from the diagrams, Figs. 1 and 2. Both sides of the primary of the transformer are equipped with flexible leads, which enable reverse connections to be made.

This panel may be used in conjunction with the tuner (panel A), using the crystal detector, which arrangement will give extremely loud signals from the local station upon the 'phones, but not sufficiently loud, as a rule, to give suitable loud-speaker signals. It may also be used in conjunction with both the tuner panel A and the valve detector panel B. This arrangement, if a little reaction is employed, will be found to be suitable for full loud-speaker strength at a moderate range. Alternatively, reaction may of course be eliminated.

The connections for crystal detector and one stage of low-frequency amplification which is obtained with the use of panels A and C, will be as follows :—

Aerial to Clix socket 3 of Panel A.

Earth to Clix socket 5 of Panel A.

Panel C blue plug to Clix socket 4 of Panel A. Panel C green plug to Clix socket 5 of Panel A. (Reversible.)

Panel C white plug to socket 22 of Panel C.

'Phones to Clix sockets 17 and 18 of Panel C.

H.T.+ to Clix socket 18 of Panel C.

H.T.– and L.T.+ to Clix socket 20 of Panel C.

L.T.– and G.B.+ to Clix socket 21 of Panel C.

G.B.– to Clix socket 22 of Panel C.

If grid bias is not used, all that is necessary is to insert the white plug of panel C into Clix socket 21 of Panel C. The other arrangement, that is the tuner panel A, valve detector panel B with reaction, and one stage of low-frequency amplification, panel C, will require the following tabulated connections to be made :—

Aerial to Clix socket 3 of Panel A.

Earth to Clix socket 5 of Panel A.

Panel B blue plug to Clix socket 1 of Panel A. Panel B green plug to Clix socket 2 of Panel A. (Reversible.)

Panel B yellow plug to Clix socket 3 of Panel A.

Panel B red plug to Clix socket 5 of Panel A.

Panel C blue plug to Clix socket 9 of Panel B.

Panel C red plug to Clix socket 12 of Panel B.

Flexibility in Receiving Equipment—*continued*

Panel C black plug to Clix socket 13 of Panel B.

Panel C white plug to Clix socket 22 of Panel C.

'Phones to Clix sockets 17 and 18 of Panel C.

H.T.+ 2 to Clix socket 18 of Panel C.

H.T. + 1 to Clix socket 19 of Panel C.

H.T.– and L.T.+ to Clix socket 20 of Panel C.

L.T.– and G.B.+ to Clix socket 21 of Panel C.

G.B.– to Clix socket 22 of Panel C.

Panel D

The material actually used for the construction of the second-stage low-frequency amplifier, panel D, was as follows:—

One anti-microphonic valve holder (Magnum).

One filament resistance, 30 ohms (Peerless).

One second-stage L.F. transformer (Eureka).

One ebonite panel measuring 8 in. × 6 in. × $\frac{3}{16}$ in. (Radion).

One baseboard measuring 6 in. × $6\frac{7}{8}$ in. × $\frac{3}{8}$ in. (Camco).

Eight Clix sockets (Autoveyors).

Six Clix plugs with bushes, blue, green, red, black, two white (Autoveyors).

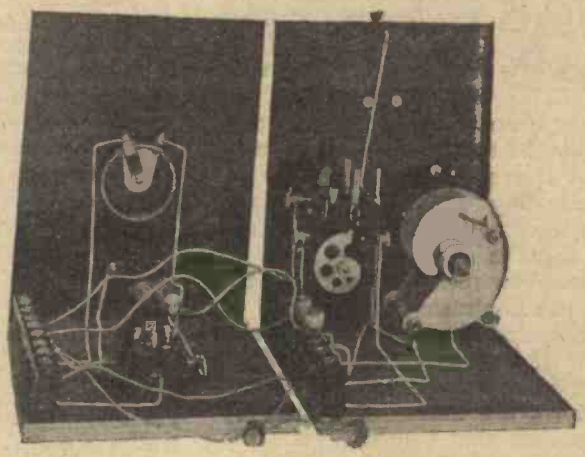
Glazite for wiring (London Electric Wire Co.).

Three $\frac{3}{4}$-in. countersunk wood screws.

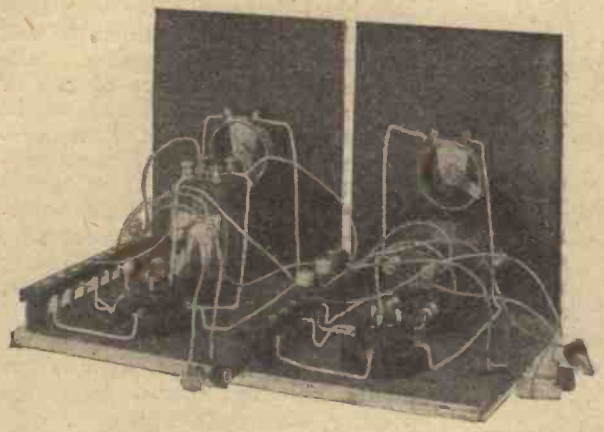
The construction of panel D is similar to that of panel C, with the exception of one or two extra connections. The work entailed may easily be followed from reference to the appropriate diagrams.

Connections

This panel may be used in conjunction with the tuner panel A, the valve detector panel B, and the first-stage L.F. amplifier panel C. This arrangement may of course be employed with or without reaction, and should give full loud-speaker strength on local signals.



A rear view of the first two units, namely, the tuner and valve detector panels.



Panels C and D are the note-magnifying units.

THE "WIRELESS WEEKLY" CALIBRATION SCHEME

As announced in our last issue, measurements will be made at Elstree on April 7 in connection with the *Wireless Weekly* calibration scheme, at the times given below. The exact frequencies of a large number of B.B.C. main and relay stations will be obtained, and in our April 14 issue we shall publish the results.

Station	Time of measurement.
Aberdeen	7.45 p.m.
Swansea	7.50 ,,
Birmingham	7.55 ,,
Belfast	8.0 ,,
Glasgow	8.5 ,,
Newcastle	8.10 ,,
Dublin	8.15 ,,
Bournemouth	8.20 ,,
Manchester	8.25 ,,
London	8.30 ,,
Cardiff	8.35 ,,
Plymouth	8.40 ,,
Hull	8.45 ,,
Liverpool	8.50 ,,
Nottingham	8.55 ,,
Stoke-on-Trent	9.0 ,,
Sheffield	9.5 ,,
Daventry	9.15 ,,

THREE FREQUENCIES OR TWENTY?

The congestion of the European ether is one of the most pressing problems confronting the broadcasting authorities. A most interesting suggestion is made in this article whereby the number of frequencies required in any given country could be reduced to three.

ANYONE who has listened to distant British or foreign stations must have noticed the chaos which is existing in the ether at the present moment. During the past six months there has been a phenomenal increase in the number of broadcasting stations, principally upon the Continent, with the result that there is not sufficient room in the ether for them all, and we often hear the unpleasant whistle due to heterodyning between the carrier waves of stations working too close together.

Efforts are made, of course, by the powers that be to regulate the frequencies of the various stations so that they shall not interfere, but the complexity of the problem is increased by the fact that the recommendations made by Geneva have no definite authority, and unless each station definitely maintains its allotted frequency the whole question of organisation is rendered impossible of solution.

A Difficult Problem

It will be obvious that to provide any further increase in the number of stations operating is simply to aggravate the trouble. At the same time, there are still people who are unable to obtain satisfactory reception unless they use comparatively expensive valve receivers. If such people are to be catered for—and there is no reason why they should not be—what alternative is there to increasing the number of stations?

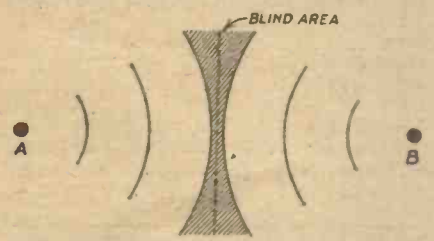


Fig. 1.—Interference may produce "dead spots" between two stations working on the same frequency.

One method of overcoming the difficulty, of course, is that the number of stations actually transmitting shall be considerably reduced, and the whole of the existing system replaced by a comparatively small number of stations operating on a higher power. By a suitable arrangement of a group of high-power stations such as this it would be possible to serve practically every part of the country, so that wherever a person was situated he would be able to receive one programme, at any rate, on a crystal receiver.

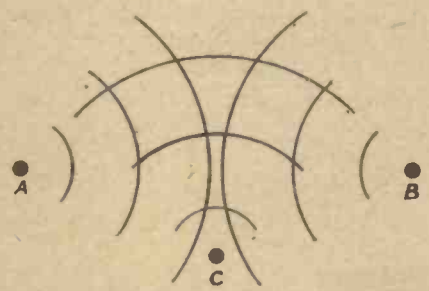
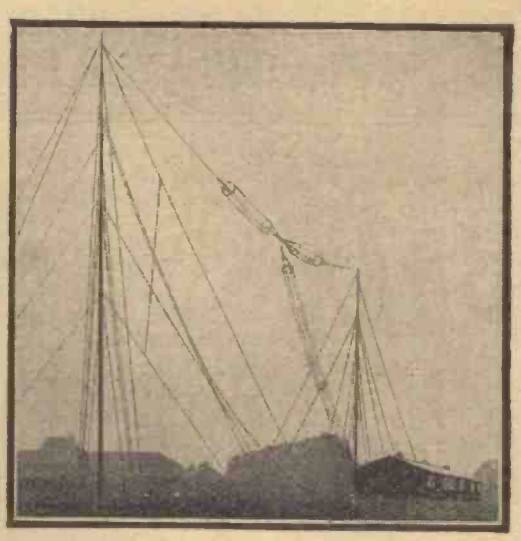


Fig 2.—The provision of a number of stations would ensure that such interference effects as might occur would not produce blind areas.

Disadvantages of High Power

A disadvantage of this method lies in the fact that in order to provide really adequate reception all over the country it would be necessary for the power of several stations to be considerably higher than it is at the moment, and there are objections to any considerable increase in the number of high-power telephony stations operating in the country. It is not proposed, however, to discuss this aspect of the question in the present article, but rather to put forward a very interesting suggestion which was recently made, and which is attractive by virtue of its novelty. Although in some ways it is rather revolutionary in character, it possesses several points which may be found to suggest possible solutions to the difficulty.



Instead of a few powerful stations it is suggested that a network of low-power transmitters be used with a special scheme of frequencies.

An Interesting Suggestion

The scheme in essence is this: it is well known that the tastes of individual listeners differ very considerably, but they generally fall into fairly definite categories. It is suggested that a choice of one of three alternative programmes would satisfy the requirements of the average listener. Thus, if it were possible to provide an arrangement giving three alternative programmes at any part of the country, then it is claimed that something approaching a perfect broadcast organisation would be the result.

The scheme, therefore, is to radiate from a large number of points suitably spaced over the country *three* definite programmes. The programmes would be transmitted each on a distinctive frequency, and the important thing is that these frequencies would be absolutely the same throughout the whole of the country. Any listener, therefore, wherever he is situated, would be able to tune-in to any one of these three possible programmes.

Numerous Low-Power Stations

The individual stations would be of quite small power, and could be

Three Frequencies or Twenty?—*continued*

so erected that practically the whole of the reasonably populated portion of the country would be adequately served, even for the crystal user. At the same time, the use of three frequencies instead of the present twenty would greatly reduce the amount of interference which is experienced, and it would be possible to receive the programmes free from disturbance, so that real pleasure could be derived therefrom.

Such is the scheme which has been suggested. It is interesting to consider the actual arrangements in somewhat greater detail. In the first place, each reasonably large centre in the country would be provided with its own transmitting station, of a suitable size, adequate to cover the area of the surrounding district.

A big town like London might be provided with perhaps two or even three such transmitting stations, each of which would, of course, only handle a fraction of the power of the present 2LO. In cases where noticeable screening was observed, such as is experienced in the neighbourhood of the Cardiff station and such-like localities, a group of stations could be provided, suitably spaced, so that practically the whole of the area was served.

Difficulties

There are minor difficulties which present themselves at this stage of the proceedings. If, for example, two stations only were provided, then there would be some points in between the two stations at which the effects of one station would be completely cancelled out by that of the others. The two wireless waves, one from the point A and the other from the point B in Fig. 1, would arrive exactly opposite in phase, and so produce a dead area. The erection of a third station, however, at point C in Fig. 2 would immediately overcome this difficulty, so that, although there might be cases where the reception was weaker than normal, there would be no definite blind spots.

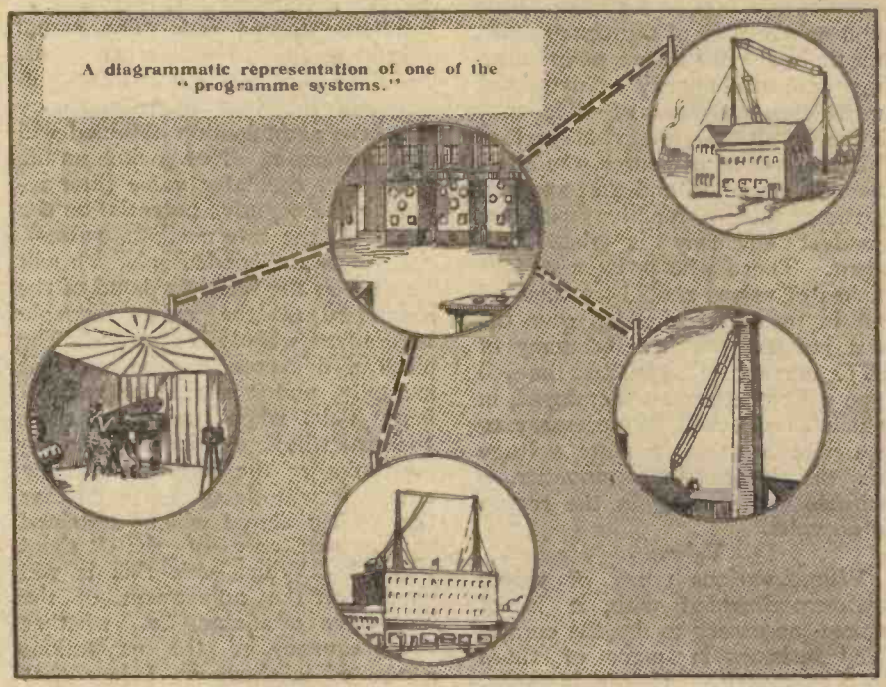
The larger the number of stations in any particular group, the more uniform would be the reception throughout the whole of the area, and the design and arrangement of the various stations throughout the country would only be a matter of suitable arrangement. Where suitable, of course, one station of fairly high power, perhaps 1 kilowatt, would be provided to serve the whole of the area, but in cases where it was desirable the transmission would be split up into a large number of small stations, radiating from different points throughout the area, as has just been described.

Programme Organisation

The next link in the organisation is that of providing the necessary programmes. This could be done by having studios in various more or less central parts of the country, from which programmes would be relayed as required to a central control room. This only involves a slight extension of the existing scheme of control actually in operation for simultaneous broadcasting, and would present no difficulty. As there have only to be three programmes in operation simultaneously, it follows that all the studios will not be in use for the whole of the time, but the employment of several studios in different parts of the country is suggested in order to obtain reasonable centres for more or less local talent, and also to facilitate the work of obtaining the best possible programmes.

Distribution

At any instant, therefore, we have three programmes being performed at suitable points in different parts of the country, and the necessary audio-frequency currents are relayed to the central control room of the organisation. Here these currents are made to modulate carrier waves of an intermediate frequency of the order of 20,000 to 50,000 cycles. Three separate and distinct carrier waves would, of course, be necessary, one for each of the programmes, and these carrier waves would have to be separated by a sufficient frequency to obviate any possible interaction between the three.

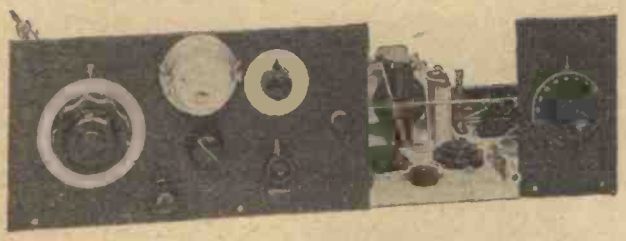


In the scheme suggested each of the three programmes would be distributed by "Wired Wireless" to the various transmitting stations.

These medium-frequency currents, modulated in accordance with the programmes, as we have seen, are then transmitted by landline to the various transmitters all over the country. This, again, is a perfectly feasible operation, and is only a development of "Wired Wireless," an art which has been developed to a considerable stage, both in this country and on the Continent. Each of the small transmitting stations, therefore, all over the country, will receive the three definite carrier waves.

(*Continued on page 243.*)

Getting the Best from the 15 to 100-metre Superheterodyne



By C. P. ALLINSON, A.M.I.R.E.

How to operate last week's short-wave super: choice of valves, adjusting the long-wave oscillator, searching for weak signals.

THE operation of the short-wave superheterodyne, described in last week's issue of *Wireless Weekly*, calls for but little skill on the part of the constructor, but there are one or two points dealing with preliminary adjustments, on which a few words of advice may prove helpful. The vital part of this receiver is, of course, the intermediate amplifier, and time spent in getting this to function with the greatest efficiency is time well spent. Those who possess various makes of valves should try them all out in turn to see which give the best results. Where economy of H.T. current is requisite, the .06 type will, of course, be employed, in which case it will be necessary to use a high value of plate voltage for the intermediate amplifier, a suitable value being in the region of 90 volts.

Valves

Where various types of valves are experimented with, it is, of course, necessary to use the correct fixed resistors in place of those used by myself. If, for instance, two-volt valves of the D.E.R. or Wuncell type are being used, they may be placed in series for the second detector and L.F., using a four-volt L.T. battery, while for the intermediate stages four-volt power-valves of the P.M.4 type may be employed or else D.E.R. type valves. In the latter case the resistances for the two intermediate valves will be of 7 ohms each. The first valve may be chosen from either of the types mentioned above.

The Long-Wave Oscillator

In view of the greatly improved background that may be obtained with it, some hints on adjusting the separate long-wave oscillator may also be of interest, since its correct adjustment will largely affect the signal strength obtained with this receiver on Morse. First of all, a C.W. signal should be tuned in with the long-wave side of the receiver oscillating and the separate oscillator turned out. The signal should be tuned to the silent point, in which case, since it is exactly in tune with the intermediate frequency side, the amplification obtained will be a maximum. Now switch on the long-wave oscillator valve (first reducing the negative potential on the grids of the intermediate valves), and rotate the condenser which will be seen at the far right hand of the baseboard till the most readable heterodyne whistle is obtained. The pitch of this note may be recorded mentally, and it should be remembered that, when tuning in, since the beat will be obtained by varying the tuning of the detector-oscillator circuit, it will always be found that the loudest signal will be obtained to one side only of the "silent point." Which side this is will depend on the adjustment of the long-wave oscillator, *i.e.*, whether the frequency of the oscillations generated is above or below that to which the intermediate amplifier is tuned, and on whether the upper or lower setting on the dial is used for reception.

The Two Readings

Like most superhets, this receiver will be found to "repeat," and all stations will be found to come in at two positions on the dial. In some cases it may be found that one of these gives stronger signals than the other, and it is as well to make a comparison to determine if this is so. This point may also be made of use when interference is being experienced, since, if the second setting is tried, it may be found that the signal is now free from the jamming which was present on the first setting.

It may be desirable in some cases to erect a separate small aerial for use with this set, since bad "dead spots" on the short-wave oscillator may be experienced with a large outdoor aerial. All the results given in last week's article were obtained with a small indoor aerial barely ten feet long, with a hank of rubber-covered flex lying on the floor for a counterpoise.

Plug-in coils should be kept away from the receiver, especially when reception is being carried out on the very high frequencies, since such coils may happen to have a natural frequency close to that being received, so that "dead spots" will occur on the oscillator.

Searching

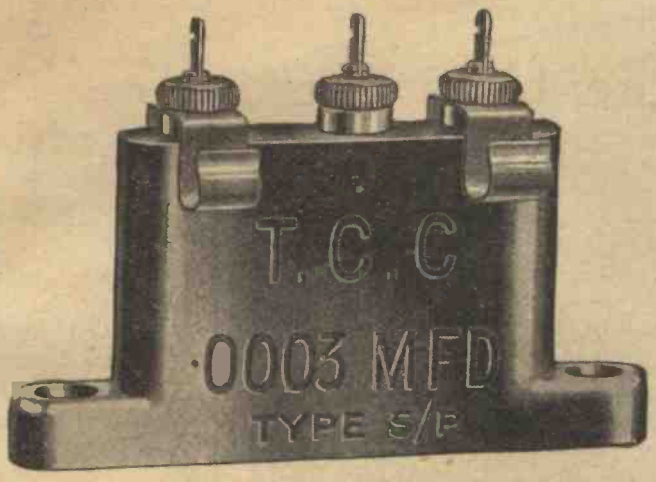
Searching for stations should be carried out with great care, for so sharp is the tuning that even a strong transmission may be passed over and not heard, and the use of a reduction geared dial will be found of great help here. The coarse adjustment may be used to shift quickly from one band of frequencies to another and the actual searching then done on the vernier adjustment.

The use of this receiver will be found to revolutionise one's standard of signal strength, for what one calls R3 on this would have been counted as being R6 on the old two-valve "low losser," and, in the language of our American cousins, this set does "sure perk some."

Test Report

On test at Elstree the set was found very simple to control, and the long-wave oscillator was particularly pleasing in its adjustments.

In the course of the test period signals were identified from the following stations: BZ 2FR, PCLL, POW, F 8DDH, U 1CH, U 1CMP, I 1AD.



Don't take a chance on a Grid Condenser—for safety's sake specify T.C.C.

WHEN you find the sign T.C.C. stamped on the side of the familiar green moulded case you should appreciate its meaning. It signifies a Condenser manufactured by a firm with more than 20 years' experience in Condenser building. The whole of this period has been devoted to *Condensers only*. Obviously such a unique experience has resulted in an exceptionally high level of manufacturing practice being attained.

Choose any T.C.C. Grid Condenser, therefore, with confidence. You may be assured that it has been made from the highest grade of ruby mica—hand picked and free from pin-holes. That its capacity is within 5 per cent. of its rating. That the insulation of its green moulded case is absolutely above suspicion. That every Condenser is subjected, not once, but many times to the most critical tests that can be devised.

The new T.C.C. Series-Parallel

Illustrated above is a new type of Grid Condenser. Its three terminals permit the Grid Leak being shunted across the Grid Condenser or connected to negative L.T. and thence to earth. This alteration can be effected without removing the Grid Leak from its clips. Remember that this Condenser in common with all other T.C.C. Condensers—Mansbridge and Mica—is fitted with the new Duplex Terminals. All connections can be made to the soldering tags or screwed under the milled heads—just as you choose.

In all values from ·0009 to ·000x mfds. Complete with clips **2/10**

Prices of T.C.C. Mica Condensers

No. 33. All capacities between ·004 mfds. and ·001 mfds. - - 2/4

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Grid leak clips supplied free.

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[Mansbridge and Mica]

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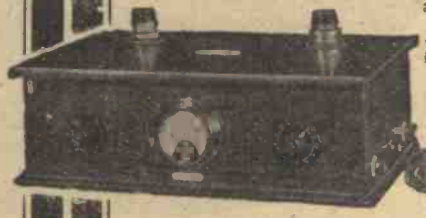
Gilbert Ad. 4957.

IMPROVED RECEPTION
Without Batteries and Accumulators

"AERO" BATTERY ELIMINATOR for D.C. Mains.

The inconveniences and expense associated with the use of batteries and accumulators need trouble the wireless enthusiast no longer. The "Aero" Eliminator substituted for H.T. and L.T., gives far better reception. Suitable for use with direct current mains only, with dull-emitter valves of the .06 and .1 amp. types.



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No. R.B. 75/5. Open model (illustrated).

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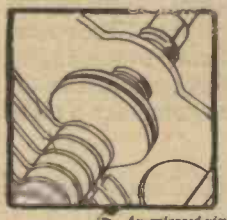

An enlarged view of the Rotor that ensures fine movement always.

From an experimenter of 14 years' standing: "I find that the special knob and dial supplied by you, make geared dials and verniers unnecessary, in my opinion, and I have been experimenting since 1912."

Complete with large 4 in. Knob Dial as illustrated.

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·0005 ,,	17/6
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Dual Condenser.	
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From your dealer or sent post free from the makers.

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The first time you use a "Cyldon" you'll tune in the most truant station with amazing ease. Never before will you have experienced such smooth, silky action. And the months to come will confirm the wisdom of your choice—a "Cyldon" will *always* give perfect service—will never lose its pristine smoothness of action. The secret lies in the accurately grounded Rotor, backed by long experience and perfect workmanship in every detail of construction.

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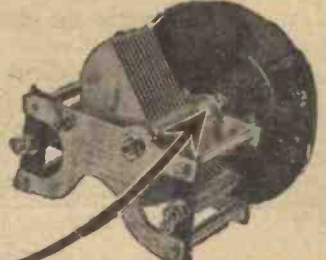
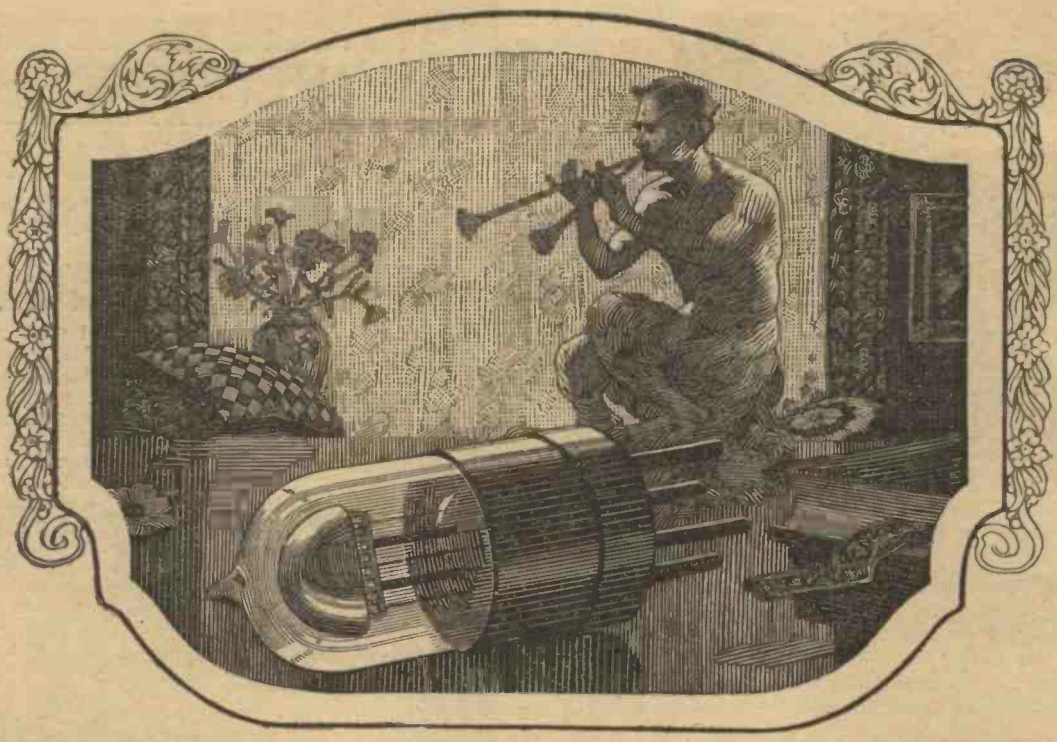
Straight Line Wavelength Condenser.





The Dull Emitter which defies old age

LISZT'S beautiful Rhapsody Hongroise—full of dramatic fire and brilliantly contrasted passages—was being broadcast. Away in the Studio, the artiste's fingers tripped lightly over the ivory keys. At home, the family sat enthralled—captivated by the richness and emotion of the masterpiece which won for its composer a niche in the Hall of Fame.

And then suddenly . . . dead silence. A valve in the Receiving Set had burnt out.

What causes a valve to burn out prematurely? Excessive heat—nothing else—is the devastating influence. All metals when heated expand—when cool, they contract. A valve filament constantly expands or contracts as the current is turned on or off. The higher the temperature, in fact, the greater the expansion. Such treatment, in course of time, produces brittleness and inevitably renders the filament very susceptible to fracture.

This was the problem Cossor set out to solve—and so successfully unriddled—by the invention of the triple-coated filament used only in the Wuncell Dull Emitter Valve.

Whereas in most dull emitters, low current consumption has been obtained by the use of extremely fine filaments operating at temperatures as high as 2000°, the Wuncell ensures economy by entirely different methods. Its special filament is *triple-coated* to ensure a prolific electron stream at only 800°—practically the temperature of the embers of a dying match.

Further, its filament is practically as stout as that used in any bright emitter. Because of this, and the fact that its working temperature is so much lower than hitherto thought possible, heat has little or no effect upon it.

As a result the Wuncell has already won a great reputation throughout this country and abroad among broadcast listeners as the one dull emitter "which really defies old age."

Types and Prices:

*W.1. For Detector and L.F. use - 14/-
1·8 Volts. Consumption: ·3 amps.
*W.2. (With red top) for H.F. use 14/-
1·8 Volts. Consumption ·3 amps.
W.3. The Loud Speaker Valve - 18/6
1·8 Volts. Consumption ·5 amps.

**Also in special base with resistance to suit 2, 4- or 6-volt Accumulator* 16/-

Cossor Valves

Issued by A. C. Cossor, Ltd., Highbury Grove, London, N.5

Gilbert Ad. 1943.

Wireless News in Brief.

Moscow Radio Activity We understand that the Communist International of Moscow, by the establishment of a number of receiving stations in Germany, hope to influence the workmen of Germany. The receiving stations will be used for reception from Moscow, whence special programmes will be sent out, their special objective being the German workmen's radio clubs.

* * *

The B.B.C. and British Opera. That the broadcasting of excerpts from their performances has been of great benefit to the British National Opera Company was stated recently by the manager of the company. The practice has been to allow the B.B.C. to select an act from any opera for broadcasting, with the condition that it must not be broadcast in the town in which the B.N.O.C. are at the moment.

* * *

Mobile Wireless. We understand that the experiment of equipping a motor omnibus in Leeds with a wireless receiver has proved very successful. The aerial is fixed round the roof of the omnibus and a loud-speaker is used.

* * *

Legality of Licence Fees We hear that Mr. R. M. Ford, who last November was fined for working wireless receiving apparatus without a licence, has decided to sue the Postmaster-General for the return of the 10s. fee "paid under protest." After losing the previous case he applied for and obtained a receiving licence.

* * *

Listeners who enjoyed the broadcasting of the Aldershot Tattoo last year will no doubt be glad to hear that it is proposed to repeat this at the Tattoo next June.

Boxing Broadcast. Conflicting reports on the success of the broadcast on March 29 of a boxing championship fight from the National Sporting Club appear to indicate that the "atmosphere" for such an event is difficult to provide for listeners. The announcing was well carried out, but anyone who had not actually seen a similar contest must have found it difficult to form a mental picture of what was happening.

The irresistible Mr. Ford is once again at loggerheads with the Post Office.

Wireless in Sahara Desert. In order to link up Northern and French West Africa, we hear that two wireless stations are to be established at Wallen and Tessalit in the Sahara Desert. These isolated outposts, which lie on the new route from Colomb Bechar to the Niger, will form the completing links in the wireless chain across the Sahara

* * *

Geneva Conference. We gather that certain recommendations are being put forward by the conference of European broadcasting organisations held recently at Geneva. Since the conference has no executive powers, the new scheme can only be suggested for the consideration of the Governments concerned, so that no permanent changes in the present arrangements need be anticipated at the moment.

Under the new plan every country would have at least one station, presumably of high power, with the use of an exclusive wavelength; the actual number of such stations would depend on the area to be covered. Also there would be a number of low-power stations, their wavelengths being so arranged that those working on the same wavelengths would be widely separated from each other.

* * *

The Report. In reply to a question in the House of Commons, the Postmaster-General, Sir William Mitchell-Thomson, stated that the report of the Broadcasting Committee had not yet been considered by the Cabinet, and that, in view of the expense involved, it was not proposed to publish the evidence given before the Committee.

* * *

Ilford Radio Society. At a meeting of the Ilford Radio Society held recently, Mr. Percy W. Harris gave an entertaining lecture on his tour in the U.S.A. last year, illustrated with cinematograph pictures taken by the lecturer. Mr. Harris took his audience for a trip round New York City, and also to Washington and East Pittsburgh. He also gave some interesting details about the design and performance of modern American receiving apparatus, making comparisons with current practice in this country.

This Week's Interview

No. 6.—Professor C. L. FORTESCUE, M.A., M.I.E.E.

These interviews contain a series of questions and their answers, which have been very carefully framed to give the greatest amount of interesting and useful information in the space available.

PAST AND FUTURE

Q.—I understand you have been associated with wireless from its early days. Is that correct?

A.—Yes; my first serious dealing with the subject dates back as far as 1906.

Q.—What was it that brought you into contact with wireless twenty years ago, when it could be said in real truth that the problems were in their infancy?

A.—It was in connection with my duties of instructing naval officers at Portsmouth.

Q.—Were you fascinated with the possibilities of what then appeared a revolutionary departure in the methods employed for the transmission of signals?

A.—Yes; as a natural application and development of the principles of physics and electrical engineering.

Q.—What, in your opinion, is the most striking invention which has contributed to the progress of wireless during the present century?

A.—In all the spheres in which wireless has been applied I do not feel that there is any *one* invention which can be looked upon as being the all-important one.

Q.—You rather regard the progress then as being due to the concerted effort of many investigators who laboured for the love of the subject?

A.—Yes; wireless as we know it to-day is the result of an accumulation of ideas which have more or less found practical application after painstaking and persevering efforts on the part of those concerned with the problems.

Q.—In what category, then, would you place the valve?

A.—I thought you were coming to that. To Professor Fleming we must give full credit for his adaptation of the "Edison effect" in order to produce a rectifier which was far more efficient than those previously in vogue. He saw that there would be great possibilities in taking advantage of the unilateral conductivity of the minute particles of disembodied electricity, or electrons, to give them their proper designation, which were given off from an incandescent filament.

Q.—Did the introduction of the grid make a vast difference to the potentialities of the valve?

A.—Yes; that modification of Lee de Forest undoubtedly was a big step, but when this control electrode was first incorporated into the valve I feel that its full significance was not appreciated, even by Lee de Forest himself, at the time, or else he would not have allowed his patent to lapse.

Q.—What other factors then contributed towards making this particular device a piece of apparatus of great commercial and utilitarian value?

Professor Fortescue, of the City and Guilds Engineering College, possesses an experience of wireless which dates back to its early beginnings and enables him to see present-day problems in their true perspective in a way denied to many of us. Particular interest therefore attaches to his views on probable future developments.

A.—The improvement in the degree of vacuum in which the three electrodes were placed, the better filaments and the general improvement in the methods of manufacture now adopted by the makers.

Q.—Do you feel that the valve has reached a very advanced stage in its progress or development?

A.—It has advanced as other things have advanced in wireless, but it certainly has not reached any degree of finality.

Q.—Can I interpret that answer as meaning that the valve will not be replaced by some other device which will perform in a more efficient manner all the functions now carried out by the valve itself?

A.—Yes; the valve may alter its shape and appearance, but the fundamental principles on which it works seem to indicate to me that it is not replaceable by some other device. That is to say, we shall only have a development of exactly the same principle, while better and cheaper manufacture will do much towards still further popularising the valve.

Q.—Your remarks on this matter lead me to assume that you think the valve will ultimately replace the high-frequency generator, arc and spark systems for transmission purposes?

A.—Your assumption is quite correct. For frequencies above about 10,000 cycles per second the valve is the generator of the future, a conclusion which I have publicly expressed on many occasions in the past.

Q.—Under those circumstances I should imagine that you regard generating oscillations as the most important function of the valve?

A.—That is true.

Q.—On what grounds do you base your convictions.

A.—Well, there are really two fundamental reasons which lead me to favour that aspect.

Q.—Would you mind telling me what they are?

A.—Certainly I will. First of all the ultra-sensitive receiver has no great value unless larger powers are used for transmission, and the only way to do this is to increase the strength of the radiating field at the point of transmission by utilising the full power of the valve or valves.

This Week's Interview

(Continued)

Q.—And now for the second one?

A.—Valves have made heterodyne reception a problem of comparative simplicity and thus reduced the difficulties presented by atmospheric interference.

Q.—Do not these remarks of yours appear to indicate that the valve is something of outstanding merit?

A.—No, I am not trying to convey that impression, for all the other inventions have contributed, both individually and collectively, to the general advancement of wireless.

Q.—Just previously you spoke about atmospheric interference. What are your views on this matter?

A.—I feel that the solution of atmospheric interference lies at the transmitting end of the complete wireless system, and that, relatively speaking, the receiving end has little to do with the elimination of atmospherics.

Q.—What is your proposed solution to this problem?

A.—The only prime solution today seems to be in an increase of power at the transmitting end; ultra-sensitive receivers cannot in themselves solve the difficulty, although they might contribute in a small measure.

Q.—You speak of an ultra-sensitive receiver. What is your definition of such a receiver?

A.—It is rather difficult to define in concrete terms, but I mean one that is sufficiently sensitive to receive signals very much below the average strength of an atmospheric. Of course, with a large and very efficient aerial the receiver need not be quite so sensitive, but naturally, if the aerial is small or not particularly efficient, a more sensitive receiver will be required.

Q.—You have no doubt carried out quite a number of interesting experiments on atmospherics during your research work?

A.—Yes, I have, and they all confirm the opinions I have just expressed.

Q.—Do you regard atmospherics as being due to any peculiar or particular phenomena?

A.—No, the effects are produced merely as the result of electrical thunderstorms.

The enlargements in the equipment of 2LO present a marked contrast to the cramped quarters of the original station, as this view of the control room indicates.

THREE FREQUENCIES OR TWENTY?

(Continued from page 239)

Production of High Frequencies

Here the carrier currents are heterodyned with a high-frequency oscillation, and a complex current is produced having a very high frequency of the order of 700 or 800 kilocycles. This high-frequency oscillation, however, will still be modulated at audible frequencies in exactly the same manner as the original intermediate-frequency carrier wave.

The high-frequency currents produced are simply amplified by a suitable bank of valves and the resultant complex current applied to the aerial. We thus have three distinct programmes radiated on definite and distinct wavelengths from the same point, possibly even from the same aerial, from a large number of transmitting points throughout the whole of the country.

Constant Frequencies

It is necessary, of course, for the frequencies of the heterodyning oscillators to be absolutely the same at each of the various transmitting points. This, however, is not an unduly troublesome matter, because once adjusted, no alteration would be required unless it was decided to change the transmitting wavelengths of the whole of the system.

Without going into detail, it may be remarked that it is a practical proposition to arrange that the various heterodyning oscillators shall not only be constant in frequency, but shall automatically be kept in phase at all points of the country, so that the whole system would behave as one huge station of very large power transmitting three programmes simultaneously.

An Example

As a practical example, we could take three carrier waves having frequencies of 20,000, 50,000 and 80,000 cycles respectively. Each of these would be modulated with suitable speech currents, and transmitted to the various centres. At each of these a local oscillator of 700 kilocycles would be provided, and out of the resultant complex system of frequencies the following would be selected:—

720 kc., corresponding to 417 metres.
750 kc., corresponding to 400 metres.
780 kc., corresponding to 385 metres.

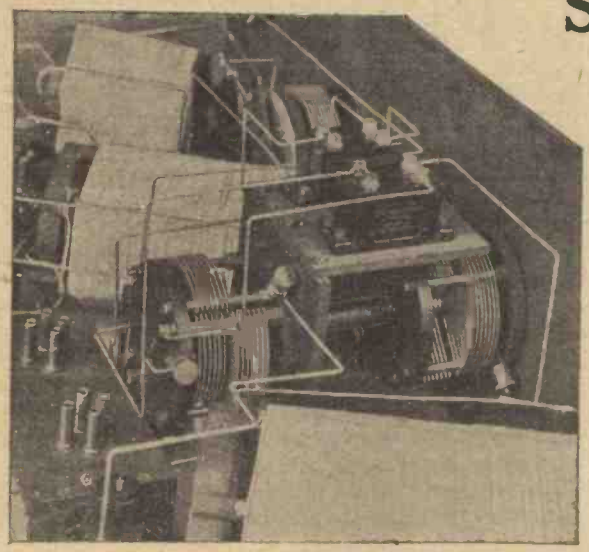
Even greater separations could be obtained if desired.

Whether anything will come of this scheme remains to be seen. It is technically sound, and its very ingeniousness is one of its attractions. There would be a distinct saving owing to the provision of three simultaneous programmes only instead of the many which are at present necessary. Maintenance of the various transmitting stations could be left to fairly unskilled labour under the supervision of a skilled engineer, who would be in charge of the whole district. The first cost of reorganisation is one of the principal objections to it, but nevertheless this scheme is interesting, and will probably set in motion many trains of thought.

Some New Uses for Split-Condenser Circuits

By the Staff of the Radio Press Laboratories

An important development in the use of symmetrical neutralised circuits is fore shadowed in this article.



The "Isofarad" receiver described recently employed a form of split-condenser tuning.

RECENT developments in neutrodyne reception have tended to the adoption of circuits employing centre-tapped coils. For example, the circuit shown in Fig. 1 employs a tuned circuit, both in the grid and the anode circuit of the valve. The grid is connected to one end of the circuit L_1 C_1, but the filament connection is not taken to the other end, but to the centre point of the coil. The remote end of the coil is then at opposite potential to the grid, and this point is connected through a small condenser to the anode of the valve, so that the feed-back through the inter-electrode capacity of the valve may be neutralised.

Some Advantages

A circuit such as this has many advantages. One of the most valuable of its properties is that the neutrodyne setting will remain adjusted over the whole of the tuning range, whereas, if only half of the coil is tuned, and the remaining half left untuned and used to provide the necessary neutralising, troubles arise towards the bottom of the condenser setting owing to the self-capacity of the untuned portion of the coil. These troubles are overcome by tuning the whole coil and taking a centre tapping as described.

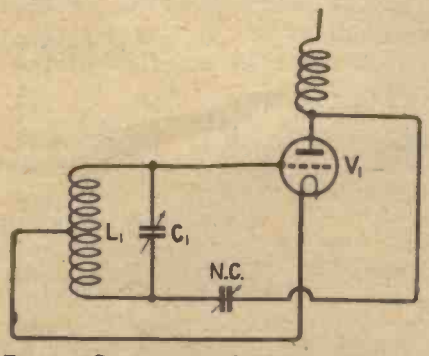


Fig. 1.—Centre-tapped coil circuits are prone to parasitic oscillation troubles.

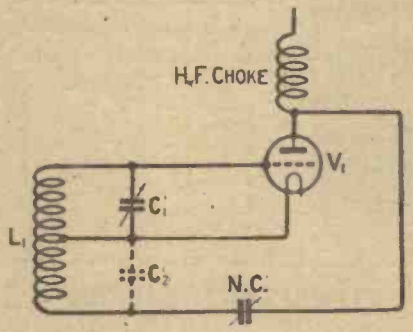


Fig. 2.—If only half the coil is tuned trouble may be produced by the self-capacity of the untuned portion.

Such circuits, however, suffer from a very serious defect, particularly if more than one stage of high-frequency amplification is employed. It is found, in practice, that parasitic oscillations may be produced in the circuit, due to one half of the coil forming an oscillating circuit with the self-capacity across it, and producing currents of very high frequency.

Symmetry

One method of overcoming the difficulty lies in destroying the symmetry of the arrangement The beauty of the original method, however, was the absolute symmetry of the whole system, so that this method is not particularly desirable. Moreover, it is not always effective, and cannot be considered an ideal one.

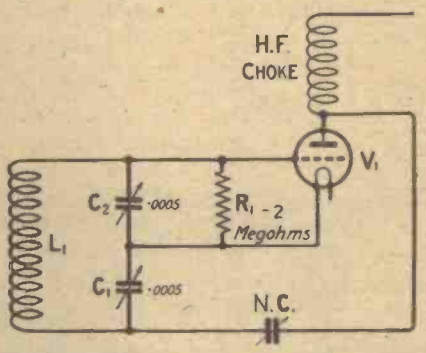


Fig. 3.—This circuit is free from parasitic oscillations, but the position of the grid-leak is not a desirable one.

Another method consists in the insertion of small high-frequency chokes in suitable parts of the circuit. These choking coils may be so designed to offer a very high impedance to the parasitic oscillation (which, as has been stated, is of a frequency of 5,000 kilocycles and upwards), while offering a comparatively low impedance to the ordinary legitimate high-frequency currents. Such a method, however, is only satisfactory on one particular range of frequencies. If the coils in use are replaced by other coils suitable for a different range, then the chokes originally in circuit are unsatisfactory, and have also to be changed.

An Improved Method

After some considerable experiment, a method was devised which overcame these various objections in a very satisfactory manner, and at the same time opens up new possibilities in high-frequency circuits. This method, which was suggested by Capt. Crowther and subsequently developed by Capt. Tingey, employs a dual condenser, consisting of two identical condensers mounted on the same shaft. If we tune the coil with a condenser

such as this, then we may utilise the middle point of the double condenser for the filament tap in place of a centre tapping on the coil.

The circuit shown in Fig. 3 utilises this principle. It will readily

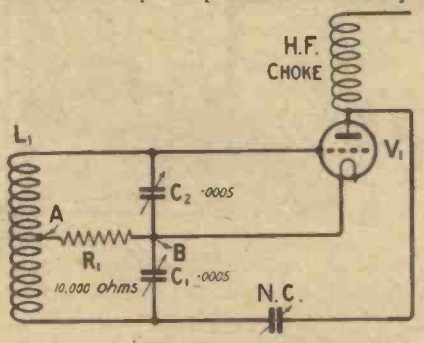
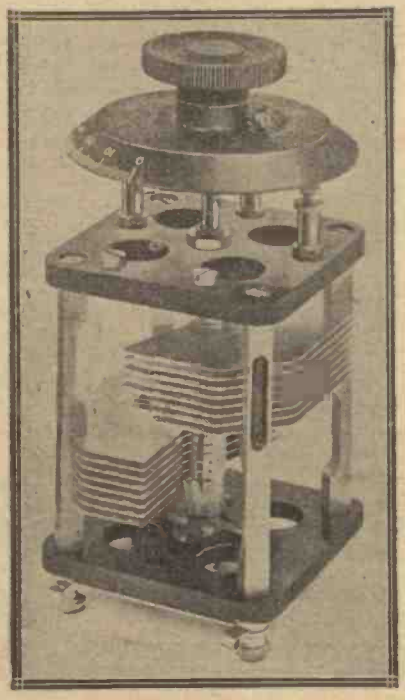


Fig. 4.—Very good results have been obtained with this circuit.

be seen that parasitic oscillations will be avoided in this case, because the self-capacity of the coil acts across the whole of the inductance, and therefore merely operates in parallel with the tuning condenser. At the same time, with this particular method, the grid has no definite path back to the filament, all the direct paths being blocked by condensers, so that it is necessary to connect a leak from the grid



The ordinary double condenser can be used in certain of the circuits under consideration.

to the filament in order to adjust the grid potential.

Position of the Leak

This method gave very satisfactory results, but the presence of

Some New Uses for Split-Condenser Circuits
(Continued)

the leak in the position shown is not altogether desirable, and experiments were made in order to remove this objection. As a result, the circuit shown in Fig. 4 was devised, in which the leak has been connected from the centre point of the dual condenser to the centre tapping of the coil.

In this position the leak does not exercise any appreciable damping on the circuit, because it is really connected across two points at the same high-frequency potential. If we have a certain voltage developed across the coil, then the voltage across one half of the coil will be only half the full amount. At the same time we have an equal voltage developed across the condenser, and consequently half that voltage developed across the half of the condenser. Thus it will be seen that the two points A and B in Fig. 4 are at the same potential as far as the high-frequency current is concerned, and therefore no high-frequency current whatever will flow through the leak, and no damping effect will result.

Effect on Parasitic Oscillations

Obviously, this state of affairs does not apply as far as any parasitic oscillation is concerned. Such oscillations are set up in half of the coil only, tuned by any stray capacities which may happen to be associated with it, and thus the resistance connected across these two points A and B must be sufficiently high to damp out any possible parasitic oscillation (with which it will be in series), and should have a value of the order of 10,000 ohms or more.

A receiver has, in fact, been constructed on these lines, and has so far maintained its neutralising adjustment practically constant over a frequency range of from 100 kc. (3,000 metres) to 5,000 kc. (60 metres). Experiments are at present proceeding in the direction of still higher frequencies.

Application to Reflexing

A point of unusual interest about this scheme is that it lends itself in an admirable fashion to a reflexing arrangement. It will immediately be obvious that since the two points A and B in Fig. 4 are at the same high-frequency potential, then if we connect a transformer across these points we shall not pass any high-frequency current through the low-frequency circuit. Consequently it is possible to utilise this connection in order to provide a reflexing action, and if this is done the resulting arrangement is absolutely free from the note-frequency howl which is very often experienced in a reflex circuit.

Promising Results

Experiments which have been conducted indicate that a two-valve reflex circuit arranged on these lines behaves in every way as a straightforward high-frequency amplifier followed by a detector and note-magnifier, all the controls functioning in the normal manner, so that

There are a large number of makes of double condenser now available, as a result of the popularity of certain types of multi-stage H.F. amplifiers.

there really is a definite separation of the high- and low-frequency components of the current.

It will be seen from these few remarks that this new method of arranging high-frequency circuits is one which possesses considerable possibilities. The principal feature is the double condenser which has to be employed, and which must contain two equal halves. Various manufacturers are now supplying these condensers, which are simply a modification of the old dual type of condenser which was formerly used for tuning two circuits simultaneously. Since, however, the two halves of the condenser are in series in the circuit, it is essential that each individual half shall be not less than .0005 capacity, so that the resulting capacity of the two halves in series shall not be less than .00025, and this point must be borne in mind in choosing a coil for the circuit.

The WEEK'S DIARY

IN that charming way which characterises the morning newspapers, we were told the other day that Sir Oliver Lodge had perfected a remarkable new invention which would do away with "howlers." No one has a greater respect than I have for Sir Oliver Lodge's wonderful attainments, but it did occur to me at once that Mr. Hercules' well-known exploit in cleansing certain stables was a spare-time hobby compared with getting rid of the howlers. I see that Sir Oliver has now favoured a responsible morning paper with a much clearer statement on the subject, or at least has made it quite clear that the previously published statements were "entirely premature."

* * *

IN point of fact, it is quite easy to make a wireless receiver which will not howl, however abused, and the present absence of howls in the American ether is due to the fact that practically all commercial radio sets sold on the other side of the Atlantic are of the non-radiating variety. A number of similar circuits have been published in England, and, indeed, Mr. Harris described a non-radiating set which has passed the most exhaustive tests in *The Wireless Constructor* recently. In my opinion, howling is caused not by ignorance but selfishness. The chief howler is the man who endeavours to receive all he possibly can on a single valve by the simple expedient of making it oscillate and hunting for carrier waves.

* * *

SOME years ago the word "atmosphere" was introduced into artists' jargon to express something otherwise difficult to define, and has been much abused ever since. Lately it has been introduced into broadcasting jargon, and now we are so frequently told that "the atmosphere" of this, that, and the other is to be broadcast. Whether or not the public likes this medley of noises from such places as the National Sporting Club, an aeroplane, or what not, I do not know. I somehow think that the broadcasting authorities frequently skate on very thin ice in such matters. One of these days the remarks of some disgruntled ringside backer, spoken straight from the heart, will vibrate through the ether and strike horror into the hearts of millions of listeners.

* * *

AND assuming that the straight spoken gentleman of the ringside should be hauled before the magistrate and tried (in front of the microphone) he will probably find himself in prison where wireless equipment is part of the—I was going to say scheme of punishment, but I really should say amusement given to the prisoners. Even Borstal is to have its wireless installation, for the *Daily News*, which has already done such wonderful work in equipping hospitals with wireless sets, has offered, and the offer has been accepted by the Home Secretary, the provision of installations in two of the Borstal establishments.

* * *

SERIOUSLY, I venture to think that the experiment should be very valuable, for the Borstal institutions are planned, not as prisons, but with a view to changing the outlook on life of those who are inmates. The institution officials are to be regarded more in the light of teachers and leaders than as warders, and I am sure that they will arrange the broadcast entertainments at such times as will give really excellent instruction and improvement to those who are listening.

* * *

A FRIEND of mine in the trade has asked me if I can beat this for a case of meanness. A man bought a radio set, and, not getting the results he thought he ought to get from it, complained to the makers of the valves he used. The valve firm, whose name is practically a household word, changed the valves without question, although actually there was nothing wrong with them, and when this did not satisfy the purchaser, sent an expert to his house to work the set. He could find nothing wrong, and, in fact, rather admired the set.

The purchaser then complained to the makers, who also went into the matter, even going to the trouble of inviting the purchaser to the house of a high official, where the set was demonstrated against another. Nothing could be found wrong with it. Still not satisfied, he complained to the publishers of the journal where he saw the set advertised, and they took the set and proved there was nothing wrong with it. I do not know what the end of the affair was, or will be, but I do know that he hasn't paid for the set about which he was making all the fuss!

* * *

A TYPE of entertainment that is proving popular by radio, and seems to adapt itself more easily than many other forms to this medium, is the Nigger Minstrel Troupe. I have heard many expressions of appreciation of some of the recent B.B.C. shows of this kind. Perhaps because it is easy to visualise the banjos, trombones and the semi-circle of black faces and shining teeth.

CALIBRATION TESTS

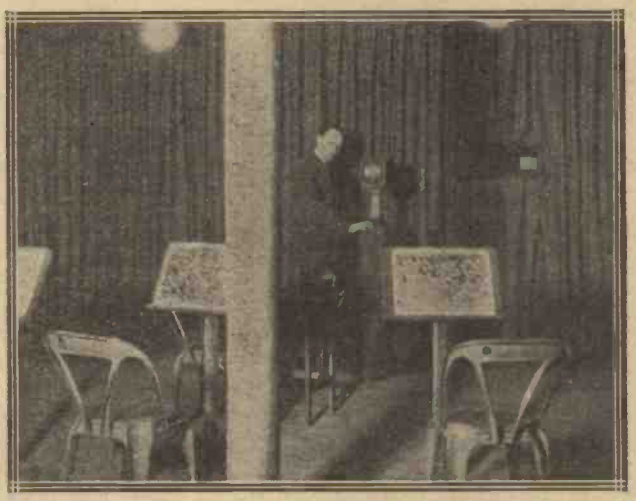
Do not fail to take advantage of the special tests organised by "Wireless Weekly," which take place to-night. They are given in detail on page 237.

The Week's Diary—*continued*

IN spite of all attempts that have been made to remove the ill-feeling that at one time existed between various interests and the Broadcasting Company, we are still treated occasionally to the dramatic "The curfew shall not ring to-night" kind of message. Mr. de Groot, the famous violinist and conductor of the Piccadilly Orchestra recently received a telephone call from the offices of the organisation controlling a number of music halls, telling him that he was not to broadcast on that particular night. It seems a pity that these matters cannot be settled beforehand without a melodramatic last-minute announcement.

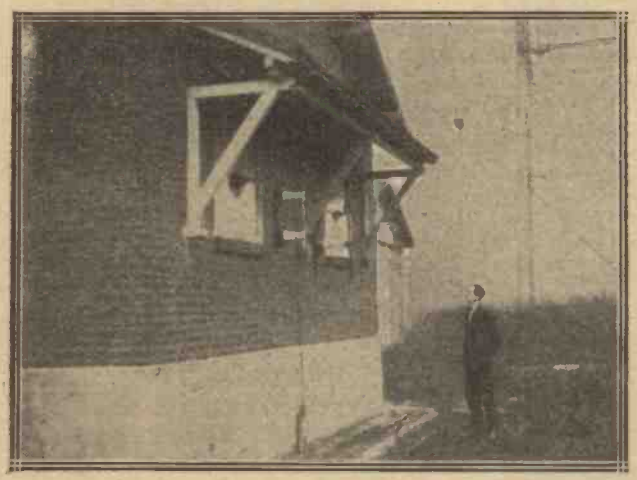
* * *

CROSSING a well-known Surrey common the other day, I heard faint strains of music proceeding from a clump of trees, and on investigation found, as I had suspected, that the source was a portable set (a superheterodyne, to be exact), amusing a small group of motorists by means of a loud-speaker. Last year portable sets were not greatly in vogue, but now the dull-emitter valves have reached such a state of perfection and the superheterodyne is becoming much more popular, I think we shall hear a great deal more of outdoor radio this summer.



The Studio of Radio-Paris is situated in the Boulevard Haussmann, Paris, while the transmitter is at Clichy.

ment of the evening broadcasts to suit Summer Time. The change will come into operation on Monday, April 26, when the weather forecast, second news bulletin and the talk which follows will be broadcast between 9.30 and 10 p.m. This will give us an hour's programme between 10 and 11 p.m. of the type which has a more general appeal. Of course, the ordinary evening programme will be given at 8 o'clock as usual.



The down-lead and lead-in tube at Clichy.

Very frequently, indeed, the crystal set will give good telephone signals with a temporary aerial thrown over a tree, provided the place of reception is not more than 10 or 15 miles from a broadcasting station. There are many such spots in the neighbourhood of Glasgow, Cardiff, Bournemouth, and even London, so why not try taking your "single-valver" out with you one day?

* * *

TALKING of summer radio reminds me that this year, as last year, there will be a rearrangement of the evening broadcasts to suit Summer Time. The change will come into operation on Monday, April 26, when the weather forecast, second news bulletin and the talk which follows will be broadcast between 9.30 and 10 p.m. This will give us an hour's programme between 10 and 11 p.m. of the type which has a more general appeal. Of course, the ordinary evening programme will be given at 8 o'clock as usual.

WHO is your favourite Continental announcer? This may seem a strange question, but I find many of my friends are greatly intrigued by the tones of some of the announcers at foreign stations. Our friend at Hilversum is very popular. He first came into prominence at a time when the British Broadcasting Company relayed this station, and since this date many listeners have deliberately searched for the station on their own receivers, and have been very interested in the results.

* * *

WHILE British wireless broadcasting seems to be settling down at last to a really reliable service, foreign countries have not yet reached that fortunate stage, although many European countries have made remarkable progress in a short time. In Italy a company has held for some time the sole right to broadcast, paying to the Government about £1,000 per annum for each of its stations. Listeners have licences just as they do in England, and can pay for them by instalments. Holland does not quite know where it is yet, as although it has an excellent broadcasting station, no provision has been made for collecting a fee from the listeners, and as a consequence there is no direct revenue. Voluntary subscriptions have been relied upon up to the present, but obviously something else will have to be done in the near future. Spain seems to have gone quite mad on wireless.

WAVE-TRAP.

PRACTICAL TOPICS

By G. P. KENDALL, B.Sc.

Topping accumulators—Charge first, top afterwards—Topping H.T. accumulators—Joints in portable sets

I WONDER how many people who do their own accumulator charging are quite sure of the correct procedure when "topping up" an accumulator in which the acid level has been allowed to fall rather low? Presuming that the level of the electrolyte has fallen to, say, half an inch below the upper edges of the plates, should the level be raised once more with distilled water *before* or *after* charging? The advice usually given in books of instruction is that the accumulator should first be charged, and then the distilled water should be added, but this is by no means the end of the story.

The Correct Procedure

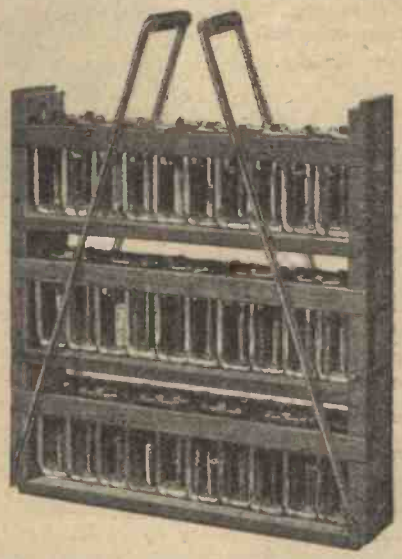
It should be remembered that the parts of the plates which have not been covered will not have received a charge, and although they will not have been run down to the same extent as the lower portions, it is not quite correct simply to fill the accumulator up to the desired level with distilled water and then proceed to use it. Those who value their accumulators highly and are prepared to take trouble on their behalf, first give the normal charge, add distilled water to the correct level, and then place on charge once more for a short period, say, an hour, before considering the accumulator fit for service once more.

Topping H.T. Accumulators

In no type of accumulator is it more important to keep the acid level at the correct height than in the high-tension variety with its multitude of small cells. It is very easy to overcharge these accumulators, and, of course, whenever this happens there is a considerable reduction of acid level as a result of the evolution of gas. The operation of adding small quantities of distilled water to a very large number of small cells is therefore one which is to be faced fairly often by the owner of these batteries. Now, the method commonly recommended for adding water to H.T. accumulator cells is by means of a pen filler, but this is an exceedingly tedious affair, since the filler may not hold enough liquid to top more than a single cell, and sometimes barely that, depending upon the size of the units.

A Useful Appliance

A method which I find very convenient is to use the instrument known to the chemist as a "pipette," which may be familiar to some of my readers as an instrument of which good use is made in what is called "volumetric" work. It is an instrument for measuring small quantities of liquid with a moderate degree of accuracy, and consists of a length of glass tube, perhaps 12 in. long, in the middle of which a bulbous or cylindrical-shaped enlargement has been blown. One end of the tube is finished with a small nozzle, and the other is simply cut square off.



The Oldham H.T. accumulator is an example of a battery whose cells are of considerable size. A special filler is a great convenience when "topping" them.

In use, the nozzle of the pipette is placed in the liquid with which it is desired to take up, and one then proceeds to suck at the other end until the liquid rises within the instrument, fills the bulb right up, and rises to a mark on the glass tube above. A readily-acquired knack soon enables one to slip a finger quickly over the end to which suction was being applied, whereupon the pipette can be lifted from the vessel from which it was filled. Removal of the finger from the end permits the liquid to flow out as required, the flow being very easily graduated by removing the finger a little at a time, and replacing it when the desired amount has run out. With one of these instruments which is capable of holding 50 cubic centimetres, I find that one can run over a large number of small cells in a very few seconds. A pipette of a cheap type need only cost a few shillings, and is a most convenient adjunct when dealing with one's high-tension equipment.

Joints in Portable Sets

A point which arises in connection with portable sets intended for motoring use is that of the method of making the various joints in the wiring. A long and painful experience has convinced me that the ordinary soldered joint in stiff square wire is not an adequate method of making contact, since I have found that such joints are not by any means so proof against vibration as they should be. It is really surprising how many apparently well-soldered joints will come unstuck at the end of a day's run over not too perfect roads, even in a car with unusually good suspension.

The point is one whose importance is never fully realised until experience has been gained, but the reader will begin to appreciate what a problem it is when I say that in my early days with portable sets I used regularly to take with me a soldering outfit which was brought out with the set on arrival at my destination with the full expectation of finding several joints that required attention!

A Solution

In my experience, to screw wires down under terminals or nuts is not an entirely dependable scheme unless extreme force is used in tightening up the nuts. I am coming to the conclusion that the best scheme is to use a type of soldering tag in which there is a hole, and to pass one end of the wire through this hole, twist it round, and then make a substantial soldered joint over the whole. This scheme has been adopted in my portable set for this year, and I have found that no joints have yet come adrift at these points.

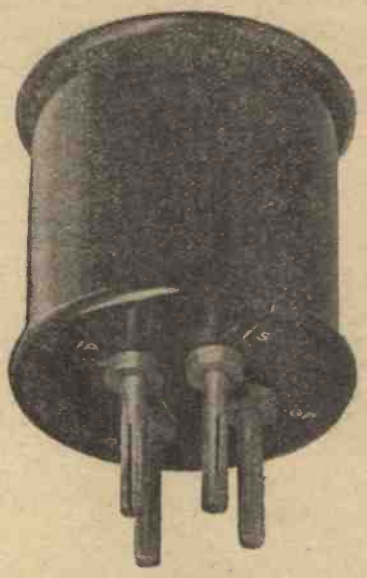
High Frequency or Low?

By

H. J. BARTON-CHAPPLE,

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

A controversy which has raged since the early days of the amplifying valve concerns the relative effectiveness of high- and low-frequency amplification for long-distance work. Is L.F. really capable of bringing in a station inaudible with the detector alone?



SINCE radio in all its spheres of application has grasped the imagination of millions of people it is only natural that different points of view should exist on many things connected with it—nay, shall we say on everything—and the title of this article will no doubt call to the mind of the reader one of the most controversial subjects of all.

A Much-debated Point

How many and persistent are the arguments we hear concerning the efficacy of high-frequency amplification as opposed to low-frequency amplification and vice versa, and yet the final conclusions have repeatedly left much to be desired and often fail to convince.

In the space of this short article let us marshal together some of our facts and examine them in the light of present-day practice. It is, perhaps, superfluous to mention that by high-frequency amplification we mean amplification at frequencies reckoned in hundreds of thousands or millions, accomplished before rectification takes place, whereas the term low-frequency amplification refers to amplification at audible frequencies, i.e., after rectification of the particular type of wave.

Common Features

Apart from considerations of frequency, wherein lies the difference in these two methods which aim at an increase of the energy imparted to the receiving set from the aerial system?

A common feature with all amplifiers is the resistance or impedance in the anode circuit of the valve, whose function is to resist changes of anode current, and thus make the signal reproduce itself in the form of the largest obtainable fluctuation of anode potential. According to the type of amplifier, we thus have a resistance, an inductive choke, a tuned inductance, the primary of a high-frequency or low-frequency transformer, etc., in the anode circuit, all with the same object of offering a high impedance in the anode circuit.

The Difference

With high-frequency amplifiers the transformers or inductive chokes are usually wound with an air core, which is distinct from low-frequency working where iron cores are the accepted thing. This is largely due to the fact that if iron was present at the high frequencies rather heavy losses would take place and thus detract from the efficiency of the amplifier as a whole.

A NOTE-MAGNIFIER HINT.

Howling in a low-frequency amplifier is a trouble for which most experimenters know several remedies, such as reversal of transformer connections, but it should not be forgotten that an external cause may make a previously stable amplifier develop a whistle. A running-down H.T. battery will do it, and when this happens a really large reservoir condenser (of several microfarads) should be provided.

Drawbacks of L.F.

Let us for a moment examine one or two of the objections to low-frequency amplifiers. One is the development of amplifier noises. These are due in a large measure to a slight unsteadiness in the first valve, brought about, perhaps, by a small voltage variation in the L.T. accumulator or the H.T. battery, or a non-uniform electron emission along the length of the filament. These fluctuations of a spontaneous character after amplification in, say, two stages, cause loud and troublesome parasitic rustling and crackling noises in the telephones or loud-speaker, and a stage is thus reached which renders further amplification useless.

Why Amplify?

The common object of amplifiers is not so much to convert an audible into a very loud signal, but rather to render audible an incoming signal which, without the amplifier, would be quite inaudible. With the improvements brought about in amplifiers they have been used for searching further and further into the ether (or, shall we say, space, in case we start another argument as to whether an ether exists or not!) where previously signals were too weak to be picked out at all.

The Limit

Now, when once these depths have been sounded so far that the incoming signals are no stronger than the spontaneous disturbances which originate in the circuits of the first or subsequent amplifiers, then further amplification appears to be of no advantage.

This really sets the limit on the number of stages of low-frequency amplification which can be employed in an efficient manner to two or

High Frequency or Low ?—*continued*

three valves with conventional circuits.

Atmospherics

Again, atmospheric or other so-called static interferences, which always more or less seriously affect the efficient reception of signals, produce disturbances of a character akin to acoustic fluctuations, and these also will be amplified to an unbearable extent if a rectifier and an excessive number of stages of note magnification are in use.

What is the conclusion which we are presumably led to accept from such a circumstance? Why, that high-frequency amplification is the only alternative. Since these radio-frequency amplifiers are definitely designed to increase the energy at high frequencies before passing it on to the rectifier, then such of the atmospheric disturbances as are at the vastly lower frequencies will not be efficiently passed on from stage to stage, and thus more distant reception becomes possible.

Great Possibilities

Indeed, high-frequency amplifiers have been profitably designed and employed with quite a large number of valves in cascade, and Capt. H. J. Round stated as far back as January, 1920, at a meeting of the Institution of Electrical Engineers, that he had used a high-frequency short-wave amplifier containing as many as twenty valves in cascade.

Why Not Use H.F. ?

Wherein, then, lies the objection to high-frequency amplification? As a rule, the main objection laid against it is its alleged impracticability, but many of the points of attack do not seem very cogent. For example, I have seen it mentioned with reference to H.F. working that the resultant selectivity is an advantage, while the extra difficulty in tuning is a disadvantage.

I appeal to the reader, wherein lies the difference? It seems to me much the same as saying that the joys of the glorious summer sunshine are inestimable, but the consequent absence of the comforting warmth and glow of the coal fire during that period is to be deprecated!

A Possible Explanation

I am strongly inclined to the opinion that those who point out in an eloquent manner the superiority of low-frequency amplification have had a certain amount of trouble with high-frequency work, which further trial and experiment might show not to be insuperable. It perhaps was not so very long ago that some of these difficulties were potent factors, but with the vast strides that have been made with efficient neutrodyning schemes these have largely been overcome.

Uneven Amplification

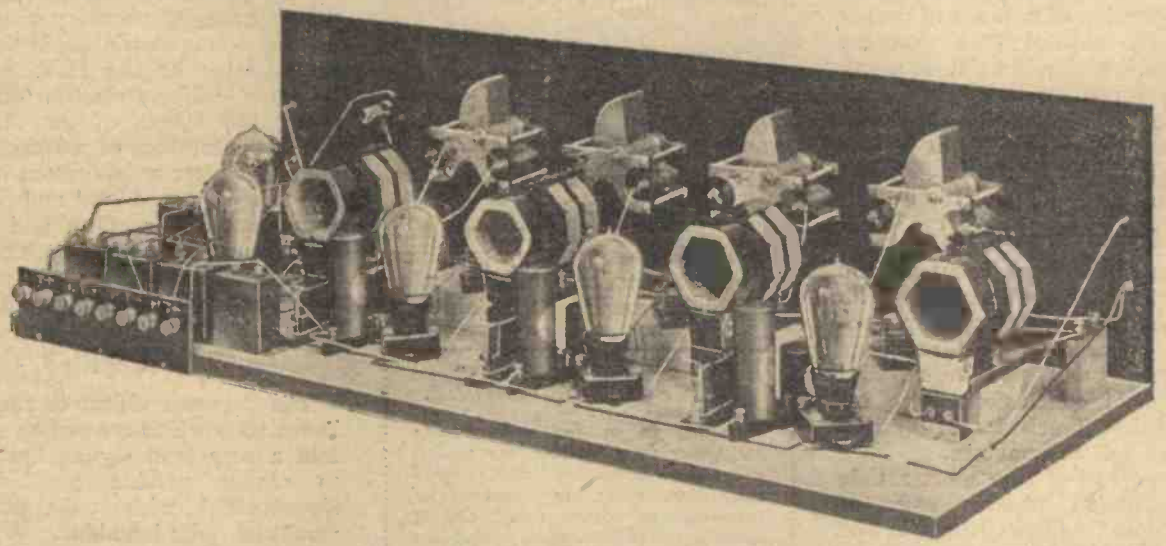
Another potent factor which merits attention arises from considerations of uneven magnification in the use of low-frequency amplifiers. In practice it is found that an L.F. amplifier amplifies the strong signals more than the weak signals. Now, what is the ultimate result?

When searching for distant stations the weak signal may be received and is amplified, but the extraneous noises are also amplified, only to a much greater extent, with the result that the "background" is distinctly unpleasant and spoils the reception.

Uniformity of H.F.

With high-frequency amplification, however, the amplification is more uniform, and it is thus possible to bring the weak signal up to a greater strength when compared with the extraneous noises.

In addition, although the case about to be quoted is not a common one, it will make the arguments more complete if it is mentioned. This assumes anode current rectification to be employed, and here the output from the rectifying valve is proportional to the square of the input voltage.



A good example of a set depending on the use of H.F. amplification, described in the April issue of "Modern Wireless."

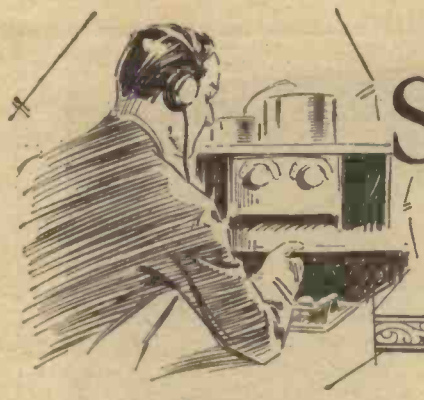
Advantages of H.F.

Thus the advantage of H.F. amplification is almost self-obvious, for if the input to the rectifier is, say, trebled by an H.F. amplifier, then the resultant rectified signal is nine times the original. With L.F. amplification, however, the incoming signal in the aerial circuit is applied direct to the rectifier, and we lose an amplification of nine.

The Ideal Combination

Circuits can be made quite stable

(*Continued on page 260*)



SHORT-WAVE Notes & News

"DX" conditions on the 6,667 kc. band have at last shown a slight tendency to improve, which, even if it does not last long, will have a reassuring effect; some of us were beginning to wonder if the ether had been completely used up and a fresh supply was needed! The American stations are, however, still somewhat scarce, compared with the numbers of them that used to be heard on the 4,286-kc. (70-metre) band. The chief beauty of the popular 6,667 kc. frequency-band seems to be, not consistency or regularity of DX work, but the occasional bouts of "Super-DX" which seem to be possible to the lucky ones.

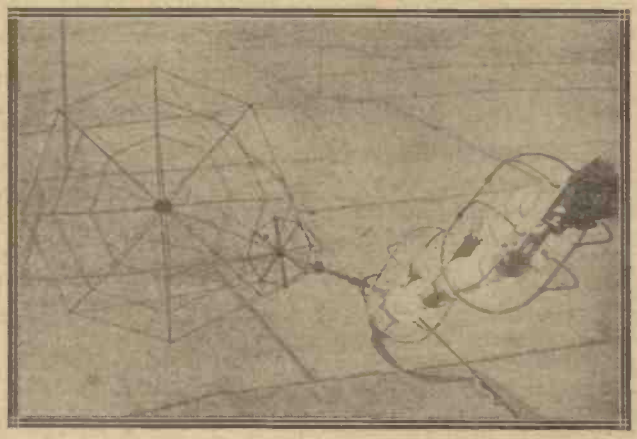
What of the Future?

On the other frequency bands no one ever dreamed, for instance, of being able to establish communication with Indo-China and the Phillipine Islands; New Zealand and Australia were looked upon as the privilege of the high-power man. This has changed enormously now, and the writer is wondering what changes will accompany the next move (though to what frequency-band we shall move is a doubtful point!) It certainly would be unlike the amateur, however, to stick to one spot for more than six months or so.

'Phone Work

The British stations are still carrying on fairly smoothly, low-power work apparently being the order of the day. The writer spent several days quite recently listening on a superheterodyne which covered a range from about 10,000 kc. (30 metres) to 6,000 kc. (50 metres) and was surprised at the large amount of really good telephony to be heard from amateurs. Of course, there is no receiver quite like the superheterodyne for telephony reception, but, with only one stage of L.F. amplification after the second detector, several amateurs were capable of filling the room with their telephony, received on quite a small and very ancient loud-speaker.

Prominent among these were 5TZ (Cowes), 5SZ (Morecambe), and GI-5NJ (Belfast). Of course, innumerable C.W. stations were heard, a great proportion of these luckily employing D.C. notes, as compared with the French stations' favourite "Raw A.C." It is therefore becoming increasingly easy to tell a French station from a Britisher without having to listen to the never-ending call! True, they mostly call CQ, which is not allowed for British stations.



One of the attractions of short-wave work is the simplicity of the aerial system: compare your own "sky-wire" with this view of one of the details of the Rugby aerial.

Good Work with H.T.B.'s

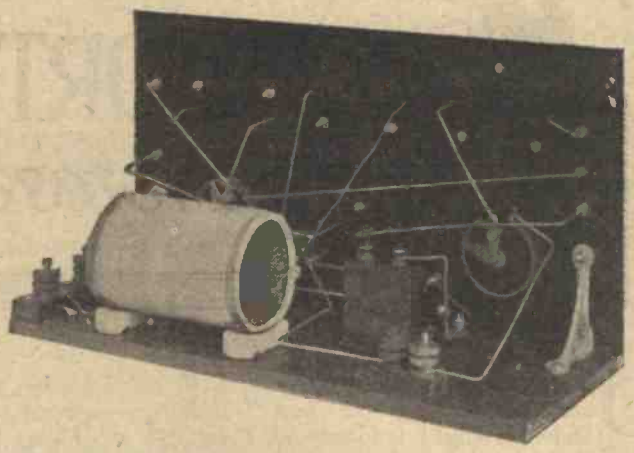
6KO (Forfar) has at last emerged from the 3,333 kc. band and is now in full swing on 6,667 kc. He seems extremely strong in London, especially as he only uses very low power, being one of those unfortunates who possess no mains except "no-volt gas mains." He obtains his power from dry cells. 5HU, another dry-cell enthusiast, has already worked P-3FZ (1,600 miles) with an input of 3.6 watts, as well as Italy, Belgium and France, although his station has only been in operation for a fortnight or so! 6MU, hitherto a low-power enthusiast, has fallen a prey to the sight of power (30 watts or so), his big generator having arrived. With about 27 watts he has worked C-8AR (Newfoundland), BZ-1AB, and NOT at Alexandria. The "GI's" seem to be keeping their reputation up very well.

Trouble in the Netherlands

The Dutch stations are apparently in dire trouble with their Government, judging by several pathetic messages received from various sources. 6QB received the following version from B-08: "Msg for QSR to all British hams. From N-oPX via RB and 08 and 6QB. Non-authorised Dutch hams being in great trouble with Dutch authorities don't send them any more QSL cards or ask for QRA's. Their apparatus has been confiscated." Other versions state that all QSL cards sent to them are also being confiscated! We hope they are as indomitable as the Danish amateurs, one of whom left about five-shillings' worth of scrap lying in the room outside the radio den, and had it thoughtfully removed for him by a Post-Office official, who gravely signed a receipt for it!

How an H.F. Choke Really Works

By the Staff of the Radio Press Laboratories.



Does an H.F. choke really function by virtue of its inductance? What is the effect of its self-capacity? What happens when a choke is tuned to the incoming signals? These, and a number of other points, are clearly explained in this interesting article.

THERE is an increasing tendency in modern wireless circuits to separate the high-frequency component of the anode current in a valve circuit from the low-frequency or D.C. component. In the ordinary valve anode circuit we have two currents flowing. First of all, there is the steady current from anode to filament, due to the emission of electrons by the latter, and this current is varied by the application of varying voltages between the grid and filament of the valve.

A Modern Tendency

The actual current therefore varies somewhat in the manner shown in Figure 1, and this current will readily be seen to be equivalent to two currents, one a steady current, and the other alternating. We are interested only in the pulsating portion of the current, the steady component being a necessary, but unwanted part of the whole. It is often found that beneficial results are obtained if the two components are kept distinct, and there is thus an increasing tendency definitely to separate them.

The Usual Method

The method adopted in order to achieve this result is shown in a diagram herewith. The anode circuit of the valve is divided into two parts. One of these contains a high-frequency choke and a high-tension battery; the other contains a small condenser and the active portion, if one may so term it, of the tuning circuits associated with the particular valve.

The high-frequency choke is designed to offer a very high impedance to any variation of current, but not appreciably to affect the high-tension supply. On the other hand, the coupling condenser forms

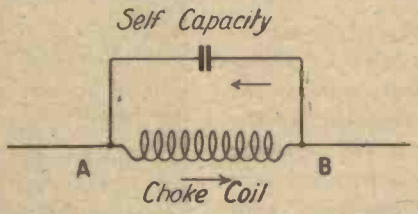


Fig. 2.—The inductance of the choke and its self-capacity may provide an actual rejector circuit.

a complete barrier to the steady D.C. current, but offers a comparatively low-impedance path to the varying currents. The actual impedance offered by the condenser to the flow of the high-frequency component of the current depends upon the value of the capacity. The smaller the condenser, the higher becomes the impedance, and vice versa.

In Reaction Circuits

This effect is often utilised in controlling the amount of energy supplied to various portions of the circuit. A specific example is that of Reinartz reaction, in which the amount of current flowing through the reaction coil is controlled by placing a variable condenser in series. Then the smaller the value of this condenser, the less will be the current flowing through the reaction coil, and so the tendency for the circuit to oscillate is maintained under adequate control. This, however, is an aspect of the question which does not concern us at the present moment, the portion under discussion being the high-frequency choke.

Function of a Choke

Now, a choke is simply an inductance coil wound to comply with the particular conditions required. It is well known that an inductance offers no impedance whatever to the passage of steady current (neglecting the effect of the resistance of the coil), but that if the current varies in any way, then opposing E.M.F.'s are called into play which tend to restrict the variation of current. In other words, an inductance coil always endeavours to maintain the current through the coil steady.

The magnitude of the choking effect is dependent upon the inductance and the frequency. Consequently, in order to provide a suitable high impedance at a very high frequency, only a comparatively small inductance is required. As the frequency is reduced, that is to say, as we increase the wavelength, so a larger and larger inductance is required in order to obtain an adequate choking effect. The actual impedance offered by the coil is directly proportional to the product of the inductance and the frequency.

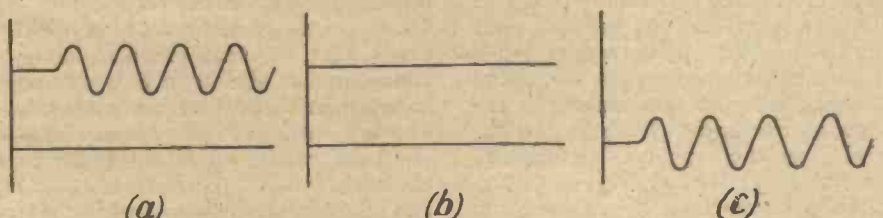


Fig. 1.—The anode current of a valve (a) can be regarded as being made up of a direct current component (b) and an alternating one (c).

Limits of Inductance

An interesting question arises at this point, however, and that is whether there is any limit to the inductance to which a choke coil may be wound. Associated with this question is that of the effect of the self-capacity of the coil. There is a general impression that a choke coil must be one having a very low self-capacity, the reason given being that any appreciable capacity across the coil would act as a shunt for the high-frequency components, and so destroy the choking action.

While this is correct to some extent, the effect does not operate quite in the way which is popularly assumed. A choke coil is really a simple parallel-tuned circuit, such as is illustrated herewith. There is the inductance of the choke coil itself, and there is a small shunt capacity due to the self-capacity of the coil. A certain portion of the current will flow through the inductance, and a small portion through the shunted capacity.

Circulating Currents

Now these two currents do not flow in the same direction. When the current is flowing in a particular direction through the inductance, the current through the capacity is flowing in exactly the opposite direction. The result is, we obtain a circulatory system of currents, and the actual current flowing through the whole system between the points A and B is really the difference between the two currents in both branches of the system.

Effect of Self-Capacity

It will be appreciated, therefore, that the effect of the self-capacity may increase the circulating current, but it reduces the total current flowing through the choke. As the value of the self-capacity is increased, the current in the capacity branch increases up to a point where it becomes equal and opposite to that in the inductive portion of the circuit.

At this point it will be obvious that the total external current will be nothing, and obviously such a system would be an ideal choke. This condition of affairs, of course, corresponds to the point at which the choke coil is tuned by its own self-capacity to the frequency of the current. The circuit then becomes a rejector, pure and simple, just as is the case with a tuned-anode arrangement.

The point to note particularly is

HOW AN H.F. CHOKE REALLY WORKS

(Continued)

that as the self-capacity increases towards the actual value required to tune the choke, so the impedance of the whole arrangement rises consistently until it reaches a maximum at the point where the self-capacity actually tunes to the frequency. Beyond this point, however, the impedance falls again, and the current flowing in the capacity

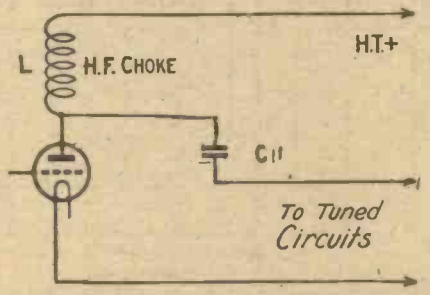


Fig. 3.—It is becoming quite a common practice to separate the oscillatory component of the anode current from the steady current.

branch begins to swamp any current in the inductance branch, so that the arrangement becomes more and more nearly equivalent to a simple condenser.

Extent of the Effect

The actual magnitude of the capacity effect depends entirely on

In the sizes often employed the natural wavelength of the choke is much above that of the signals.

circumstances. As the inductance of the coil is increased, so we have seen that the actual choking effect or impedance of the arrangement increases progressively up to a point at which the arrangement actually tunes to the particular frequency in question. If we exceed this point, that is to say, if we use the coil at a frequency above that to which it is tuned (or a wavelength below the natural wavelength), then the impedance of the arrangement falls off.

An Example

The falling off, however, may not be very rapid for some considerable time, and it is possible to obtain a form of choking effect, even when the coil is being used at frequencies very considerably in excess of the natural frequency. A particular case in mind is that of a well-known choke on the market which has a natural wavelength of the order of 1,600 metres. This coil still exercises quite an appreciable choking effect on ordinary broadcast wavelengths, although really in such cases it is acting as a small capacity with a resistance in parallel with it.

Distribution of Currents

The high-tension current, of course, flows through the resistance, but the high-frequency current finds the small capacity too great a barrier, and seeks alternative paths. Of course, if the capacity were fairly large, even as large as .0001 (a value which one would normally consider as a small capacity), then the choking effect would vanish altogether, but since the self-capacity is comparatively small, so the arrangement still offers an appreciable impedance to the high-frequency currents, and a form of choking action is obtained.

An Advantage

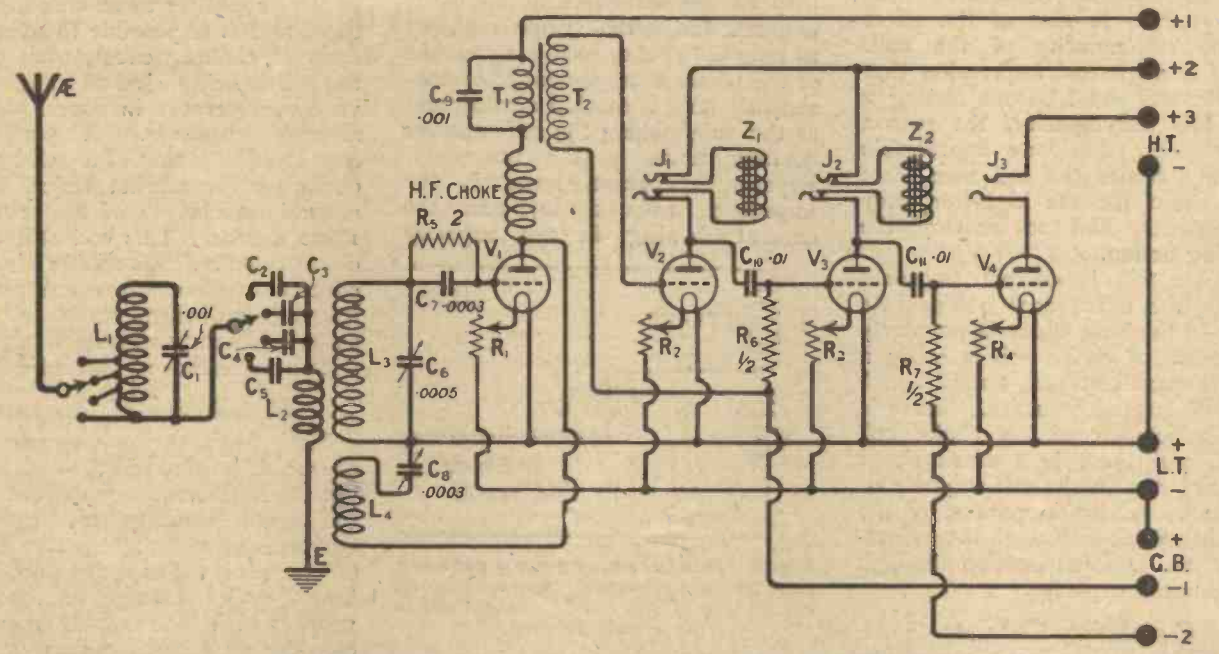
This arrangement has an advantage, in that it can be used over a wide band of frequencies. The same choke would be effective on the broadcast frequencies and also on Daventry's frequency, but it should be borne in mind that the arrangement is not a legitimate choke. A coil ceases to be a pure choke after the tuning point is passed, and although it may operate effectively, it will not be as efficient as a choke specifically designed for a particular band of frequencies.

Conclusions

It can be seen, therefore, from these considerations, that a high-frequency choke does not act in the manner in which it is popularly supposed. In many cases it is not actually a choke at all, but a capacity with a resistance in parallel. There are many circuits in which such an arrangement is quite as satisfactory as a true choke, while there are other circuits in which deleterious effects result unless a proper choke is used.

CIRCUITS FOR THE EXPERIMENTER

No. 10—A LONG-RANGE REINARTZ CIRCUIT



THE Reinartz circuit was, of course, primarily intended for long-distance reception, and for this purpose it is certainly very hard to beat without using high-frequency amplification. To get really good results, however, certain points must be attended to with some care, and this week's circuit is intended to show how a Reinartz receiver should be planned if it is desired to achieve real long-distance work.

The L.F. School

Now, there is a school of enthusiasts which believes that high-frequency amplification is not necessary at the moderate distances involved in reception of European broadcasting, and alleges that the correct procedure is this: first arrange your detector and reaction circuits in such a way that a good degree of selectivity is obtained, *i.e.*, so that the desired signal is heard with a quiet background, even though at reduced strength. Then to this initial circuit add a sufficient number of note-magnifying stages to bring the signals up to the desired strength. This method, of course, presupposes that it is possible to arrange a really powerful low-frequency amplifier in such a way that a quiet background is still obtained at the end of the amplifying chain, and, further, that a slight sacrifice in quality is permissible.

A Debatable Point

Whether the results obtained on these lines are truly comparable with those given by a true H.F. amplification scheme is a debatable point, but there is no doubt that the simplicity of operation of the receiver is an attractive point. For example, in the circuit illustrated this week there is only one tuning control, and a single reaction control, yet large numbers of stations can be tuned in upon the loud-speaker when the operator has acquired a little skill in the manipulation of the controls.

CIRCUIT No. 10

SPECIAL FEATURES

1. **High "Special" selectivity.**
2. **Only one tuning control.**
3. **Three L.F. stages.**
4. **Absence of hand-capacity effects on reaction condenser.**

The aerial circuit is one of the critical points in the Reinartz arrangement, since it incorporates one of the conventional forms of the tight-coupled aerial, and to obtain the best results either a tapped winding or a series condenser of roughly adjustable size is imperative. The expedient adopted in the circuit shown above is the use of a stud switch and a range of fixed condensers of suitably graduated size, *i.e.*, C2, C3, C4 and C5. A range of capacities between .0002 and .001 is suitable, with an aerial winding of about twice the size normally recommended for use in Reinartz receivers. For example, if the coil L2 is wound upon a 3-inch tube, it may consist of 30 turns of No. 34 double silk-covered wire wound in a single close layer.

The Coils

The coils L2 and L3 should be arranged with a reasonably close degree of coupling, pains being taken to see that the coupling is as much as possible magnetic and not too greatly capacitative. For example, L2 and L3 might be arranged end to end upon the same tube with a space of about ¼ in. between them.

The degree of selectivity given by a simple Reinartz receiver is quite good, remembering that there

Circuits for the Experimenter

(Continued)

is only one fully tuned circuit; but it is not, as a rule, adequate for the elimination of a powerful local station in favour of a distant one on a closely adjacent frequency. Accordingly a simple series-tapped wavetrap is included in the circuit, and this consists of the coil L1 tuned by the condenser C1 of .001. The coil may consist of 35 turns of No. 34 double silk-covered wire wound in a single close layer upon a 3-in. tube. Taps should be taken at 5, 10 and 15 turns to a stud switch, one of whose studs is so connected that it cuts out the trap altogether when the switch arm is placed thereon. The exact connections will, of course, be seen above.

Reaction Details

In any Reinartz circuit one of the most important features is to be found in the reaction arrangements, and these should therefore be made with every care. The H.F. choke in the anode circuit of the detector valve, for example, should always be provided, since it is not a particularly satisfactory arrangement to depend upon the choking action of the low-frequency transformer primary winding or a pair of telephones. On the contrary, it is better to by-pass these with the usual fixed condenser and to provide a choke between them and the anode of the valve.

Again, there are several advantages which follow upon the use of an entirely separate winding for reaction purposes, instead of using the aerial winding for this purpose. The principal advantage is that the reaction condenser can be arranged to have one set of plates at filament potential, with a corresponding reduction in hand-capacity troubles. This is done by connecting the condenser between the reaction winding and the filament circuit, the other end of the reaction winding being taken to the anode of the valve, as is actually shown in the circuit given this week.

Reaction Winding

In connection with the reaction arrangements, it is to be borne in mind that a more pleasant control is usually obtained by using a large reaction winding and a small reaction condenser than by the opposite scheme. Therefore, if the coils L2 and L3 are wound end to end upon the same piece of tube, place L4 upon a smaller piece of tubing inside the first one, and let it consist of, say, 40 turns of No. 34 double silk-covered wire upon a tube which fits easily inside the larger one. C8, the reaction condenser, may then have the common value of .0003.

L.F. Circuits

The low frequency side of the circuit employs one valve transformer coupled to the detector, followed by two further stages with iron-core choke couplings, the whole arrangement giving a powerful amplifying circuit with little tendency to instability. Quality, also, will be quite good.

The low-frequency transformer T1 T2 should be of one of the modern low-ratio types with a large primary winding, and to use a cheap component here is false economy. Plug and jacks switching is indicated to provide for the use of telephones with a reduced number of valves.

Valves

The valves to use in a circuit of this sort are decidedly important, the requirements in the first being that it should be a good detector valve and that it should give the desired smooth passage into self-oscillation, which means so much when it comes to picking up really weak distant transmissions. Valves of the DFA 4, DE 5b, etc., variety are suitable, as also are some of the special H.F. valves, such as the DE 8 H.F. A moderate value of high-tension voltage will be desirable upon this particular valve, and 60 volts upon terminal H.T. +1 is suggested as a trial value. The two valves which are choke-coupled, namely, V2 and V3, should also be of the high amplification ratio type, such as those which have just been mentioned. These valves should have an anode voltage of about 90 volts, while a grid bias of about 1½ volts should be applied to the terminal GB —1. In the last stage one of the customary small-power valves should be used with a moderate impedance, and about 100 to 120 volts upon the grid, with 4½ or 6 volts negative grid bias.

APPARATUS WE HAVE TESTED

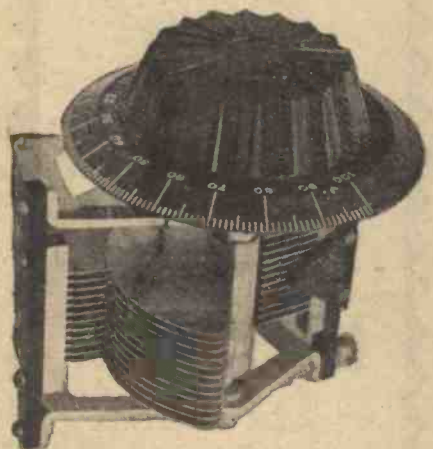
Conducted by the Radio Press Laboratories, Elstree.

Two-Way Coil Holder

A sample of their L.E.S. Two-Way Coil-holder has been submitted to us for test by Messrs. The London Electric Stores, Ltd.

It is claimed that this new two-way coil-holder embodies an entirely novel principle. At its maximum travel, it is stated that the reaction coil is right out of coupling, an important advantage which is not included in the majority of coil-holders. The movement is easily variable throughout, and the strength of the guide spring eliminates any possibility of backlash.

This component is designed for behind panel mounting, in which case the coils are at right angles to the panel, one- or three-hole fixing being provided as required. Two holes are also provided for fixing to a baseboard. The coupling between the coils is loosened by moving the adjustable coil across the face of the other coil until it takes up a position at right angles to its original position.

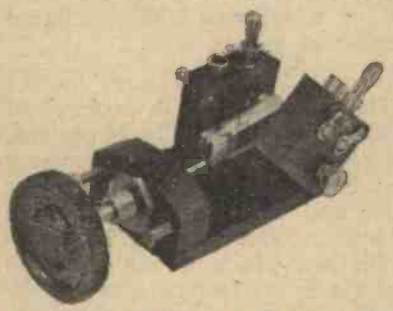


The large dial and fluted knob of the Wootophone condenser are pleasing features.

A knob of moulded material controls a screw which actuates a lever motion, so as to alter the coil's position. A coiled spring is provided to take up backlash.

On test it was found that the fit for a number of coils was satisfactory, and that there was no detectable backlash. A few large coils were found to foul the panel when the component was mounted in position, and hence could not be used in practice.

This coil-holder is a very good specimen of its type. It suffers from the common disadvantage with coil-holders in which only a vernier motion



The novel two-way coil-holder of the London Electric Stores, Ltd.

is employed, viz., that it is a somewhat slow process to move from one extreme position to the other.

It is not possible to substantiate the claims made by the makers that when the two coils are at right-angles the coupling is zero. There is, however, a position between the two extremes at which the coupling is zero, and when moved from one side of this zero position to the other the coupling changes sign.

Wootophone Variable Condenser

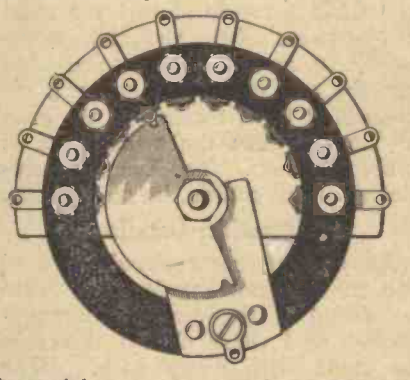
We have received one of their Variable Condensers from Messrs. F. E. Wootten, Ltd., for test and report.

This condenser is of good low loss construction, the vanes being of brass, while skeleton end plates are used. The fixed plates are insulated from the end plates by strips of ebonite in a manner familiar in low loss condensers. A pigtail connection is made to the moving spindle, and the connections to the condenser are made by means of terminals. The condenser is supplied with a 4-in. dial graduated in 100 divisions, and the condenser is designed for one-hole fixing.

On test it was found that its minimum capacity was 11 micromicrofarads, which is well below the average, while the maximum capacity for the .0005 size was .00046. The losses in this condenser were of a very low order, and the efficiency of the component is quite satisfactory.

Ten-way Switch

Messrs. The Silvertown Co. have sent us one of their Ten-way Switches for test and report.



A useful ten-way switch of Messrs. The Silvertown Co.

This switch is of the under-panel mounting type, and is for use with either inductances or capacities, being used for placing these either in series or parallel.

When used with inductances it forms a dead-end switch, since the portion not in use is short-circuited. A drilling template is supplied for mounting the switch, while an indicating dial is provided for showing the position of the switch segment. Soldering tags are used for making connections, and the insulation resistance between the contacts was found to be infinity.

The switch is solidly constructed and well made, while a ratchet-like arrangement gives positive indication to the touch when the switch is in the various positions.

Least Loss Condenser

We have received from Messrs. The Mareoniphone Co., Ltd., one of their Sterling Least Loss Variable Condensers. It is a well constructed instrument, the fixed plates being insulated from the moving plates by means of Pyrex glass. The vanes are constructed of brass, while the end plates are aluminium castings, one-hole fixing being provided.

Positive connection is made to the moving vanes by means of a pigtail, and a pointer and scale are used instead of the conventional knob and dial. Only one adjustment is provided, this being of a semi-fine nature, the actual reduction, which is obtained by means of special friction gearing,

APPARATUS WE HAVE TESTED
(Continued)

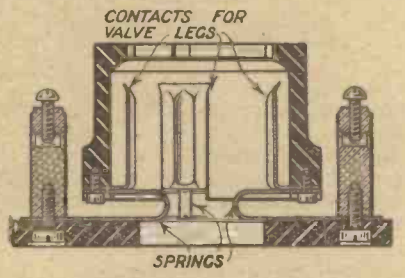
being about 8 to 1. The maximum capacity of the condenser is exactly the value given by the makers, namely, .00028 microfarad, while its minimum capacity is only 11 micromicrofarads, which is well below the average.

The efficiency is of a high order, and the losses at broadcast frequencies are too low to be measured. The two small points which call for criticism are that only soldering tags are provided for making connection to the condenser, and the use of rubber in the friction gearing introduces a slight amount of backlash.

The mechanical design of the condenser is excellent, and neither side play nor end play were perceptible in the bearings.

Anti-Microphonic Valve-Holder

We have received from Messrs. The Norman Radio Co., Ltd., samples of their baseboard Anti-Microphonic Valve-Holders. These can be supplied for either baseboard or panel mounting, and a sample of each has been sent to our Elstree Laboratories for examination and report.



An anti-microphonic valve-holder of good workmanship, made by Messrs. The Norman Radio Co., Ltd.

The valve-holder itself consists of a hollow ebonite moulding, in which contact strips for the ordinary type of valve pins are held by screws to the bottom of the moulding. These screws also secure further strips of brass which are bent round in such a way as to form a spring mounting to the component. In the case of the baseboard mounting holder, these brass strips are joined to a small square piece of ebonite with four terminals. The panel mounting holder is fitted with suitable screws for mounting the holder in place.

The insulation resistance of this valve-holder was found to be infinity, and the mechanical strength of the brass strips which are used for springing purposes was quite adequate when submitted to the most exacting tests.

These valve-holders are of good workmanship, and were found to be thoroughly satisfactory in use, except that no soldering tags are provided for connections, these having to be made to the screws themselves.

The Superheterodyne on Short Waves

SIR,—I followed the recent correspondence in your columns between Mr. J. R. Stingleberry and Mr. L. R. Brand with great interest; in fact, Mr. Brand's letters induced me to construct a short-wave superheterodyne, which I should probably not have done but for the way in which he praised the "superhet." as the best short-wave receiver.

I cannot help feeling, however, that he studiously omitted to mention two very serious disadvantages of this type of receiver. First, I was considerably surprised at the enormous increase in interference due to the fact that every station could be received, both on its upper and lower "channel." Thus in effect, there are twice as many stations working within a given range of frequencies as would be heard with a receiver of the "straight" type.

Secondly, I have an extremely accurate heterodyne wavemeter, on the construction of which I spent a large amount of time and trouble. I find, however, that it is almost impossible now to take readings on it, not only on account of the two "channels" which may be received, but also because of innumerable "chirps" caused by harmonics of the wavemeter heterodyning harmonics of the separate oscillator, and even the long-wave oscillator.

I must confess that I now have considerable sympathy with Mr. J. R. Stingleberry's point of view.—Yours faithfully,

H. B. SANDFORD.

Bristol.

[EDITORIAL NOTE.—The difficulties experienced by Mr. Sandford are capable of being overcome; perhaps Mr. Brand would like to deal with these points?]

Oscillating Neighbours

SIR,—I was interested in Mr. Clyne's letter in a recent issue of your excellent periodical, *Wireless Weekly*, and it reminded me of some experiments in which I took part in 1924.

Two aerials were used; one a 100-ft. single wire aerial, 30 ft. high, suspended between two buildings, and the other a 60-ft. single wire running at right angles to the first. The two crossed about 2 ft. from each other and were led into different rooms. The earth for the larger was a buried plate with a 4-ft. lead, while the small wire was earthed to the hot-water system by a lead of about 3 ft.

A valve set was used on the shorter aerial, this being a straightforward two-valve receiver, H.F.—D, with reaction on the aerial. The other set was a variometer-tuned crystal receiver.

With this arrangement several peculiar effects were noticed. When both the valve and the crystal sets were tuned to the same station any alteration in the tuning of either set necessitated retuning the other. I may say that the valve set was not oscillating, but was being worked fairly close to the oscillation point. Of course, if it had been oscillating howls would have been produced.

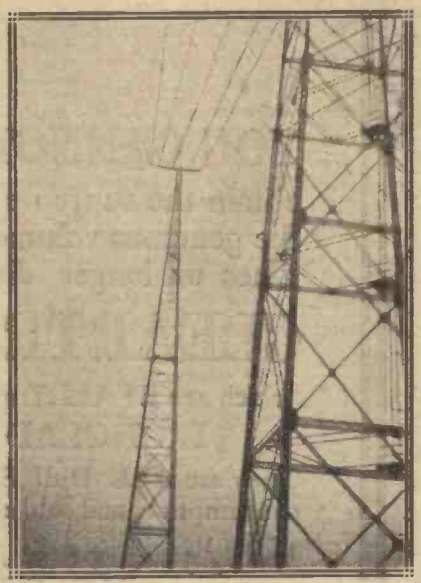
If the valve set was tuned to some other station only very faint results (R.2) could be obtained from the local station (Cardiff—35 miles) when the crystal set was tuned to it. Normally on this set the strength was R.5. The crystal set would, however, pick up any station to which the valve set was tuned.

When the catswhisker of the crystal set was adjusted loud "atmospherics" were picked up by the valve set.

Hoping this will interest your correspondents.—Yours faithfully,

H. DARE.

Woodbury, Devon.



The aerial and the transmitter of Radio-Paris are situated at Clichy, some little distance from the studio, which is in the city itself.

B.B.C. Hours

SIR,—With regard to the letter in your issue of March 24, by Mr R. D. Watts, who complains of the length of the B.B.C. programmes, I should be glad if you could spare me some of your valuable space in which to say a few words on behalf of amateur transmitters.

The amateurs, who, though allowed to work on their shorter wave-bands *at any time*, generally refrain from doing so until after about 11 p.m., on account of the interference they may cause to owners of non-selective crystal sets. If my own case is any criterion, the B.C.L.'s fail to show any semblance of gratitude, and in more than one case when I have started up on low power while the Savoy Bands were being broadcast at 11.30 p.m. an enraged neighbour has come to my house and nearly knocked the front door down.

If the B.B.C. keep on until midnight almost every night, when *do* the B.C.L.'s think the amateur is going to do his work? A large number of them are engaged on really serious and useful experiments, in the carrying out of which they are often seriously hampered simply because the owner of a 5s. crystal set appears to imagine himself as "lord of the ether."

On approaching the owner of such a set, I have met with the reply, "I don't see why I should alter my set. It's up to you to improve your transmitter so that I don't hear you." The really great point is that I have a perfectly ordinary loose-coupled crystal set *in the same room* as the transmitter, on which no trace of interference can be heard!

It seems to me that something serious is bound to happen soon, unless the B.B.C. shorten their programmes, or the direct-coupled crystal set is banned by law!

Readers' Comments

(Continued)

Can any of your readers suggest a solution to the problem?—Yours faithfully,

"SHORT-WAVER."

West Norwood.

B.B.C. Hours

SIR,—Mr. J. L. Bennett, who replied in your issue of March 31 to Mr. R. D. Watts's letter on "B.B.C. Hours," seems to me to be rather an optimist. He says, "I fail to see how short-wave reception is affected by the activities of the B.B.C., unless one presupposes inferior apparatus." Mr. Bennett apparently does not realise that the amateur transmitter, both in this country and abroad, has been so effectively squashed by the incessant complaints of the "crystal scratcher" that he no longer transmits to any extent during the broadcast programmes, and consequently there is hardly anything to be heard on short waves until after 11.30 p.m.

Has Mr. Bennett constructed a receiver selective enough to receive the other B.B.C. stations through the terrible noise created by the re-radiation of 2LO by valve sets and crystal sets operating on aerials directly underneath his own? If so, I should be glad to hear from him how he does it.—Yours faithfully,

R. B. BARRETT.

Lewisham.

X's on Short Waves

SIR,—I wonder if any of your readers who are interested in short-wave work and who have taken note of atmospheric disturbances at various times have any comment to offer on the following?

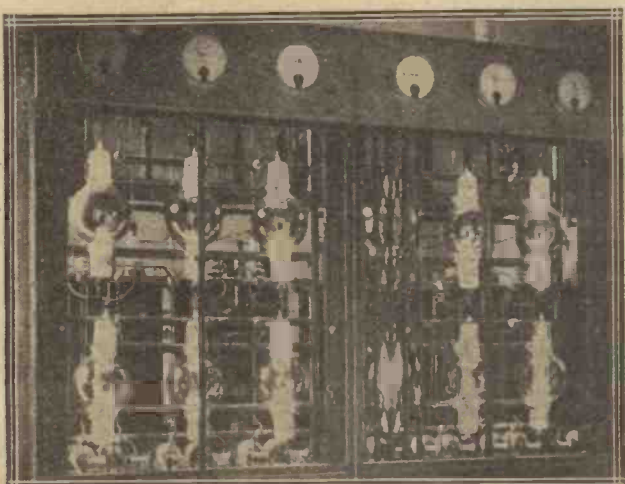
I do a good deal of listening on the wavelengths between 50 and 30 metres, and I have observed on many occasions that when "X's" are violent on 45 metres they are not nearly so noticeable on 35 metres. This seems to occur usually when the types of "atmospheric" prevalent are the heavy "crashes" and "grinders," with an undercurrent of less intensity. At such times the crashes are less prominent on the lower wavelengths.

When the "X's" consist mainly of a more or less continuous "hissing," with rarer crackles, the same conditions usually prevail over the whole band of wavelengths mentioned.

I should be most interested if any of your readers would furnish their own observations on the above subject.—Yours faithfully,

A. R. DYSON.

London, N.W.8.



The valve "panels" at Radio-Paris are protected by sliding doors like those of a lift.

A Curious Phenomenon

SIR,—I have encountered a somewhat troublesome "loss of power" recently when transmitting on 45 metres, and I should be glad to know whether any of your readers have had similar experiences, and whether they have found any cure for the trouble.

The circumstances are as follows: My aerial, which I am unable at present to raise more than about 10 or 12 ft. (average) above the ground, crosses another aerial belonging to a broadcast listener with a crystal set, approximately at right-angles. My own wire is about 4 ft. above the other one at the point of intersection.

READERS' COMMENTS

(Continued)

Normally, when the crystal set is out of use, my reported signal strength is satisfactory. I had noticed on several occasions that if the crystal set was brought into use when I was transmitting, the aerial current reading would fall to about 60 per cent. of its normal value. A few nights ago I was in communication with a station in the Midlands when he reported a weakening of the strength of my signals. This occurrence, as I found, coincided with the tuning in of the crystal set to London's transmission.

As the crystal set is not always disconnected when it is not in use, and as I am unable to attend to this matter

A rather unusual way of looking at an aerial mast: looking downwards from the top of one of those at Rugby.

myself whenever I wish to transmit, I should be glad to know if anyone has found any satisfactory cure for this source of leakage.—Yours faithfully,

A. V. D. HORT.

London, N.W.8.

HIGH FREQUENCY OR LOW?

(Continued from page 250)

over a wide range of frequencies by correct adjustment, which adjustment, once made, does not need further alteration. Flexibility over the upper and lower broadcast band of frequencies is now possible, and my reasoning on the matter seems to point to a receiver with three stages of high-frequency amplification, a rectifier and one stage of low-frequency for adequate loud-speaker work over great distances.

Wireless Weekly Small Advertisements.

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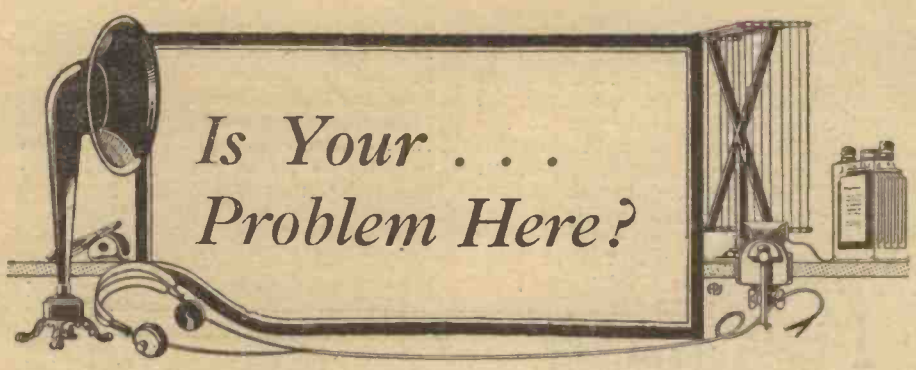


Filaments in Series

"I wish to wire up a 3-valve receiver, mainly for loud-speaker work on the local station, which is 20 miles away, but the set should also be capable of reaching out and should have a fair degree of selectivity. I have two D.E.R. type valves and one D.F.A.0 power valve, and would be glad if you could give me a circuit arrangement which will give the most economical working as far as filament current is concerned, since battery charging facilities are not of the best here. I have a 4-volt 30 actual ampere-hour accumulator."

Since filament current consumption is of importance, in your case we would suggest that you run your first two valves in series with no filament rheostat, since these require a filament voltage of approximately 2 volts, whilst the power valve, which works on 3.5 volts, may be connected in the normal manner. We give in the figure herewith a circuit arrangement which should prove highly satisfactory in practice. Direct coupling is employed in the aerial circuit and a choice of constant aerial tuning, which arrangement is to be preferred on "stiff" aerials or where it is desired to cover a maximum wavelength range with a given aerial coil, or plain parallel tuning is available.

The method of coupling the H.F. and detector valves departs somewhat from the more conventional systems, but will be found to give excellent working in practice. A high-frequency choke coil is required in the plate circuit of V1, and here one of the many chokes now on the market will serve excellently, although in cases where it is desired to also receive Daventry it may be found advantageous to employ plug-in coils of high inductance and low self-capacity.

For the higher frequency band Nos. 250 or 300 prove suitable, whilst for the lower, employed by Radio-Paris and Daventry, larger coils, such as the Gambrell G, H or I, or Nos. 500, 600, etc., should be used. The blocking condenser C3 may conveniently be of .0003 or .0005. The grid coil L2, which will be of a size normally employed for tuned-anode working, is tuned by a parallel condenser of .0003, and is arranged so that the detector valve works on the lower bend of its characteristic curve. In practice, anode bend rectification is to be preferred where strong signals will be handled by the detector valve, and since this latter is negatively biased, some improvement in selectivity results therefrom.

The lower end of L2 may be connected either through a grid biasing battery G.B.1 to the negative leg of the detector valve filament, or may be taken to the slider of a potentiometer R2 in order that fine adjustment of the grid potential of the valve may be obtained.

Reaction may be found advantageous and can be obtained magnetically by coupling the coil L3 to L2. For stabilising purposes we have included the potentiometer R1, but in practice

Is Your Problem Here?—Continued

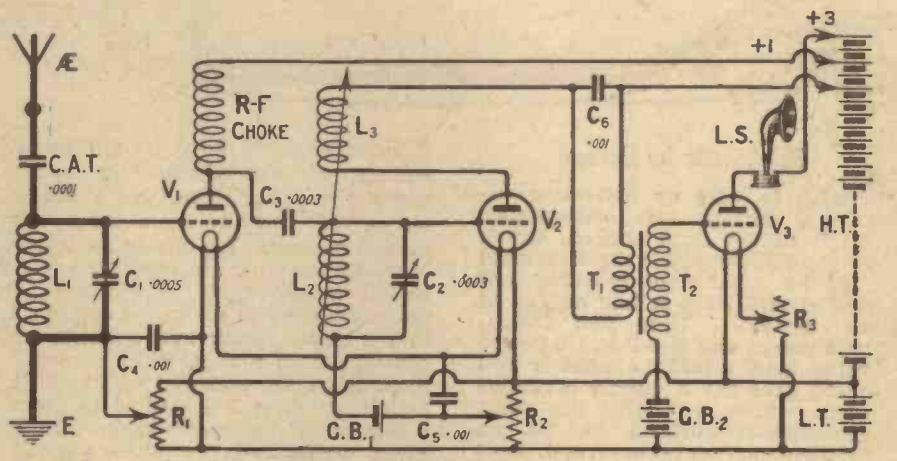
where the aerial and earth system is not a very good one, or where the value of C3 has been suitably adjusted, the potentiometer may often be omitted and the lower end of L1 and C1 may be taken directly to low-tension negative.

"I have a 4-valve receiver constructed from the particulars given in Radio Press Simplex Chart No. 3 and wish to employ a power valve in the fourth valve socket, with extra high tension and grid bias. I should be glad if you would show me how this may be done without cutting out the present useful switching, which I find particularly convenient."

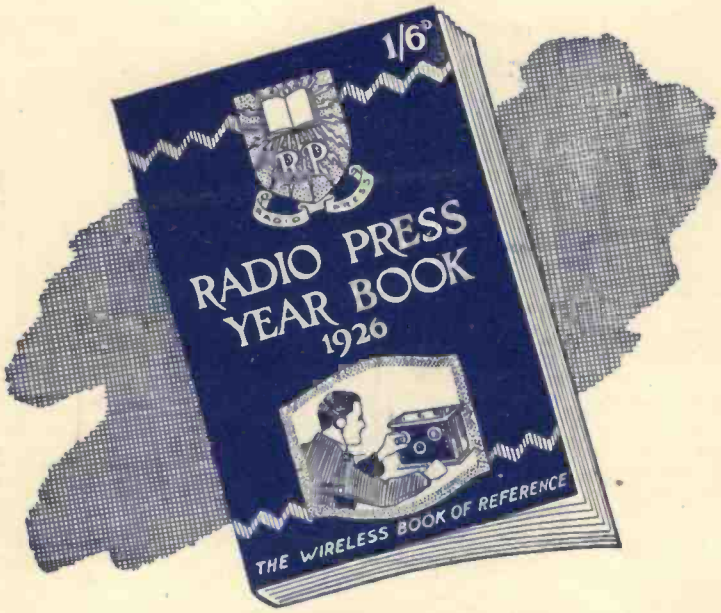
To retain the simple switching arrangement incorporated in the receiver necessitates the use of an extra high-tension battery when a power valve is placed in the last socket of the set. The voltage of this extra battery should be such that, added to that at present used on all four valves, the resultant voltage on the last is of the order advised by the makers, usually about 100 or 120 volts. Should you now use a 72-volt high-tension battery a further separate battery of 36 volts should prove satisfactory, making the H.T. applied to the power valve 108 volts in all.

A comparatively slight alteration allows this to be done; the procedure to adopt is to sever the lead between the plate of the last valve, namely, the point 8, and stud 48 of the switch. The two wires so formed should be brought out to two further terminals, between which the extra high-tension battery will be placed. This latter is so connected that its positive terminal is joined to the plate of the fourth valve, and its negative terminal to stud 48.

In order to work the power valve on the correct part of its characteristic curve for pure reproduction and to limit the high-tension current taken by this valve it is advisable that provision be made for grid bias. For this purpose, the lead between the filament end of the secondary winding of the second L.F. transformer and low-tension negative should be removed. The former point, that is 43, should now be brought out to a further terminal placed conveniently near to the low-tension negative terminal. This will serve for grid-bias negative, whilst the positive lead from the grid-bias battery will be joined to the L.T. negative terminal; 56 should still be left joined to 38.



Reaction may be applied in a very simple manner to the circuit L_2 C_2, as illustrated.



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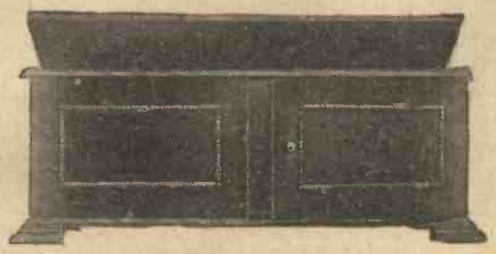

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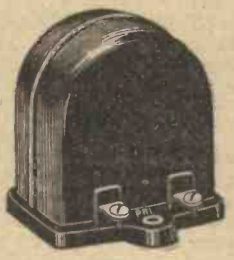

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Technical Editor:

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Technical Editor
J. H. REYNER
B.Sc.(Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

A Two-Valve Set for Centre-Tapped Coils

By JOHN W. BARBER

This interesting receiver confers the power to obtain a good degree of selectivity without the need for specially-wound coils, and will be found particularly simple to construct.

THE question of selectivity is one which is constantly receiving attention from the serious experimenter, and the same property is in increasing demand in the sphere of activity of the home constructor. The latter is desirous of getting rid of his local station, to hear some other transmission, while the experimenter is also after "DX" results, but he is, naturally, more capable of handling tricky circuits. The home constructor, on the other hand, is in most cases desirous of achieving his ends by the simplest possible means, and would, in a large number of cases, be alarmed at the mention of a large number of tuning controls.

Although the set will appeal to the constructor with experimental tastes, it is quite simple and straightforward in design.

Obtaining Selectivity

The desired selectivity may be obtained in a number of ways, depending upon the desire to include or exclude high-frequency amplification, the maximum number of tuned circuits desirable, whether or not some form of wave-trap should be included and many other factors.

Readers will have seen the "Wave-trap Reinartz" receiver described in the issue of this journal dated February 3, 1926, by the present author, and will have realised that the desired selectivity is, in that case, obtained by the use of a special form of wave-trap, combined with low-loss coil construction and the provision of tappings to enable the best aerial coupling to be obtained. There are, however, a large number of people who object strongly to winding their own coils, especially when fine wire and tappings are called for, and although the operation is, in reality, simplicity itself, it is felt that some receiver should be designed which will give a reasonable degree of selectivity, using commercial coils of the plug-in variety.

Degree of Selectivity

At the outset it may be stated that selectivity cannot with reason be expected to approach closely to that given by the above-mentioned Reinartz, which is capable of cutting out 2LO at 4½ miles, and bringing in Cardiff and Manchester on the loudspeaker, with no interference from London, principally by reason of the fact that such coils as those used therein, that is, provided with suitable tappings, are not available commercially, to my knowledge, and thus a compromise has to be effected which will give satisfaction.

The Circuit

The present receiver employs a circuit similar to that given in

A Two-Valve Set for Centre-Tapped Coils—*continued*

"Circuits for the Experimenter," in a recent issue of *Wireless Weekly* (March 3), and comprises three tuned circuits, each consisting of a centre-tapped coil, tuned by a .0005 variable condenser. The aerial is taken through a small fixed condenser, of the order of .0001, to the centre tapping on the coil L1 in the grid circuit of the high-frequency amplifier. This condenser is essential on account of the fact that half a coil of the size necessary for L1 is far too much to include in the aerial circuit when auto-coupling is employed, and thus a small series capacity is necessary. The value of this condenser may usually be of the order of .0001, although on large aerials, when working at the higher end of the broadcast frequency band, a somewhat smaller condenser may be desirable. In order to obtain the best results, a range of small condensers from .00002 μF to .0002 μF may be obtained, and the effect tried of different sizes when receiving different stations.

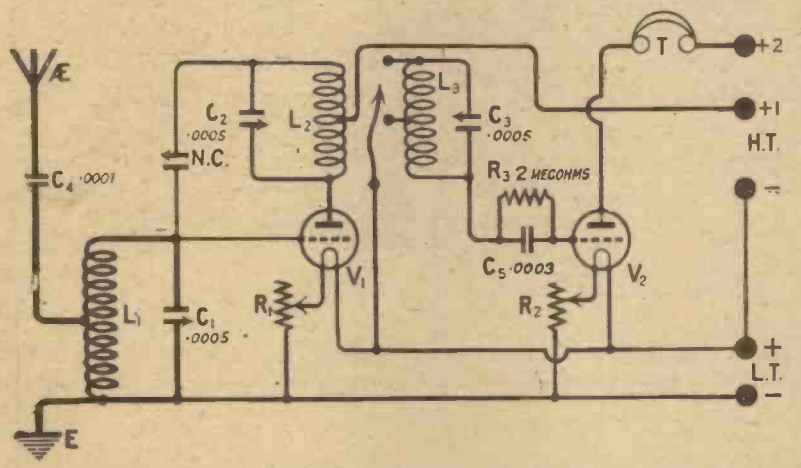


Fig. 1.—In the circuit adopted for this set the coils L2 and L3 constitute the intervalve transformer. The degree of coupling between them must be adjusted with some care.

Neutralising

It will be seen that the high-frequency amplifier is neutralised, a small condenser being connected from the top end of the primary L2 of the high-frequency transformer formed by the two coils L2 L3, with their associated tuning condensers, back to the grid of the first valve. The centre tap upon the primary L2 is joined to H.T.+, one end of the coil and tuning condenser being joined to the grid through the neutralising condenser, while the other end of this oscillatory circuit is joined to the anode of the H.F. valve.

Extension Handles

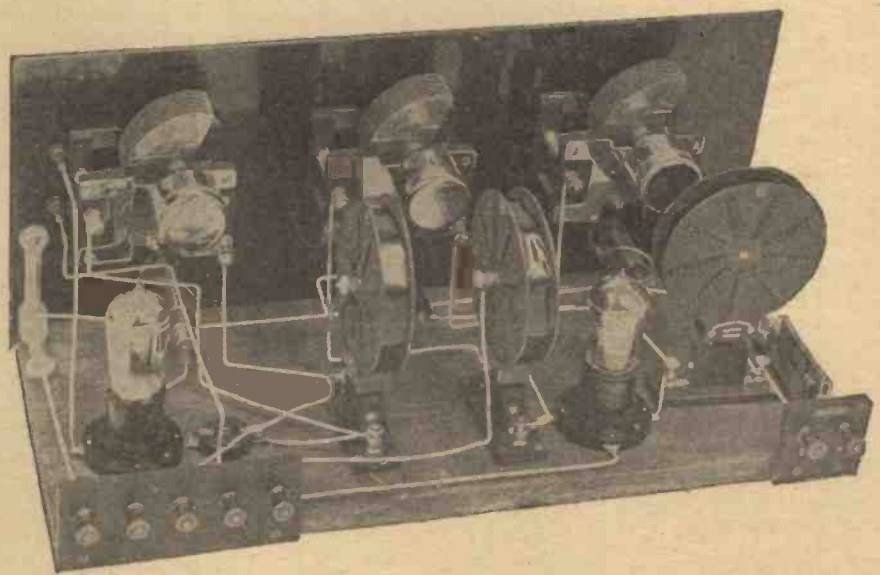
This circuit, by reason of the centre tapping, has its upper end at opposite potential (H.F.) to that of the anode at any moment, and thus we can obtain a neutralising effect in the manner shown. As each end of the circuit is at H.F. potential to earth some trouble may be experienced due to hand-capacity, and either an extension handle or some form of friction drive should be incorporated in the variable condensers employed.

Reducing Damping

In order to reduce damping in the secondary circuit of the high-frequency transformer, another centre-tapped coil is employed here, the centre tapping being taken to L.T.+. The valve is thus only joined across half of the secondary circuit, thereby effecting an increase in selectivity. A flexible lead is employed for the purpose of effecting this tapping, in order that the effect may be tried of joining the detector valve across the whole of the tuned circuit L3 C5. A by-pass condenser of about 001 across the telephones may sometimes be found advantageous, and should be tried.

Components

As a guide for those who may desire to experiment with such a receiver, the author used the following components in his receiver :—



The two coils shown parallel to each other are the ones forming the H.F. transformer. For good selectivity they will usually require to be placed almost at right angles.

One Radion panel, 18 in. x 8 in. x 3/16 in. (American Hard Rubber Co., Ltd.).

Suitable cabinet, with 8-in. baseboard (the Artcraft Co.).

A Two-Valve Set for Centre-Tapped Coils—*continued*

Three .0005 friction-drive variable condensers (Ormond Engineering Co.).

Two "Lotus" valve-holders (Garnett, Whiteley & Co., Ltd.).

Two 30-ohm filament resistances (C. A. Vandervell & Co., Ltd.).

One combined .0003 condenser and 2-megohm leak (Watmel).

One "Neutrovernier" condenser (Gambrell Bros., Ltd.).

Three single-coil mounts (Beard & Fitch, Ltd.).

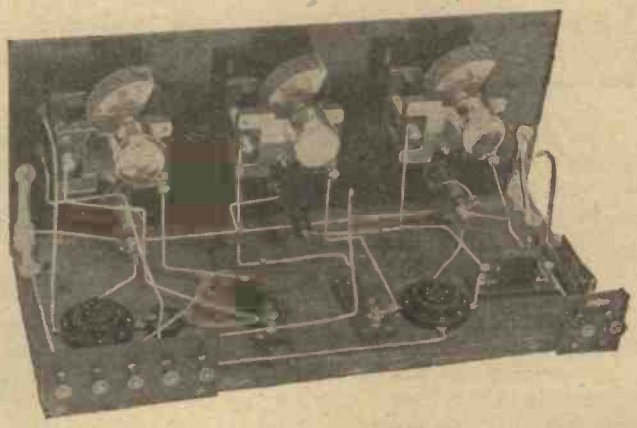
One terminal strip with five terminals, and one with two (Burne-Jones & Co.).

Three centre-tapped "B" coils (Gambrell Bros., Ltd.).

Radio Press panel transfers.

Glazite.

The three condensers will be found to give roughly matched readings for any given station.



Notes on Components

I have used a McMichael clip-in condenser and base for the aerial series capacity C4, as the value may thereby readily be changed. The centre-tapped coils are also obtainable from other firms, such as Lissen, Ltd., and these may be used if desired.

The actual constructional work involved is very simple, and will occupy very little time. The panel should first be drilled in accordance with the diagram, care being taken, if components other than those

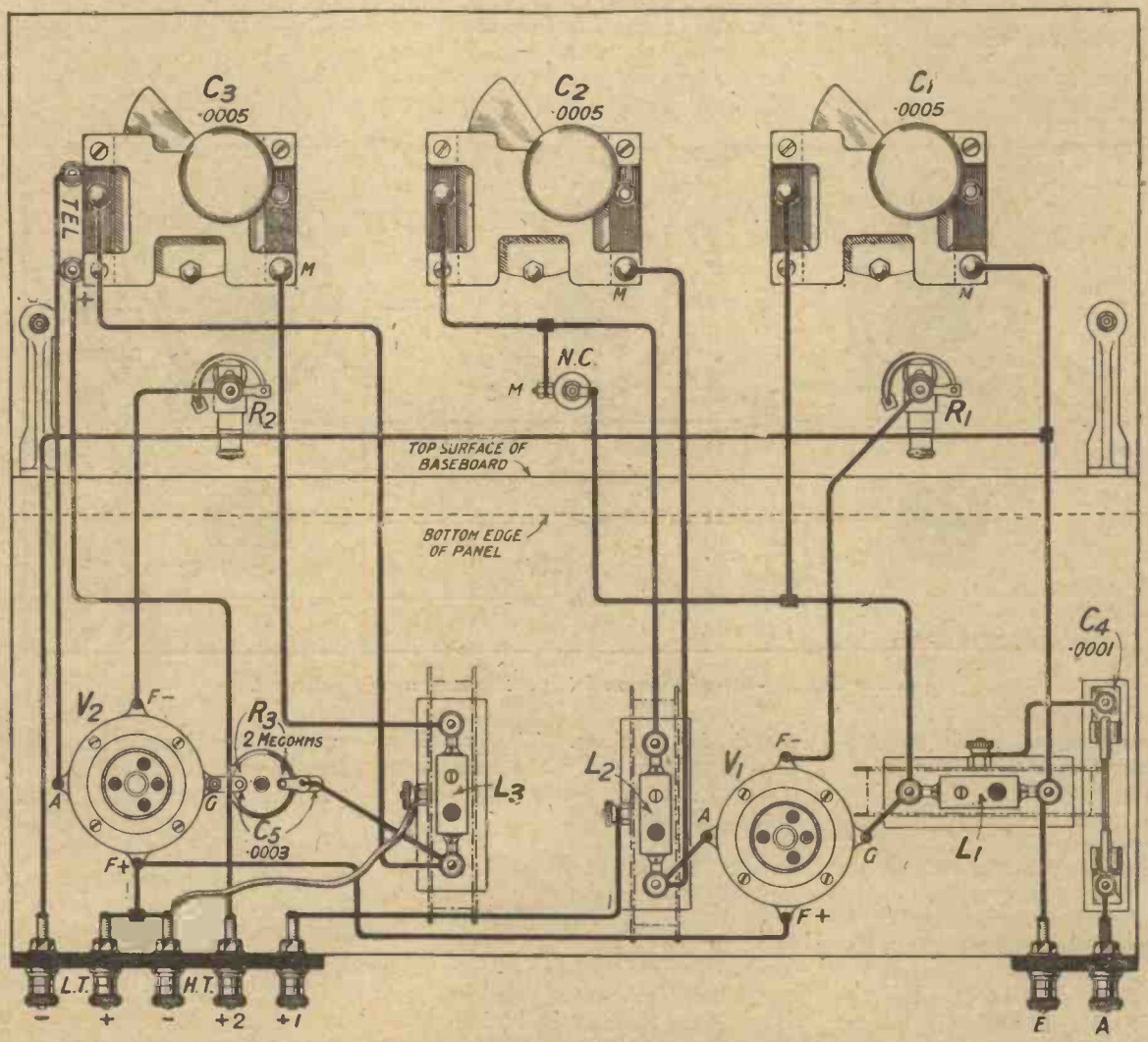


Fig. 2.—In wiring the set it is recommended that the leads to the coil L3 should be done with flex.

A Two-Valve Set for Centre-Tapped Coils—*continued*

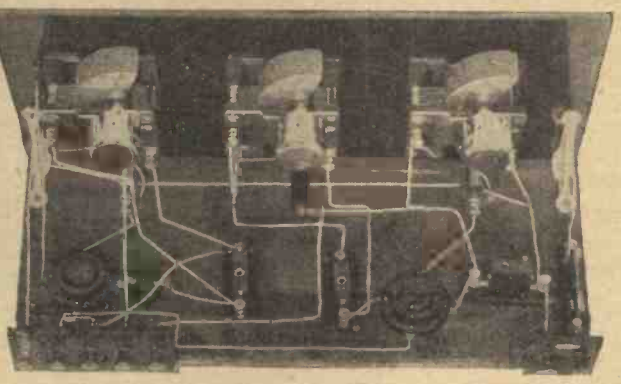
specified are used, that the drilling is modified to suit the altered circumstances.

Wiring

When mounting the components upon the baseboard it should be realised that the connections to the socket for L3 are made with flexible wire, in order that the best coupling between the primary and secondary coils may be found. The wiring of the receiver is quite straightforward, and calls for little comment, it merely being necessary to suggest that the wiring diagram and photographs be followed as closely as possible, in order that the best results may be obtained. The socket for L3 is secured to the baseboard by means of a screw through from the underside of the board into the coil mount.

Neutralising the Set

Having completed the connections, the next step is the testing out and adjustment of the neutrodyne arrangement. Set the tuning condensers C1, C2 and C3 at about the middle of the scale, and disconnect the aerial lead. Adjust the neutralising condenser to its minimum value, and, with a weak coupling between L2 and L3, it will probably be found that the receiver is oscillating strongly. Increase the value of the neutrodyne condenser until, by revolving the condenser C2, it is found that the receiver does not break into oscillation at any position of the tuning controls. When this has been achieved, join up the aerial, and the set is then ready for use.



The wiring of the coil sockets should be spaced out carefully.

Searching

As the three coils are of the same size, stations will be heard at approximately the same settings upon the tuning condensers, thus rendering it a much easier matter to search for stations. The coupling between the primary and secondary coils of the high-frequency transformer should not be made so weak that a loss of signal strength results, but it is not advisable to have this coupling fully variable, as, for example, by the use of a two-way coil holder, as readjustments of the coupling will necessitate readjustments of the neutrodyne arrangements, and will also upset the calibration of the receiver.

Some Results

The set was first tested on the writer's standard P.M.G. aerial at 4½ miles from the London station, and it was found possible to receive Bournemouth at good strength without interference from the former station. The best selectivity was obtained, as would be expected, with the movable coil set at the position of minimum coupling, although in some cases signal strength is improved by a tightening of the coupling. It will probably be found most satisfactory to find the best all-round coupling between the two coils of the high-frequency transformer, and to leave them in this position.

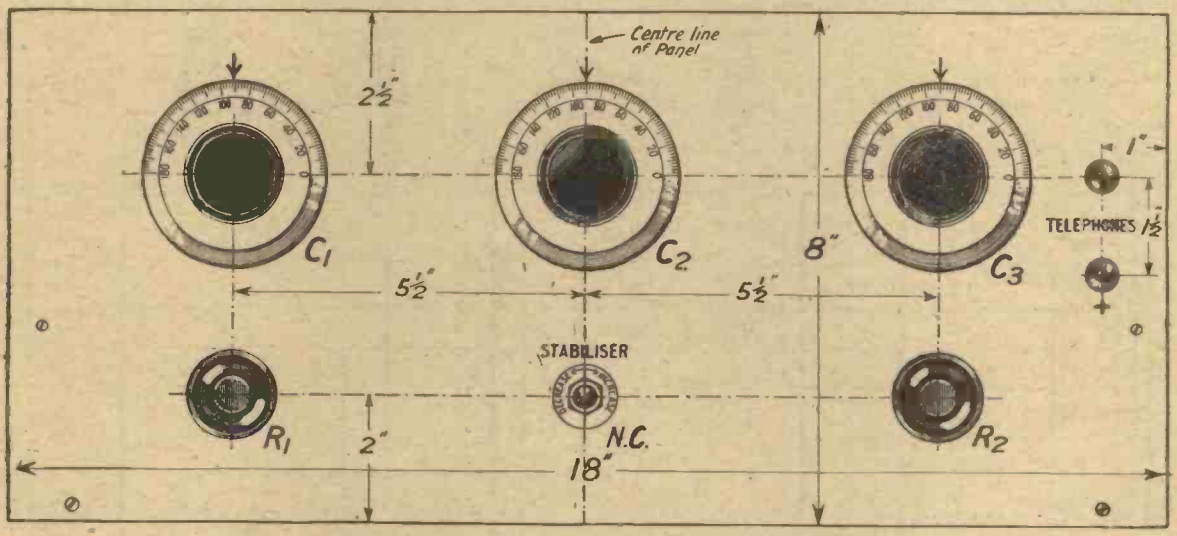


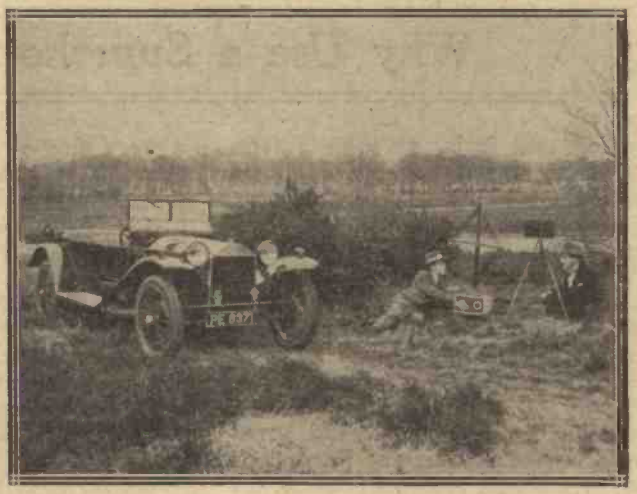
Fig. 3.—The lay-out of the panel is particularly neatly balanced.

Next week: Full test report, notes on operating the set, getting the best results, etc.

WHY USE A SUPERHETERODYNE?

By G. P. KENDALL, B.Sc.

Superheterodyne receivers in their usual form employ something between six and nine valves, and it is sometimes asked whether they are worth while. The author of these notes has used "supers" of various types for some time, and holds decided views on the point.



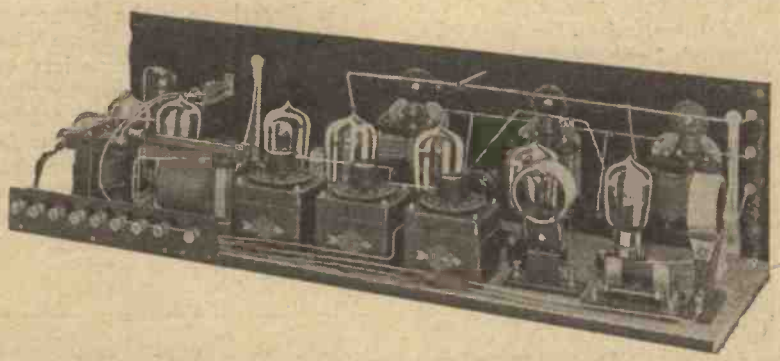
"MY friend, Robertson, has just made a 7-valve superheterodyne, and he was so pleased with the results that he invited me round the other night to hear what the set would do. Certainly he managed to bring in quite a lot of stations on the loud-speaker, but I must say I was thoroughly disappointed after all I had heard of the marvels of the superheterodyne. I really believe I could do everything that Robertson did with the aid of my old 4-valve set upon any really good aerial."

Misgivings

I have often heard things like that said, and although one can usually squash the speaker by asking him whether he can achieve as great a degree of selectivity as his friend demonstrated to him, it must be admitted that the point of view is one which is apt to cause one a little uneasiness if one is a keen devotee of the "super" circuit. Is it really so wonderful after all? Does one really do more with a superheterodyne than one can do with an ordinary straight set working upon an aerial? Such questions as these keep recurring, and the answer which one gives usually depends to a very great extent upon how one's latest particular pet among superheterodynes is behaving, since everyone who does a certain amount of experimental work with supers, trying out possible circuits, and so on, must experience times when he feels that any really good 4-valve set upon an outside aerial would be a much nicer thing to work with than a superheterodyne!

A Devotee

Now, I, personally, am a keen enthusiast of superheterodyne receivers, and I propose to give some of the views and observations on these points which occur to me, knowing full well that they are likely to be entirely contrary to those of many readers, but hoping that they will make interesting reading, nevertheless. If the things that I say run so contrary to the beliefs and experience of some of my readers that they feel they must protest, well, there is always the correspondence page!



One of the attractions of the superheterodyne is that although it contains many tuned circuits, a number of them are permanently adjusted to a fixed frequency, and do not require manipulation. In this set, for example, three circuits are provided with tuning condensers which could be located inside the receiver, where they can be set once and for all.

Let us take first that vexed question as to whether the superheterodyne will really do more upon its little frame aerial than will a circuit employing a suitable number of effective high-frequency stages upon an outside aerial. Opponents of the superheterodyne say that with the aid of, say, two high-frequency stages with suitable modern inter-valve coupling circuits, they can bring in anything which is of sufficient strength as compared with the general level of atmospherics, and with the aid of four valves can accomplish everything which the superheterodyne can do with its seven or eight upon a frame aerial, and they usually go on to ask why one is willing to continue its use simply for the satisfaction of working upon a frame aerial.

The Directional Effect

Now this is all very well, but that little question as to the signal being above the general level of atmospherics is a very debatable point, since they are overlooking entirely the directional properties of the frame aerial outfit. If atmospherics can be taken as coming from all directions more or less equally, then, surely, if we arrange our equipment to pick up signals along a certain line strongly, and those upon a cross direction comparatively feebly, surely we can reduce the general level of atmospherics, and we shall therefore be able to receive a weaker signal than would be possible if we were picking up atmospherics from all directions at equal strength?

An Important Advantage

This, of course, is a really important advantage in favour of the superheterodyne, but it must be con-

Why Use a Superheterodyne?—*continued*

fessed that it is, to some extent, offset by the disadvantage known as "second channel" interference, which means that just as any given station can be heard at two settings of the oscillator dial, so any given single setting on the oscillator dial will bring in two stations at once, if those two stations happen to be at just the correct frequency difference apart.

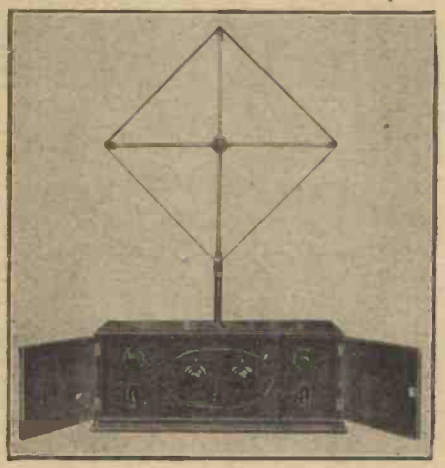
When we are considering atmospherics, of course, the proviso as to the correct frequency difference separating the two sets of waves which are to be heard does not apply, and we therefore hear two selections of atmospherics at any given setting of the oscillator dial, and thus the general level of atmospheric noise is raised. As a matter of fact, however, second channel interference can be reduced very considerably by a suitable design of the superheterodyne. For example, second channel interference as regards properly tuned transmissions can be reduced very largely by the use of really sharp tuning in the frame circuit, for it will be remembered that this circuit is tuned to only *one* of the channels through which signals are coming in.

Directional Selectivity

Another important advantage resulting from the directional properties of the frame aerial is that of the power which it gives of separating two signals which come from stations in different directions, and yet which are upon frequencies which are so close together that there is no hope of dividing them by means of a set working upon an outside aerial. There is, as most readers know, a limit to the degree of selectivity which is permissible in any broadcast receiver without loss of quality of reproduction, and if two stations lie within these limits, it is impossible to separate them fully. Now, with a superheterodyne it should be quite possible, upon occasion, to separate two stations which are working so close together as to produce an actual audible whistle, simply by virtue of the directional properties of the frame, one station going out and the other coming in as the frame is turned.

Simplicity of Operation

A very special advantage which can be claimed for the superheterodyne is that it is possible to obtain a very fine degree of selectivity, even up to the practical limits of the production of distortion in telephony reception, with only two actual tuning controls. A similar degree of selectivity can, no doubt, be obtained with special multi-H.F. sets, but to be able to do so with only two controls is practically the special prerogative of the superheterodyne. The simplicity of searching conferred by two dials is a really important attraction of the super which must be allowed by its most convinced opponents.



The Burndept "Ethodyne" is a good example of an instrument giving a high degree of selectivity with only two tuning dials.

The Frame

Believers in the theory that superheterodynes only do upon a frame aerial what any good H.F. set will do upon an outside aerial are rather prone to point the finger of scorn at the unwieldiness and unsightliness of the frame aerial which it is necessary to use in the immediate vicinity of the receiver. This point is one which, I feel, must be conceded to the objectors; but one can turn the tables upon them by pointing out that one of the most important applications of the superheterodyne is to portable sets, where the use of a frame aerial is of inestimable advantage from the point of view of rapid erection in cramped quarters. As a portable set, the superheterodyne is certainly very hard to equal, provided that the design is such that a reasonable number of valves are employed, with a consequent ability to use batteries of only moderate size. The superheterodyne enthusiast scores indeed upon one of those picnic occasions when the believer in simple straight sets finds it necessary to climb trees, or erect poles, while his opponent simply unfolds a collapsible frame aerial.

Freedom from Radiation

It is not generally realised that the superheterodyne is one of the few receivers which can be described as really "safe" from the point of view of causing interference troubles as the result of a clumsy adjustment of reaction. The reaction control in the majority of superheterodynes takes the form of a potentiometer controlling the natural tendency to oscillate of the intermediate frequency amplifier, and it is a comforting thought to most of us that this control can be used without the slightest consideration for one's neighbours, since the long-wave side can be allowed to oscillate as strongly as one likes without the risk of causing the slightest trouble at distances of more than a few feet.

Radiation from the Frame

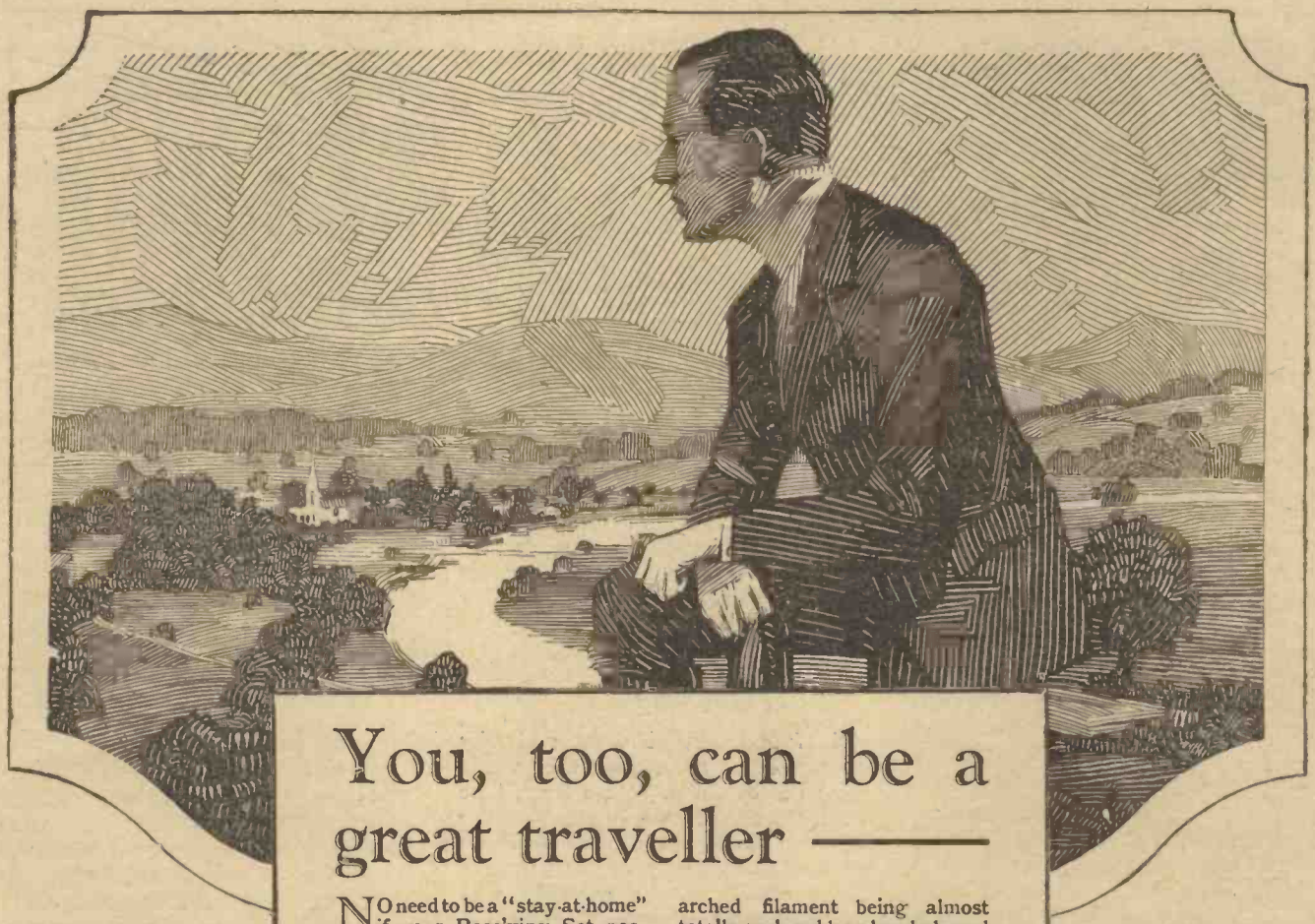
There is, of course, some slight possibility of causing interference with a superheterodyne if it is one of the type in which the oscillator feeds directly into the frame aerial circuit, but the extent of such interference is certainly limited to quite short distances, and also very many superheterodynes have a stage of high-frequency amplification in front of the first detector, or some other provision is made to reduce or entirely eliminate the possibility of even such radiation as may occur with other types.

Amateur Transmitting Notes.

Complaints have reached us from the North that the matter under this heading does not deal sufficiently with the activities of transmitters in that district. We should like to point out that if the Southern stations seem to be given preference, it is simply because they make a point of writing to us from time to time: all reports are welcomed *and used*. Please write!

"Apparatus Tested."

In the issue of *Wireless Weekly* for March 17th, a test report appeared of a repaired valve sent in by Messrs. "Radion Valves Co., Ltd." This should have read "Radio Valves, Ltd."



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Cossor Valves

PROFESSOR GOOP was exceedingly busy when I called in to see him one day last week. As a rule he does not do much constructional work, leaving it rather to my skilled hands to make up the apparatus and the sets which he so cleverly designs. Lately, however, he has been rather badly bitten by the set-building bug and he has thus been learning at first hand some of the troubles experienced by amateur constructors.

Revolutionary Improvements

It occurred to him almost at once that most of the tools used for radio work were hopelessly unsatisfactory. Take, for instance, the hacksaw. What does the ordinary man do when he knocks out half a dozen teeth from the blade by sawing lightheartedly into the jaws of his vice? He flings the blade away and puts in a new one. As soon as the Professor's Stepney Denture for chipped hacksaws is placed on the market you will be able to fit the

. . . it goes through ebonite like cheese . . .

damaged blade with artificial teeth, when it will be good for another long spell of work.

For the Sensitive

Some people cannot bear to use a hacksaw at all, owing to the way in which its noise makes them go goosey all over. The Professor is one of these, and he has now designed a toothless blade that will make hacksawing a pleasure even to the most sensitive. This particular blade is used in a red-hot state; it then goes through ebonite as a string cuts cheese. After one experience of it Mrs. Goop forbade the further use of the new blade in her drawing-room, but the Professor has since devised an automatic scent-spray attachment for the handle of the frame, which prevents the nose of even the most fastidious of wives from being offended when ebonite cutting is in progress.

Drill Problems

I found the Professor busily engaged in reviewing the whole question of drills. "So long," he said, "as I am called upon to make nothing but round holes, these somewhat clumsy tools answer fairly well." I was examining at the moment a great gulf which the Professor had cut in his panel, apparently with a $\frac{3}{8}$-in. drill and a brace, for the reception of the bush of a variable condenser. "You seem," I said, "also to be able to make quite good oval holes with the same weapons."

And Einstein

The Professor assured me that my seeing the hole as oval was an astounding verification of Einstein's theories. The diameter of the hole was, of course, greater from east to west than from north to south. And then he got really busy about Einstein, or rather he would have done had I not hastily brought him back again to the subject of drills. "Round drills," he said, "are all very well, but other shapes are obviously required. Round drills make round holes; very well then, why are not square drills sold for making square holes?"

"A splendid idea," I cried. "And let us write at once to the Zoological Society to suggest that they should use their mandrils for making manholes . . ." Luckily, the Professor has always been a rotten shot with a high-tension battery. The one that he flung on that occasion whizzed harmlessly past my left ear and annihilated a portrait of his great aunt wearing a crinoline which I have always thought rather an eyesore. He was about to follow the battery up with his biggest transformer when I crossed my fingers and called "Pax!" Discretion is always the better part of valour in such cases, especially when you have no weightier missiles than 4B.A. nuts within reach.

Enter Poddleby

It was at this moment that Poddleby tripped into the room, over little Bingo and on to his nose. Resenting this unexpected assault, Bingo had the prostrate Poddleby by the ear in a flash. The Professor and I seized the dog, endeavouring manfully to pull him off, but all that happened was that Poddleby's ear stretched like a piece of elastic under the strain whilst the hound remained firmly connected. "Quick!" yelled Professor Goop. "Bring the pepper-pot from the dining-room." Being, as you know, always swift

. . . Poddleby's ear stretched like elastic . . .

to act I was back in a flash with half the contents of the sideboard.

Complications

The first vessel that I emptied over Poddleby and the hound contained not pepper but sugar; the second, salt. But I made no mistake about the third. I unscrewed the lid first of all to make sure, and then emptied its contents over them like oil on troubled waters. The effect was instantaneous. Bingo relaxed his grip, Poddleby's ear flew back with a snap, whilst the Professor, who was exerting con-

Jottings by the Way—*continued*

siderable force upon the hind-quarters of the dog, shot backwards across the room and sat down violently on a pile of valve boxes in a corner. As Bingo was now endeavouring to attack the Professor I came to my old friend's aid with the remainder of the contents of the cruet, pouring a libation of vinegar, salad oil and Worcester sauce over him and his small, but ferocious, assailant.

And Mrs. Goop

I was still engaged in my work of mercy when the door opened to admit Mrs. Goop, who treated me and the others to a singularly frigid glare. "What on *earth* is the matter?" she asked in acid tones. "Mmmm aaatishoo!" I explained, with a polite wave of the hand. Mrs. Goop turned her back on me and addressed Poddleby. "As Mr. Wayfarer appears to be incoherent, perhaps you can tell me?" she snapped. "Cerstishly," replied Poddleby. "I was just a—a—a—ahooo!" Giving the wretched Poddleby *such* a look Mrs. Goop went over to her spouse, who was wiping off the condiments with the help of the window curtains. "Tell me at once what this is all about, Horace?" she barked. "It's quite allgurglegulpright," gasped the Professor. "We were a—a—a—ayepooo!"

Then Mrs. Goop fairly let herself go. "It's the most disgraceful scene I ever saw," she cried. "The room turned into a beargulp-garden! Horace, I am absolutely astishooomed of you. Ick—ick—ickoo!" Gathering up little Bingo she buried her face for an instant in his well-peppered hide and fled from the room overcome by a paroxysm worse than ours. A look of relief spread over the Professor's face as he watched her retreating form. "This pepper," he remarked, "is splendid stuff. I shall order a hundredweight to-morrow."

A Move

As we were all of us still heaving a little, and seemed likely to do so as long as we remained in the peppery atmosphere of the Professor's study, I suggested an adjournment forthwith to Simla Villa, telling Poddleby that I was sure that the General would be only too glad to hear the news with which he had obviously been bursting when he entered the Professor's sanctum. Out in the open air we felt much better, and we had perfectly regained our composure when we were ushered into the General's den. He was very glad to see us, laughing like anything over our

. . . *"Smashcrashoo!"—a masterly sneeze* . . .

accounts of Poddleby's adventure with little Bingo.

Another Victim

"And now, General," I said, "you must let Poddleby get off his chest the information that he is burning to impart. I believe that he has discovered a new circuit or something of that kind." "Splendid fellow, Poddleby!" roared the General, slapping our stout friend heartily on the back. If Poddleby did not get it off his chest, he certainly got it off his back. A cloud of pepper rose into the air. I flew to open the window, but I was too late. "Tell us all about it," cried the General. "I am dying to honk—honk—honk—smashcrashooo!" Never have I heard such a masterly sneeze. All the window-panes were blown out, the carpet rose into the air and came to earth like a crumpled roseleaf in a corner,

. . . *gave himself a hearty shake* . . .

whilst the flowers in the window-boxes withered and died.

On and On

It was obvious that the General's study had become as unsuitable a place as the Professor's for the unfolding of Poddleby's secret. I hurried the three of them—all of us were somewhat overcome by this time—out into the street. "Let us go," I said, as soon as I could find voice, "round to Snaggsby's." Poddleby was all for telling us then and there what was on his mind, but I protested that a matter of such obvious importance could not be discussed properly in the open street. Though Poddleby demurred, we hurried him along, knowing what a modest person he is. At Snaggsby's house all would, I think, have gone well if Poddleby had not pulled out his handkerchief with a flourish on entering the wireless den. Most of the pepper must have gone into his breast pocket; at any rate a perfect cloud flew out from the handkerchief. In self-defence we conducted Snaggsby into the street and decided to go to call on Gubbsworthy. We found Gubbsworthy engaged in tracing out coil fields by pouring iron filings on to a sheet of paper from a pepper-pot. The very sight of this was too much for all of us, so we dragged Gubbsworthy forth, taking him with us to visit Bumpleby Brown. On the way I told our latest recruits that Poddleby had something really worth hearing to say. Poddleby once more protested, but we shushed him into silence.

The Secret Out

We were just settling down at Bumpleby Brown's place and Poddleby was about to speak when there came a scratch at the door. Bumpleby Brown hastened to open it, admitting little Bingo, who had been looking everywhere for his adored master. Bingo showed his joy by giving himself a hearty shake, which finished off Bumpleby Brown's den as a meeting place. Shutting Bingo into the potting shed, we adjourned the meeting to Admiral Whiskerton Cuttle's house. And there at last Poddleby was able to give tongue. "Come, Poddleby," I said, "tell us all the great news that we have braved so many perils and tramped so many miles to hear." "Well," said Poddleby, going rather red in the face, "I have been trying to explain, only you would not let me say a word, that the Professor's chimney is on fire!"

WIRELESS WAYFARER.

[*The next instalment of "Jottings" will appear in the issue for April 28.*]

Wireless News in Brief.

N.P.L. Report The report for the year 1925 of the National Physical Laboratory, issued at the beginning of this month, contains an interesting record of observations taken on the signals from St. Assise, near Paris. A motor-car equipped with receiving apparatus toured the country, readings being taken every few miles. We gather that similar observations are to be taken on short-wave transmissions.

* * *

Wireless in Persia Largely owing to the interest taken in Western civilisation by the new Shah of Persia, that country is to have a complete system of wireless communication. It is hoped that the central station at Teheran will be in operation in a few weeks' time.

* * *

American Dance Music Part of a programme of dance music was successfully relayed by the B.B.C. on the night of April 6. This programme was picked up at Keston from WGY, Schenectady, New York. It was noticeable that atmospheric interference was only slight, and that the fading commonly experienced with relays from America was not so marked as usual.

We understand that it is not necessarily the intention of the B.B.C. to make this relay a regular feature of the Tuesday evening programmes.

* * *

John Henry's Opera An opera by John Henry, entitled "It's All Wrong," is to be broadcast from the Cardiff station on April 17. We gather that the plot is somewhat obscure, details being known at present only to the composer (John Henry), the leading vocalist (John Henry), and the producer (John Henry).

* * *

It is announced that Mr. Lloyd George's speech, which was to have been broadcast on April 7, will be heard on April 27.

* * *

Australian Broadcasting We hear that a new broadcasting station has been opened at Pennant Hill, Australia, using a power of 10 kilowatts. Listeners in this country who hear the transmissions from this station are invited to send in reports to the B.B.C.

* * *

Fire from Lightning. During a thunderstorm on the night of April 4 a house in Romford was set on fire by lightning. It appears that the lightning struck the wireless aerial and set the receiver on fire, the latter being almost completely destroyed.

* * *

From the Programmes Sunday, April 18.—London, 3.30 p.m., Handel programme. Bournemouth, 3.30 p.m., Byrd, Purcell, Arne programme. Manchester, 3.30 p.m., Band of H.M. Royal Air Force.

Monday, April 19.—Daventry, 8.25 p.m., Concert relayed from Hilversum, Holland. Birmingham, The Bubbles Concert Party. Bournemouth, Winter Gardens night. Newcastle, 10.30 p.m., A Mystery Half-hour.

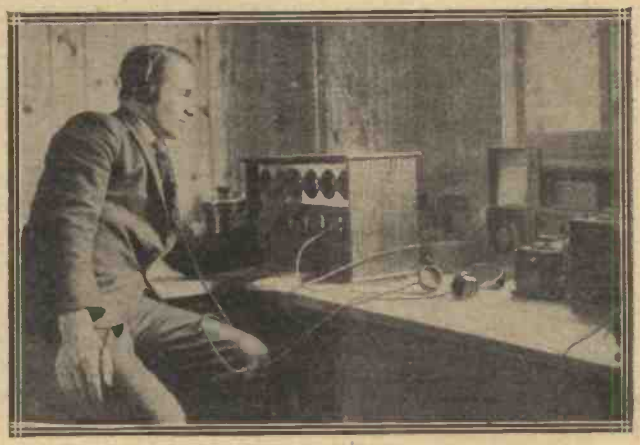
Tuesday, April 20.—London, 9.5 p.m., the London Radio Dance Band. Aberdeen, Chamber Music and Choral and Orchestra programme. Belfast, Mozart programme.

Wednesday, April 21.—London, 9 p.m., the Eastbourne Municipal Orchestra. Birmingham, dance music. Glasgow, popular concert. Manchester, chamber music.

Thursday, April 22.—London, 9 p.m., an Hour of Humour. Birmingham, 8 p.m., Grand Opera. Cardiff, 9.30 p.m., a play, "In the Dark."

Friday, April 23.—Special programmes for St. George's Day.

Saturday, April 24.—London, Jack Hylton's Band. Birmingham, popular programme. Manchester and Belfast, "Listening Time" Revue.

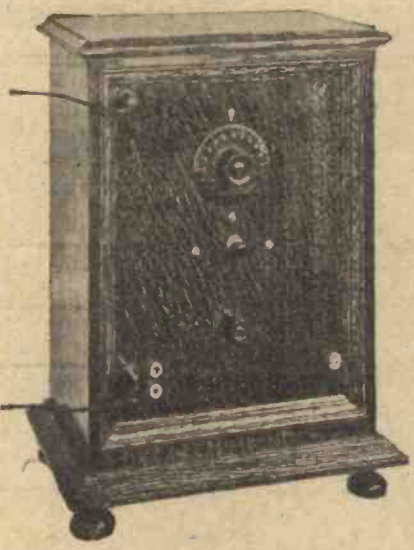


The broadcast of dance music from WGY on April 6th was one of the most successful relays carried out from Keston.

Adding Reaction to the "Prince" Circuit

By W. S. PERCIVAL, B.Sc. (Hons), A.R.C.S.

The Prince "trigger" circuit is one which has attracted a good deal of attention on account of the great purity of reproduction which it gives. It has hitherto suffered, however, from the drawback of lack of sensitivity unless H.F. stages were used.



A particular attraction of the "Prince" circuit is that it enables a receiver to be made up with remarkably few components

THE "Prince" circuit is well known as one of the best methods of obtaining distortionless loud-speaker reproduction from the local station. It suffers, however, from the disadvantage that up to the present no means of introducing reaction has been available, so that it has been necessary to add one or more high-frequency stages to receive distant stations. The additional valves required naturally raise the total cost of the receiver, so that many prefer the plain detector with reaction and a stage of low-frequency amplification, in order to receive a few stations other than the local.

Considering the extremely faithful reproduction given by the "Prince" circuit, a series of experiments were commenced at the Radio Press Laboratories with the object of enabling the receiver to obtain distant stations without using additional valves.

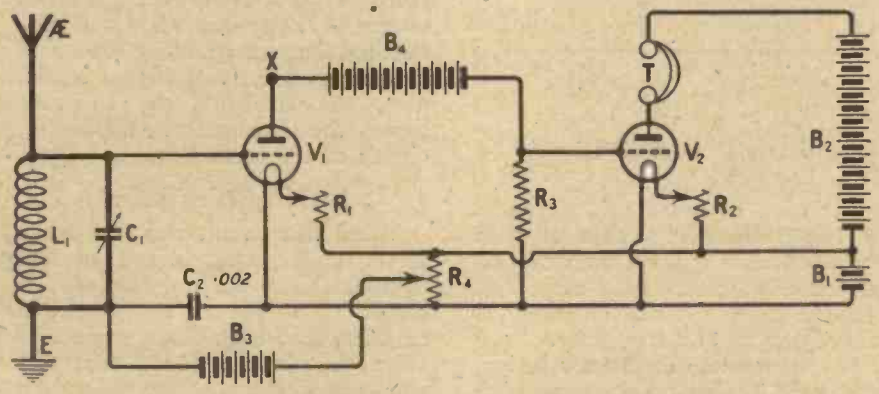


Fig. 1.—A conventional example of the trigger circuit.

Early Attempts

Two distinct lines of research were followed in order to obtain this object. In the first place, methods were tried for introducing reaction, and secondly, various methods of reflexing the receiver were experimented with. This article deals with the former question.

Now, early attempts at introducing reaction into the "Prince" circuit frequently consisted in placing a reaction coil at the point X in Fig. 1. Unfortunately, it was found that no signs of reaction could be detected, and it was suspected that the cause of this was the very small current passing through the anode circuit of the first valve. It will be realised that the whole of this current has to pass through the half-megohm gridleak from grid to filament of the second valve. Thus, if the whole 20 volts or so of the coupling battery was applied to this half-megohm gridleak, a current of about 40 microamperes could be expected. In order to ascertain this, a microammeter was placed in series with the accompanying battery, and as was expected, only a very small current was registered, i.e., between 20 and 40 microamperes. There is also the question of phase to be considered, and the net result is that this method of applying reaction is not satisfactory.

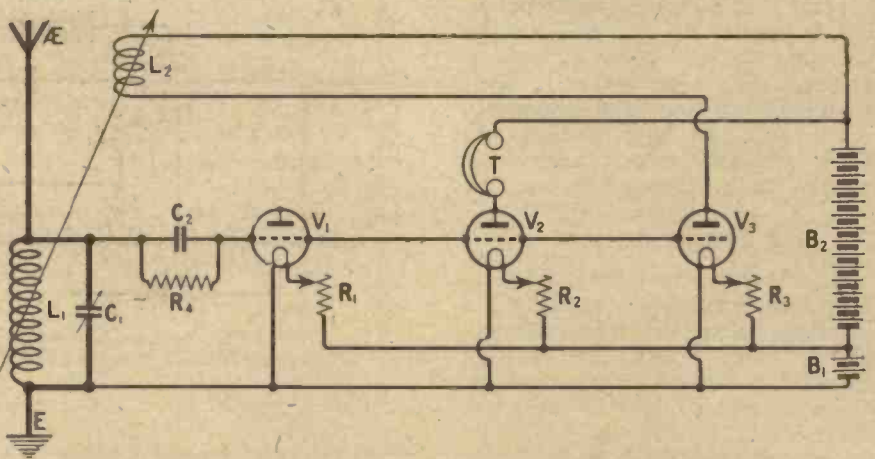


Fig. 2.—This circuit is intended to show how the three functions of a rectifying valve with reaction may be separated in an imaginary manner.

Reinartz Reaction

Another method of introducing reaction is to employ the Reinartz type. In this case we have quite a

Adding Reaction to the "Prince" Circuit—*continued*

small anode to filament impedance through the condenser and reaction coil. We have, however, the impedance of the first valve to consider as well. Now the anode potential of this valve depends not only on the voltage of the coupling battery, but also on the value of the grid-leak. This is of the order of half megohm, so that we have about 20 volts to half a megohm and the detector valve in series. Without going into details it is clear that only a fraction of the total voltage is applied to the anode of the detector valve.

The result of this, coupled with the fact that a high negative potential is applied to the grid of the valve, is that the latter is working at a point well below the bend of the characteristic. The impedance is therefore very high, so that once again we may expect very little current to flow through the reaction coil.

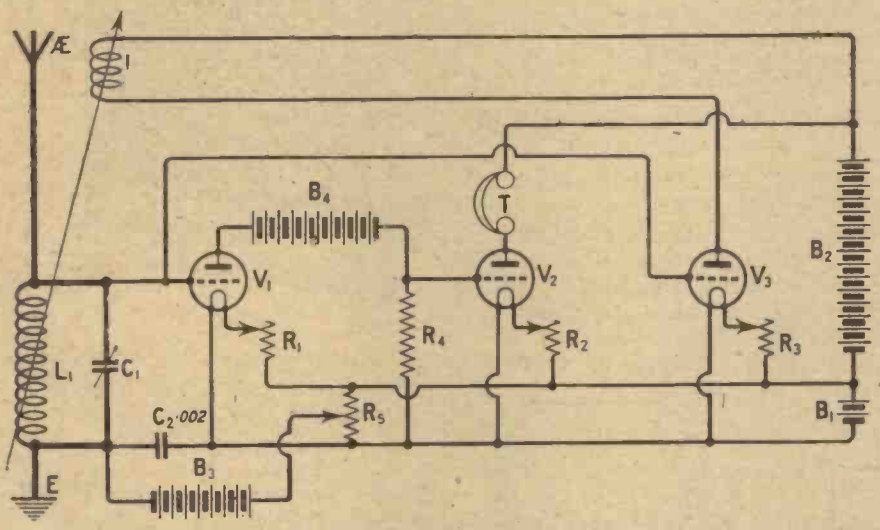


Fig. 3.—Reaction can be obtained by adding a special valve (V3) for the purpose.

A Further Attempt

One further attempt was made to introduce reaction by utilising the tuned-anode method frequently employed where sufficient reaction cannot be obtained by other means. Once again, as might be expected, no reaction effects could be detected. It was therefore decided to continue experiments on quite different lines.

In order to explain how the idea for the simple method employed first arose, it is instructive to consider the case of the ordinary single-valve circuit. We may consider this as performing three different functions: in the first place, it detects by the method known as cumulative grid rectification. This results in a variation of mean grid potential at low frequency. This is then amplified and appears as variation in anode current. We may then consider the single-valve detector as amplifying at low frequency.

If the detector employs reaction, however, it also amplifies at high frequency, and feeds back a certain portion of the high-frequency current into the grid circuit, thus producing what is known as reaction. Now it is possible to separate these three functions, and use a different valve for each. This is shown in Fig. 2, where it will be seen that the first valve detects, the second amplifies at low frequency, while the third is used to introduce reaction into the aerial circuit.

Separate Reaction Valve

By means of a slight modification it is clear that we can convert this arrangement into a "Prince" circuit with the addition of a third valve to introduce reaction. This is shown in Fig. 3, where it will be seen that the first two valves are now coupled by means of a battery.

Clearly, there is no reason why the functions of the second and third valves should not be combined as shown in Fig. 4, which shows a "Prince" circuit in which reaction has been introduced by the simple expedient of placing a reaction coil in series with the anode circuit of the second valve and connecting the two grids by means of a small condenser. (It is advisable, also, to place a .002 condenser across the telephones in the output circuit of the second valve.)

An Interesting Effect

When this circuit was first made up a choke was placed in the position Y in the diagram. The object of this was to prevent a negative feed back through the first valve, but it was found that this was unnecessary, there being no noticeable effect of this nature. The absence of any trace of high-frequency current in the anode circuit of the first valve was strikingly shown by removing the coupling condenser C_3 and attempting to obtain reaction.

There was a possibility that although the current in the anode circuit of the first valve was in-

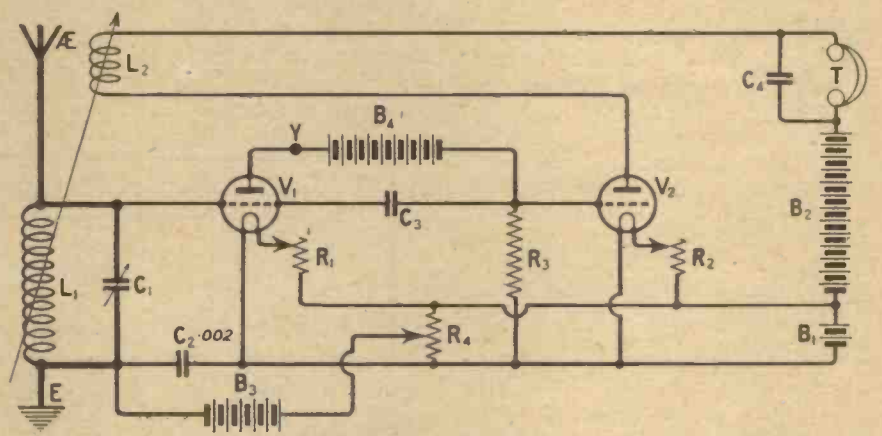


Fig. 4.—In the final arrangement good results were obtained by making the L.F. provide the desired reaction in this way.

Adding Reaction to the "Prince" Circuit—*continued*

sufficient to produce reaction when the reaction coil was placed directly in its anode circuit, yet sufficient high-frequency potential might still be applied to the grid of the second valve to enable a reaction coil placed in the anode circuit of this valve to produce reaction on the aerial. This would, of course, involve reversing the reaction coil owing to the reversal of phase in the first valve. It was found, however, that no reaction effects could be produced in this manner, although by once more reversing the reaction coil a very slight feed back could be obtained, evidently due to the grid-plate capacity of the first valve.

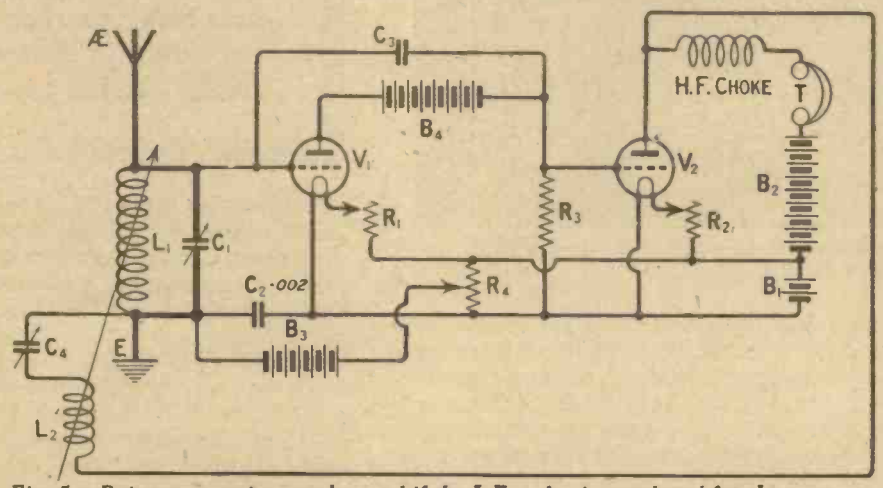


Fig. 5.—Reinartz reaction can be used if the L.F. valve is employed for the purpose.

The "Prince" Circuit with Reaction

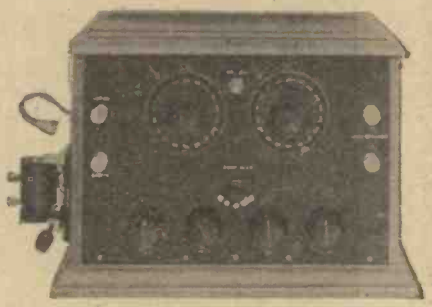
The circuit shown in Fig. 4 behaves in a very similar manner to the conventional detector and a stage of low-frequency amplification. It was, however, found that quality was decidedly improved when the condenser C_3 was very small. It was therefore found better to employ a rather larger size than usual for the reaction coil, and also to tap the aerial across only part of the grid-tuning coil. When this was done it was found possible to employ a vernier condenser for C_3, when the quality was quite equal to that obtained with the conventional "Prince" circuit.

It is clear that Reinartz reaction could also be employed, and this is shown in Fig. 5. Here, again, it is desirable to employ as large a size of reaction coil as possible, in order to keep the coupling condenser C_3 as small as is consistent with obtaining sufficient reaction.

Adapting an Existing "Prince" Circuit

A glance at the reaction form of the "Prince" circuit indicates that it is quite a simple matter to convert an existing set into a receiver of the new type. The simplest method of doing this is to fit a two-way coil holder to the receiver, and connect up the aerial and reaction coils as in the ordinary single-valve detector. It is also necessary to place a .002 condenser across the telephones and a small condenser of about .00005 to .0005 between the two grids. The experiment of tapping the aerial on the coil may also be tried.

An attractive idea is to utilise the coupling condenser C_3 for reaction control. When this was tried out,



A simple receiver using the "Prince" circuit with a stage of H.F. amplification described in "The Wireless Constructor" for February last.

however, it was found to alter the tuning by an appreciable amount and is therefore not recommended. It does, nevertheless, give a very fine control of reaction, and in the hands of an experienced operator, good results may be obtained.

Reflexing the "Prince" Circuit

Having successfully introduced reaction into the "Prince" circuit, attention was next turned towards reflexing it, and thus obtaining the advantages of high-frequency amplification without requiring more valves. This was successfully accomplished, and it is hoped to give further details in a future issue of *Wireless Weekly*.

THE "WIRELESS WEEKLY" CALIBRATION SCHEME.

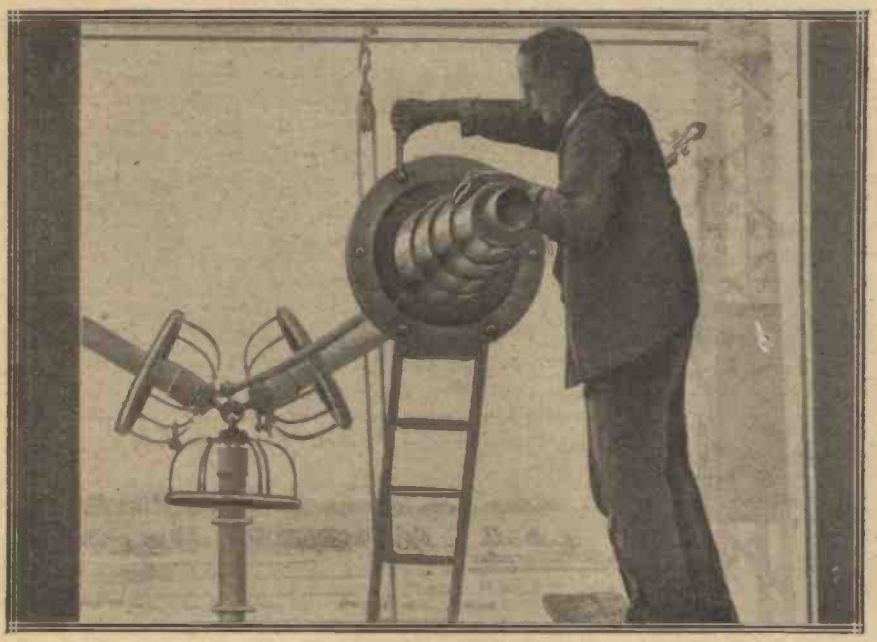
As announced in our last issue, special measurements of the frequencies of a large number of B.B.C. main and relay stations were made at our Elstree laboratories on April 7. For the benefit of readers who listened at the times given, the exact frequencies and wavelengths are given below, so that calibration charts can be prepared for each set.

Time.	Station.	Wavelength.	Frequency.
7.45	Aberdeen	497.52	602.99
7.50	Swansea	491.04	610.90
7.55	Birmingham	477.01	628.90
8.0	Belfast	443.06	676.83
8.5	Glasgow	422.06	710.79
8.10	Newcastle	407.65	735.90
8.15	Dublin	400.04	749.92
8.20	Bournemouth	386.32	776.55
8.25	Manchester	378.74	792.10
8.30	London	360.62	831.90
8.35	Cardiff	353.96	847.55
8.40	Plymouth	339.70	883.13
8.45	Hull	333.47	899.63
8.50	Liverpool	325.75	920.95
8.55	Nottingham	329.56	910.34
8.56	Leeds	327.92	914.85
8.57	Edinburgh	325.38	921.99
9.0	Stoke	302 84	990.62
9.5	Sheffield	307.08	976.94
9.7	Bradford	310.42	966.43
9.10	Dundee	315.75	950.11
9.15	Daventry	1603.8	187.05

"Hello, Lon
"Hello, N

A SPECIAL VISI

On these pages Mr. Reyner account of the methods by now being carried on betwee number" in America. Mr. Rugby Station and obtained



Fitting the giant leading-in insulator to the window through which the aerial lead passes.

READERS will have seen references from time to time to the practical trials which are now taking place on the England-America telephone service. The following description of the apparatus with which the telephony is carried out will therefore be of considerable interest.

As is well known, the system employed is somewhat different from that which is normally used for broadcasting. The underlying principle is one which can be explained comparatively simply in mathematical language, but which is not so easily understood from a purely physical point of view. The following train of thought, however, will serve to indicate what is really happening. As is well known, the actual band of frequencies which is covered by a broadcast station is somewhat broad. That is to say, the signals are not radiated on a single wavelength, but occupy a small band of wavelengths on each side of the mean or average value.

Modulation and Side-bands

What actually happens is that we have a high-frequency current, and we modulate this with a low-frequency speech current. The resultant current is not of a single frequency, but is made up of a combination of the original high-frequency or carrier current and the speech currents. If this is analysed we find it resolves itself into three groups. First of all there is the carrier, the original high-frequency itself, and then we have two groups of current on each side of the carrier. These groups of frequencies are known as "side bands," and it is these currents of varying frequency which in conjunction with the carrier give out intelligible speech or music at the receiving end.

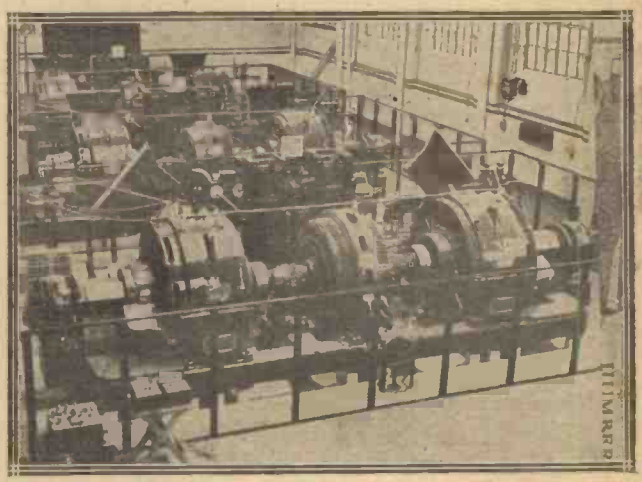
Difficulties on Long Waves

This system, though quite satisfactory for working on comparatively short wavelengths, is not suitable on the long wavelengths, because of the relatively large band of frequencies required. The actual band required for speech is between 4,000 and 5,000 cycles. At a mean (carrier) frequency of 1,000,000 cycles (300 metres) this is only ½ per cent.

At a much lower mean frequency, however, say, 50,000 cycles (6,000 metres), the band required is 10 per cent. of the mean frequency. At such frequencies the ether is crowded with commercial stations, often working closer than 10 per cent. apart, so that such a system would not only cause undue interference, but its success would be jeopardised by possible interference by other long-wave stations.

Alternatives

The use of a long wave is essential, at present, in order that a reasonable approach to a 24-hour service may be obtained so that some

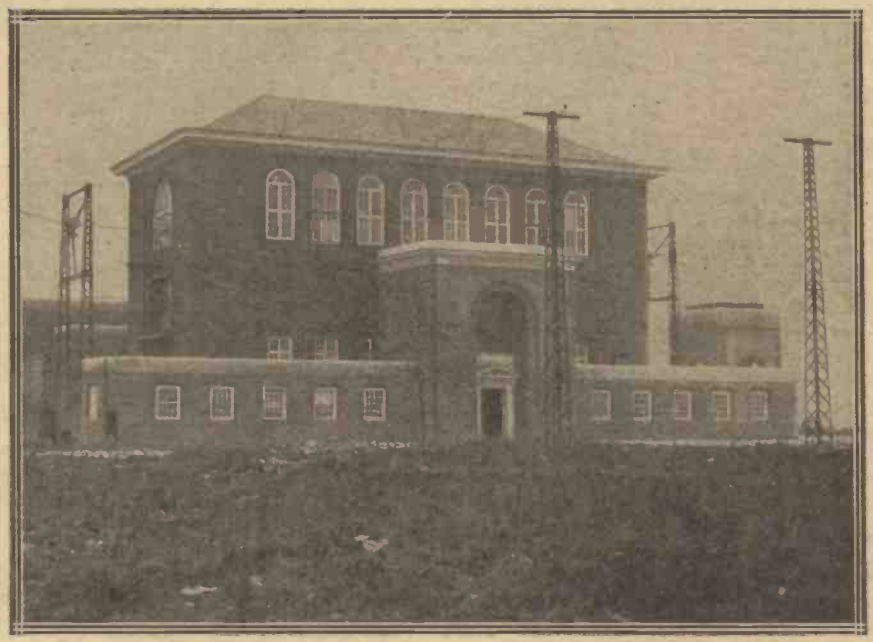


The generating plant occupies an enormous floor area.

don!"
ew York!"

T TO RUGBY.

gives a most interesting hich two-way telephony is Rugby and its "opposite Reyner recently visited the his information on the spot.



A general view of the station building. The aerial lead passes through the window on the left.

other arrangement has to be devised.

The Western Electric Co. therefore conceived the idea of eliminating some of the frequencies from the whole complex arrangement, and they found that if they cut out first of all the carrier wave, and then one of the side bands, leaving only the comparatively small group of frequencies constituting the other side band, then they were able to obtain satisfactory reception with suitable modification of the receiving equipment. By doing this they not only reduced the band of frequencies required for the channel, and so greatly reduce the possibility of interference, but they were also able to transmit on a much smaller power, since the carrier wave and the other side band, each of which required power, were eliminated.

The System at Rugby

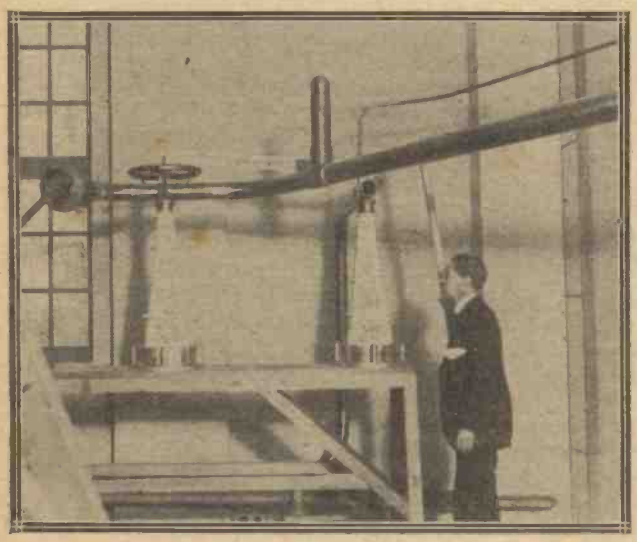
This, then, is the principle of the system which is employed in the Trans-Atlantic telephony. We start with an ordinary oscillator, and modulate the current just as in an ordinary broadcasting station. The modulated complex currents are then passed through a series of filters which cut out the carrier and one of the side bands, leaving only a comparatively small group of frequencies, which are amplified up and applied to the transmitting aerial.

On the other side of the Atlantic these frequencies are received and suitably amplified, and at this point the carrier wave is reintroduced. That is to say, a local oscillator is provided, which is oscillating at exactly the same frequency as that of the original oscillator, which was modulated by the speech currents. This, in essence, is the system which is employed. Now for the actual details.

The Details

Starting at the input end we receive current over the land line from whichever particular telephone subscriber is speaking. Before being relayed to Rugby the speech is amplified considerably above the normal strength, so that in the process of transmission between London and Rugby no appreciable interference from external sources shall be introduced. At the Rugby Station the speech is then cut down to a suitable strength, and is then passed through filters which cut off all frequencies below 300 and above 3,000 cycles per second.

Actually the frequencies employed in speech extend outside this band, but it is found that perfectly intelligible speech can be obtained with a limited band width such as this, and the result is, of course, that the



The earth lead is a very elaborate affair. Note the great thickness of the conductor.

"Hello, London!" "Hello, New York!"—*continued*

actual frequency band radiated is also limited, so reducing the risk of interference.

Modulation Methods

These speech currents are then caused to modulate the high-frequency currents produced by a local oscillator. The modulation is effected in two stages. The first oscillator has a frequency of the order of 30 kilocycles. The complex currents produced are filtered and one of the side-bands is caused to modulate a second oscillator operating on a frequency of about 90 kc.

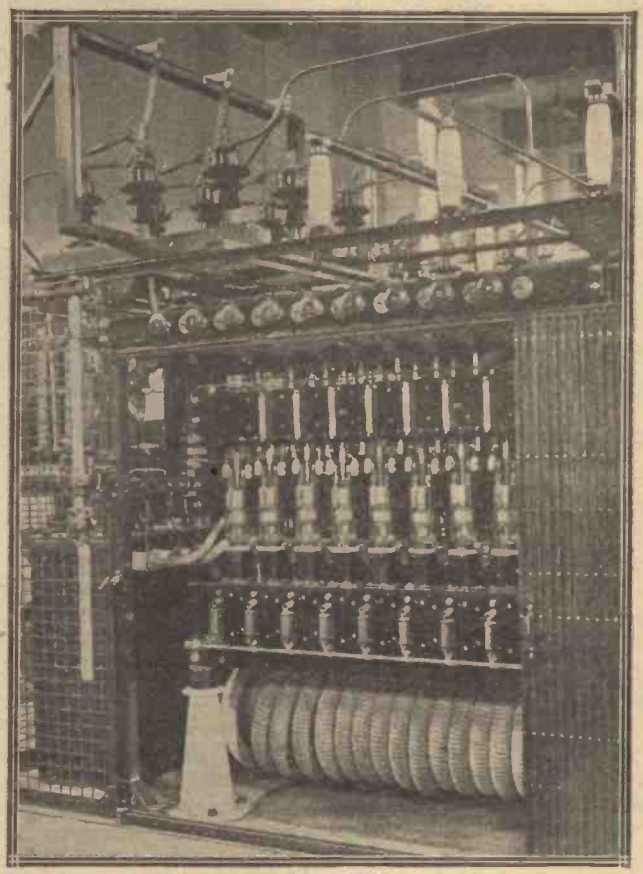
The resultant effect is the same as if a 60 kc. oscillator had been modulated in a single stage, but there are two important advantages which result from the double modulation. In the first place the construction of the filter to cut out the carrier and one side-band is simpler and more economical with a comparatively low carrier frequency.

This will immediately be obvious, since a frequency difference of, say, 300 cycles in 30,000 is a greater percentage of the whole than 300 cycles in 60,000.

An Important Point

The second advantage lies in the fact that the arrangement permits slight changes in the actual frequency band radiated. The carrier and side bands in the second oscillator are separated by nearly 30,000 cycles.

We have three frequency bands, one about 60 kc., one about 120 kc., and the carrier frequency of 90 kc. A filter is provided, which cuts off all frequencies above, say, 80 kc., thus eliminating the carrier and the upper side band, and leaving the lower 60 kc. band.



A view of one of the power panels at the station, in which two banks of nine valves each are employed

Possibilities of Flexibility

If, however, we changed the carrier to, say, 100 kc., we should have side bands at 70 kc. and 130 kc., and the *same filter* would still serve to eliminate the carrier and the upper side band. Thus, a fair degree of flexibility is permissible in the choice of the final frequency radiated.

Amplification Systems

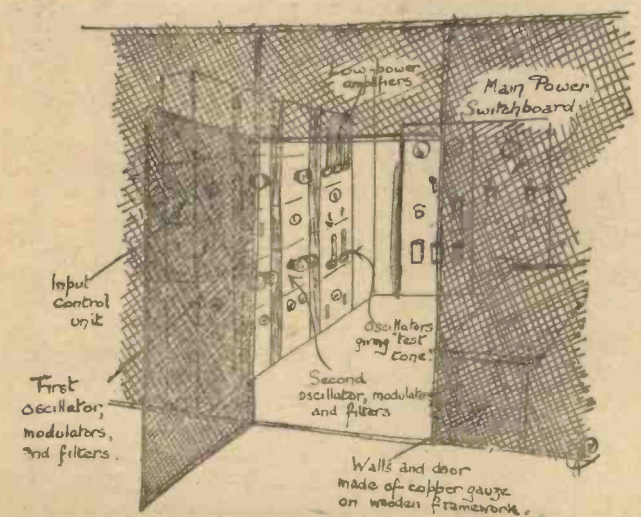
After this double modulation the selected currents are amplified in three stages. First, they pass through three low-power amplifiers, then through a single high-power amplifier, and finally through thirty water-cooled valves in parallel. This last bank of valves (each capable of handling 10 kilowatts) amplifies the current sufficiently for it to be applied direct to the aerial.

It is interesting to note that all the preliminary stages of the system are very carefully screened from each other. The first four stages, as far as the low-power amplifiers, are all housed in a small room completely enclosed in metal gauze. A unit construction is employed for these stages, the various component parts being mounted in individually screened racks.

Reaction Precautions

The single-valve amplifier is also

(*Continued on page 280.*)



This is an extract from Mr. Reyner's note-book, giving his impression of the modulating system.

SOME ANODE-INPUT DETECTOR CIRCUITS

By the Staff of the Radio Press Laboratories.

Anode-input circuits provide a fascinating change from familiar types of circuits, and will repay investigation.

One of the first designs for an anode-input set was that by Mr. Reyner, published in the November issue of "Modern Wireless."

MANY virtues, such as increased selectivity and simplicity of reaction control, are frequently claimed for valve detectors employing anode-input. While these advantages are sometimes over-rated by enthusiasts yet very considerable interest attaches to anode-input circuits owing to the field for experiment which they open up.

Some Disadvantages

The most usual anode-input detector circuit is shown in Fig. 1, and it will be seen immediately that it suffers from several disadvantages.

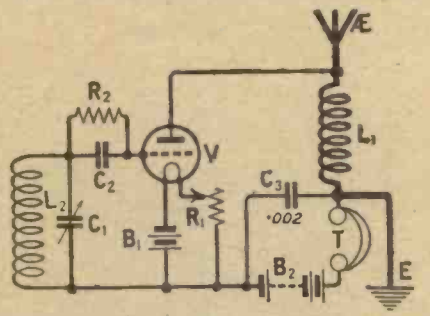


Fig. 1.—This is one of the simplest forms of anode-input circuit, with the grid and anode circuits separated in order to emphasise the salient features of the arrangement.

In the first place, the filament is at a high negative potential to earth. This may, in certain circumstances, cause trouble, but may easily be avoided by using a series condenser in the earth lead.

Another drawback is the fact that the resistance of the valve is placed directly across the aerial coil, thus introducing damping. This may be reduced by using a smaller coil and closer coupling, but is accentuated in another anode-input circuit, shown in Fig. 2. The grid circuit of

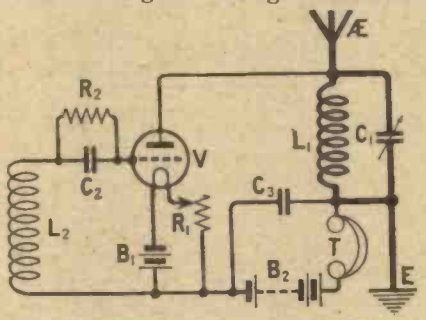


Fig. 2.—Another version of the simple type of circuit illustrated in Fig. 1. Anode and grid circuits are again shown separated, but it is to be understood that L1 and L2 are actually coupled together.

this is particularly simple, consisting of only a small coil, grid condenser and leak. This also gives moderately good results, although generally not so good as the conventional detector circuit.

Combining Coil Functions

Fig. 3 shows another interesting

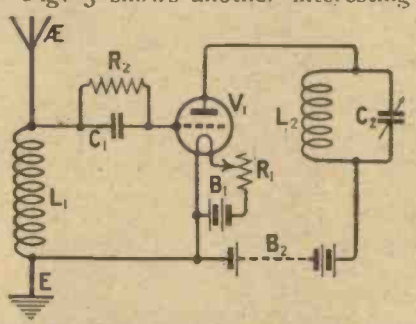


Fig. 3.—This circuit employs a form of trap tuning, by virtue of the coupling which is provided in practice between L1 and L2 (again shown separated here).

circuit in which the aerial is tuned by a resonant circuit in series with the anode and fairly tightly coupled to the aerial coil. The resemblance between the action of this and of the "trap" tuned circuit of Fig. 4 will be immediately evident, the inductance L2 in Fig. 3 combining the functions of L2 and L3 in Fig. 4.

A Coupling Difficulty

Another difficulty which frequently arises with anode-input circuits is that sufficient coupling to the grid

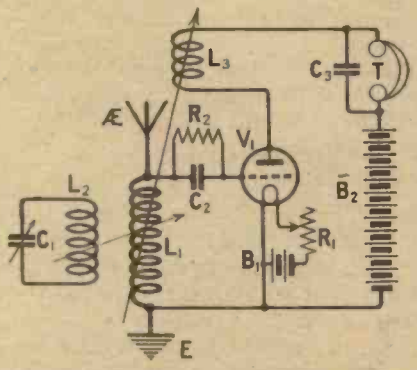


Fig. 4.—This circuit shows how that of Fig. 3 would be arranged if separate coils were used for the various functions.

circuit cannot be obtained without the valve oscillating. The circuit shown in Fig. 5 was tried out with the object of avoiding this difficulty, and considerably improved signal strength resulted.

The coil L3 is in series with the anode circuit, and is coupled to the grid coil in a negative sense. The aerial coil was also coupled to the grid coil, but in a positive sense so

as to introduce reaction. Thus the coupling of the two coils in the anode circuit is in an opposite sense, and the negative reaction of one can

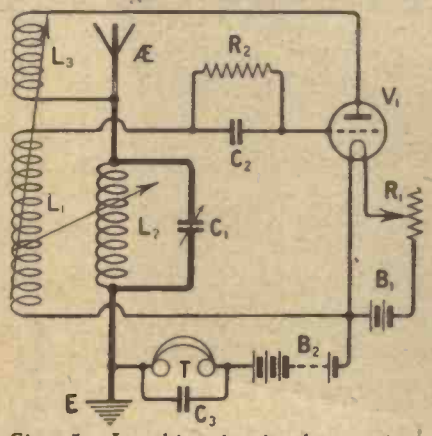


Fig. 5.—In this circuit the various couplings are shown, so that the relation of the two opposing reaction effects may be clear.

be balanced against the excessive positive reaction of the other.

This method enables us to couple the aerial coil as closely as we like to the grid coil without the set oscillating.

Reversing the Coils

By reversing the aerial coil and L_3, or, alternatively, reversing the grid coil alone, it would appear that

SOME ANODE-INPUT DETECTOR CIRCUITS

(Continued)

a similar effect could be produced. In this case, however, L_3 will introduce reaction, while the aerial coil will serve to stabilise. In practice this method gave rise to a persistent squeal probably caused by short-wave oscillation. It is possible that this could have been removed by making adjustments, but in any case there seems to be no advantage over the method previously described.

Removing Valve Damping

Fig. 6 shows a circuit designed for the double purpose of removing

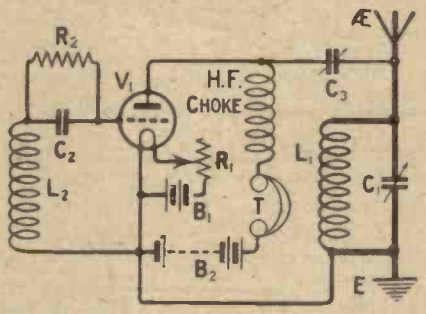


Fig. 6.—A form of reaction used in the Reinartz circuit is shown here.

valve damping from the tuned circuit, and of enabling sufficiently close coupling to the grid coil to be obtained without producing oscillation. The condenser C_3 can be very conveniently employed for controlling reaction. If the aerial and

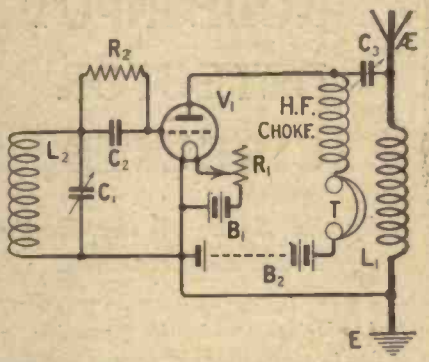


Fig. 7.—By tuning the grid circuit Fig. 6 becomes a true Reinartz. L1 and L2 are understood to be coupled together in each case.

earth are placed across the grid coil then we have an interesting variation of the ordinary method of trap tuning.

"HELLO, LONDON!" "HELLO, NEW YORK!"

(Continued from page 278)

enclosed in its own screened compartment, while adequate protection against interaction is also taken in the case of the three banks of ten valves in parallel.

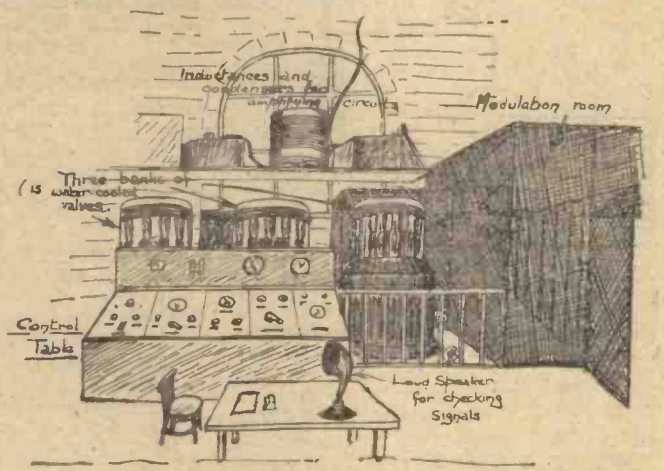
Safeguards

A control panel is provided with meters in various portions of the circuit to ensure that the whole arrangement is functioning correctly, and there are various devices for testing out in case of faults. For example, it is possible to apply a modulated tone (somewhat similar to the B.B.C. tuning note) to the beginning of the main amplifying system. If this is amplified correctly then any fault which has developed must be previous to that point. Thus it is possible to separate faults in the main amplifying system from those in the filtering and modulating portion of the chain.

A Giant "Repeater"

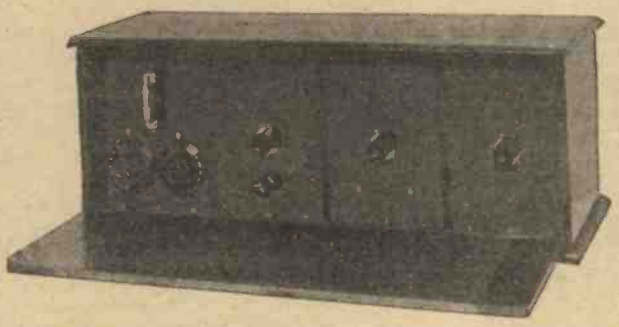
As far as Rugby is concerned the whole system is automatic in practice; the only alteration which has to be made is that of the actual strength of the speech. It will be remembered that the speech comes in considerably above strength and is cut down to a suitable value. Occasional changes in the conditions prevailing necessitate minor readjustments of the actual strength applied to the transmitter, but this is only a comparatively small adjustment, and the whole service is nothing more or less than a repeater station such as is employed on ordinary trunk telephone services.

Here is Mr. Reyner's sketch of the telephony transmitter exactly as he drew it.



Indeed it is quite a queer sensation to be present in the transmitting building. There is no noise (all the power plant being in a separate room) and little to see since the filaments of the power valves are inside the metal anodes and are thus invisible.

The whole plant appears dead, and yet—"Hello, London!" says the loud-speaker. "Hello, New York!" says London, just as if an ordinary telephone line were in service. It is an achievement of which we have every right to be proud.



Using the "Flexible Receiving Equipment"

By H. BRAMFORD.

Circuits to Try—Final Notes—Results—Elstree Test Report.

IN addition to the selection of simple circuits given last week a very large number of others can be wired up quite easily. For example, the connections for a crystal detector, followed by two stages of low-frequency amplification, are as follows :—

Aerial to Clix socket 3 of Panel A.

Earth to Clix socket 5 of Panel A.

Panel C, blue plug to Clix socket 4 of Panel A. Panel C, green plug to Clix socket 5 of Panel A (reversible).

Panel C, white plug to Clix socket 22 of Panel C.

Panel D, blue plug to Clix socket 17 of Panel C.

Panel D, red plug to Clix socket 20 of Panel C.

Panel D, black plug to Clix socket 21 of Panel C.

Panel D, white, 1, to Clix socket 22 of Panel C.

Panel D, white, 2, to Clix socket 32 of Panel D.

'Phones or loud-speaker to Clix sockets 25 and 26 of Panel D.

H.T. + 2 to Clix socket 26 of Panel D.

H.T. + 1 to Clix socket 27 of Panel D.

H.T. – and L.T. + to Clix socket 29 of Panel D.

L.T. – and G.B. + to Clix socket 30 of Panel D.

G.B. – 1 to Clix socket 31 of Panel D.

G.B. – 2 to Clix socket 32 of Panel D.

The last arrangement which may be obtained will be the tuner panel, the valve detector panel, and two stages of low-frequency amplification, reaction being employed with the detector valve. The connections for this arrangement need not be tabulated owing to the fact that the wiring diagram given last week showed all the flexible leads inserted in the necessary sockets for this arrangement on the panels.

Final Remarks

A few final remarks relating to this receiver may be desirable. Firstly, as the complete instrument was designed in order to provide a means of constructing a receiver in easy stages, while at the same time having a presentable instrument to commence with, it is suggested that the specially-designed cabinet should first be procured, after which the panels may be made up to suit the requirements or the pocket of the individual contructor. Such things, for instance as the panels, would be obtained all together, and also a good supply of Clix sockets. Neat cuts may be made at each side of the cabinet just below the lid to allow for the passage of the external leads into the interior of the cabinet. Particular care should be taken to see that no frayed ends are present where the flex leads (both internal and external) accommodate the Clix plugs, as this may result in the shorting of batteries or burning out of valves.

ELSTREE TEST REPORT

This receiver works very well indeed on all combinations, from crystal upwards.

The oscillation control is easy, and the strength of signals exceptionally good, while selectivity is normal for a circuit of this type.

Stations heard included Toulouse, Aberdeen and Breslau, when using the valve portion of the receiver. When the two note magnifiers were added all these were received at good loud-speaker strength.

Results

Tests were carried out upon all the suggested arrangements in a locality about 7 miles east of 2LO. Each test produced satisfactory results, full loud-speaker strength being obtained from the local station, using the valve detector and one stage of low-frequency amplification only.

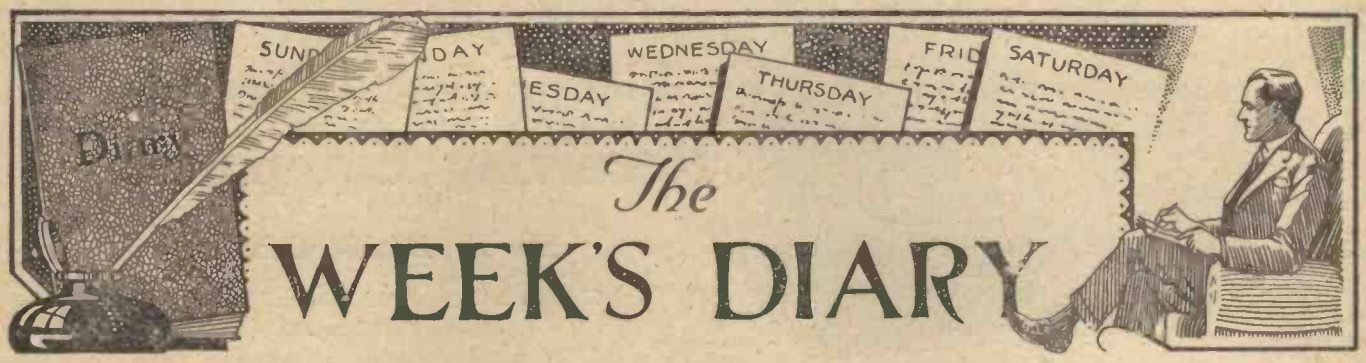
One cannot, of course, describe in detail exactly what should be obtained upon the receiver, owing to its varied and numerous uses. Some general indications have, however, already been given. Where added distance is desirable an H.F. amplification panel would prove, of course, an asset. Such a panel will be described in a later issue.

Selectivity proved to be normal, and oscillation control easy. Using the valve for detection with reaction, numerous foreign and British broadcasting stations were brought in, and fair results may be obtained from some of these upon the loud-speaker if both stages of amplification are used.

"THE BUSINESS FUTURE OF THE RADIO INDUSTRY"

By JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.

WHAT is the cause of the present apparent depression in the wireless industry? How long will it last? Is the public "saturated," or has the interest in wireless flagged? These and many other interesting questions are answered by Mr. Scott-Taggart in his article in the April issue of *The Wireless Dealer and Manufacturer*. Members of the industry should not fail to read this article, which contains some very practical suggestions for the betterment of existing conditions.



The WEEK'S DIARY

THE B.B.C. have at times recruited a number of keen amateur transmitters who did so much in pre-broadcasting days to further the art, particularly in short-wave working. Mr. J. A. Partridge, for example, is now Chief Engineer of the B.B.C.'s receiving station at Keston, while Lieut. Walker, better known to the older amateurs as "Two O Emma," has long been in the service of the company. Some very good work has recently been done by Partridge in conjunction with Mr. E. A. Simmonds, another well-known experimenter, of Gerrard's Cross, in low-power short-wave telephony with Australia. I should not be surprised to hear at a very early date that the B.B.C. is contemplating an official broadcast through Australian stations of the London programmes.

* * *

WELL, Easter has come and gone, and Whitsuntide is just far enough away to be irritating, and to emphasise the fact that there are still several weeks of work before a further holiday will be possible. Strangely enough, my own Easter holiday went off according to plan, and I duly installed the crystal set previously mentioned, complete with aerial, earth, telephones and what not. The relation in question, after viewing the set with apprehension for about twenty-four hours, now sits up until midnight every night, to the advantage of her musical education and the detriment of her health.

* * *

OF course, as this is a "100 per cent. valve-paper," you wonder why I am talking about a crystal set. My dear reader, that crystal set was only a bait. Before many months are out I expect to see a multi-valve receiver installed complete with loud-speaker (perhaps two), and all the usual paraphernalia. In future, when I feel energetic enough to drive the car down to that portion of England for a week-end, I shall hear, instead of the latest scandal about the neighbours, an enthusiastic report of how easy it is to cut out the local station, and how many of the distant ones can be brought in.

* * *

A WELL-KNOWN catering firm seems to have "put it over" the Broadcasting Company quite neatly in arranging for a broadcast of a talk by a "Nippy." I well remember Captain Richard Twelvetrees having to resort to all kinds of mental gymnastics to avoid mentioning the word "Ford" in a motoring talk, although it was painfully obvious that it was the make of car referred to, and now we have a talk, not, mark you, by a teashop "waitress," but by a "Nippy," a name which every Londoner knows applies only to the waitresses of the particular firm in question.

* * *

DID you notice how neatly I avoided any reference to Messrs. Lyons?

* * *

IN any case, I doubt the wisdom of broadcasting the talk in question. Once this kind of thing is allowed to pervade the ether, we are likely to have other talks of not quite so innocent a nature, which might stir up a good deal of dissatisfaction. I can, for example, imagine a firm broadcasting a description of the condition under which their employees work, which might not at all coincide with the views held by the employees themselves.

* * *

A WELL-KNOWN evening paper came out the other day with quite a breezy description of the future plans of the B.B.C. in broadcasting WGY every Tuesday night owing to the success which had attended the effort a week ago. Anyone with any experience of long-distance reception knows that it is quite impossible, particularly at this time of the year, to predict what conditions will be like even a few hours ahead, and I was not surprised to hear, on inquiring of the B.B.C. themselves, that the report was exaggerated. As a matter of fact, they broadcast WGY on Tuesday, the 6th, quite successfully, and, as that station will broadcast dance music every Tuesday night at the same time, they *might* do it again.

Everything depends upon the conditions ruling at the time and, as the B.B.C. engineers are watching wireless conditions hour by hour I should not be surprised to hear some quite dramatic events broadcast at short notice through our stations from America.

* * *

WHEN I wrote a paragraph a few weeks ago about Captain Eckersley's car, I did not know, of course, that by the time it appeared in print the genial Captain would have had a smash, due, I learn, to no fault of his own, so that the said car is now out of commission. Fortunately nobody was hurt, and the car is not beyond repair. Indeed, by the time this appears in print it will probably be running merrily again, and "P. P. E." will be making up for lost time.

THE "WIRELESS WEEKLY" CALIBRATION SCHEME

On the 7th of this month the exact frequencies of a large number of B.B.C. stations were measured with great accuracy at our Elstree laboratories, and we publish the results on another page. Those listeners who recorded the readings on their dials of a sufficient number of these stations at the approximate times given will therefore now be able to prepare a very useful calibration chart. Those who missed the tests should look out for future announcements of later measurements.

The Week's Diary—*continued*

MY Easter trip through the South-west country brought home to me very forcibly the immense boon the Bournemouth wireless station has conferred upon the agricultural community in Dorsetshire. There is an excellent road from Bournemouth to Weymouth, on which I am afraid I paid no attention to the legal speed limit. Through village after village and town after town I observed aerials of all shapes and sizes and of widely varying heights. I noticed that invariably they were far more business-like in appearance than the aerials one sees round London and the other big cities. Most Dorset listeners seem to take a particular pride in possessing well-built aerial systems. I noticed especially one farm at which the masts were painted and well made, the aerial was trim and taut.

Although Dorset is a very sparsely-populated county (it is, of course, an agricultural rather than an industrial county), the percentage of listeners is probably very high, and if I can judge anything by aerials the listeners are of a particularly methodical variety. I say this because it is rarely that one finds a poorly and carelessly erected aerial that is not accompanied by an equally badly-made or arranged set.

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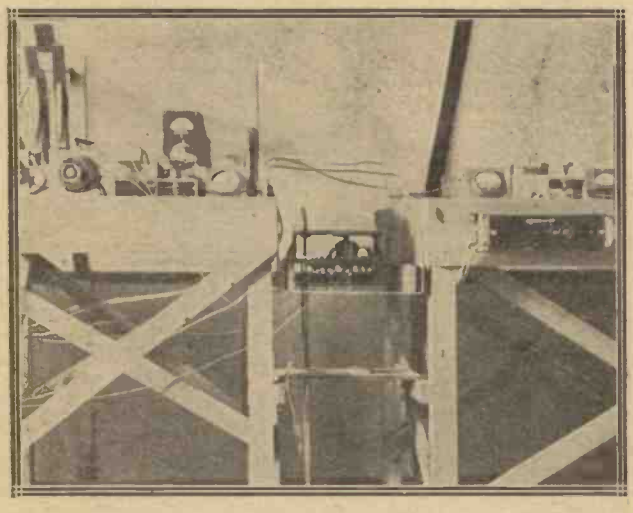
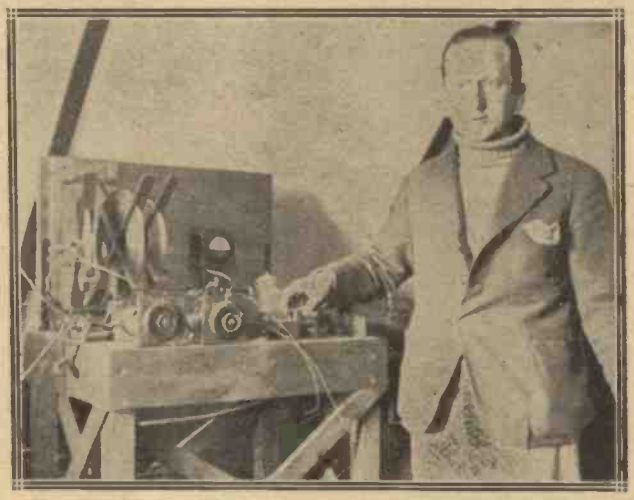


A more detailed view of Mr. Chisholm's apparatus. Note the revolving switch in the centre, with its gear drive.

AS dull-emitter valves of low-current consumption, suitable for working from dry batteries in portable sets, are now much cheaper than they were at the corresponding time last year, those people who have not previously considered building a portable set might well investigate the possibilities in this direction. Several of my friends have discovered that their existing sets (which do not claim to be "portable") can easily be hauled off to a picnic without inconveniencing anybody. Provided that the set has anti-vibratory valve sockets and all connections are well made, it will stand up to a great deal of vibration.



Mr. J. D. Chisholm has recently demonstrated his system of secret wireless communication to the Press. He is seen here with the transmitter.

* * *

I CAME across a man the other day who was convinced that he had discovered something wonderful about the conditions in his own locality. He had found, he said, that no matter what set was used in his own home, signals were always distorted. In fact, he came to ask me whether a row of trees near by could be the cause of the distortion of 2LO's signals. It appears that a set which gave distortion in his own home had been removed to a district near by, and with the same valves, batteries, loud-speaker and no better aerial, gave signals of excellent quality. Similarly, a friend's set, when brought to his house, invariably gave distorted results. I went round one evening, and found an explanation in a few minutes. The spot where he was situated was badly shielded and normally only very weak signals could be received. In order to bring them up to good strength, the reaction coupling of his set had to be brought somewhere near to oscillation point, and this, of course, gave rise to the distortion of which he complained. In the other district reception conditions were much better, and an equal volume of signals could be obtained with very little reaction.

* * *

B.B.C. ENGINEERS are now busily at work investigating the many possible ways of using quartz crystals to obtain the constancy of wavelength necessary if the suggested scheme of running all relays on one wavelength is adopted. There is a great deal of fascination in these quartz crystals, which are used in quite a different way from the crystals used for detection. Although the raw material is quite cheap, by the time the elaborate grinding and measurement is finished the final product is worth much more than its weight in gold.

WAVE-TRAP.

NOTES FOR THE OPERATOR

Hints and tips on getting the best from your set.

A FEATURE of the superheterodyne receiver which sometimes rather worries the beginner is that any given station can be heard at *two* points upon the oscillator tuning condenser dial, and this fact can sometimes be turned to good use in eliminating interference. It would, perhaps, be more correct to say, however, that the fact that any given setting of the oscillator dial may bring in either of two stations, if there happen to be two stations working upon suitable frequencies, *may result in interference being received*, which can be eliminated by a suitable manipulation of the oscillator in most cases.

Second Channel Interference

Without going into technical details, it may be stated that there is such a thing as "second channel" interference with a superheterodyne, and if it is found that a certain station is heard with an accompaniment of objectionable interference at one setting of the oscillator dial, it must not be forgotten that it is worth trying the *other* setting of the oscillator, where it may be found that the desired station will be heard quite clearly and free from interference.

Remember, therefore, when you have the desired station being blotted out by a spark station to try the other setting upon the oscillator dial, in hopes that it is a case of "second channel" interference which may be eliminated by this simple expedient.

Imperfect Matching

Another feature of the superheterodyne is that one occasionally finds that each station is heard not merely at two settings upon the oscillator dial, but at four settings, or sometimes even more. Take the case of a station being heard at four settings; it usually will be found that these four settings are arranged in two pairs, the pairs being located at the usual points on the dial, where one would have expected to obtain a single reading only, and this usually means that the intermediate-frequency coupling units are not properly matched, but, on the contrary, are tuned to two different frequencies. This is a very useful indication, and should be made use of when matching intermediate transformers of the tunable type. Turn the dials gradually until you have found the correct adjustment at which stations come in sharply and cleanly at two settings only upon the oscillator dial.

A Wavemeter Difficulty

Another feature of the superheterodyne receiver which is sometimes perplexing is that of the difficulty often experienced in making use of a wavemeter in an effective manner when trying to identify distant stations or to pick up previously-unheard transmissions. In most cases it will be found that the receiver is so sensitive that it is difficult to get the wavemeter far

The presentation of a silver cup to the winner of the reception competition run in America in connection with the International tests, to a listener of Rockville, N.Y.

Notes for the Operator

(Continued)

enough away from the set, assuming that one of the buzzer type is used. (For a beginner, at any rate, the buzzer type is to be prefered, as compared with the heterodyne wavemeter, which leads to considerable complications as a result of beat effects with the local oscillator.) It is usually found that the wavemeter has to be at least at the other end of the room before reasonably sharp readings will be obtained, and considerable inconvenience results in working the apparatus.

Try the Absorption Type

An alternative which is often found convenient is to use a wavemeter of what is called the "absorption" type, that is to say, one consisting simply of a tuned circuit made up of coil and condenser in parallel. When this is placed fairly close to the frame aerial, the result is a sudden weakening of signals (often resulting in an actual click), as the wavemeter dial is turned to a reading corresponding to the frequency of the station being received. Very definite and sharp readings can usually be obtained in this way, but a word of warning is necessary as to the actual use of the meter.

The buzzer type of wavemeter is much easier to use with a superheterodyne than one of the heterodyne type.

An Important Point

Make sure that it is really reacting upon the frame circuit, and not upon the oscillator in the superheterodyne. To find out definitely whether the latter is happening, set the wavemeter so that it produces a marked decrease in signal strength of the station being received, which denotes that the meter circuit has come into resonance with something in the receiving set, and then try the effect of changing from one to the other of the possible settings of the oscillator. If it is found that the wavemeter affects only one of the two settings, it is probable that it is producing some interaction effect between its own circuit and that of the oscillator in the set. If, on the other hand, the station remains at its new level of signal strength regardless of the setting of the oscillator to one or other of its possible points, the correct setting of the wavemeter has been found.

Relation to the Frame

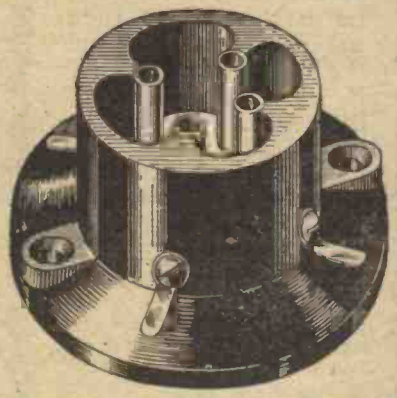
To ensure that the absorption type of wavemeter works satisfactorily with a superheterodyne receiver, it is best to put it quite close to the frame aerial and separate the frame from the set by a distance of at least 3 feet. A little experimenting with the various positions of the different parts will usually enable one to obtain quite good results with the absorption type, and it certainly has the very great merit of simplicity, although it possesses the disadvantage that it is not possible to use the wavemeter in searching for a station whose signals have not previously been heard, since there is no audible indication when the superheterodyne comes into resonance with the wavemeter circuit unless there is some station actually being heard.

APPARATUS WE HAVE TESTED

Conducted by the Radio Press Laboratories, Elstree.

Valve-Holder

Great pains have been taken to remove all superfluous insulating material between the valve sockets of the Aermonic Anti-Capacity Valve-Holder sent for test by Messrs. A. F. Bulgin. Although at first sight it would appear that this would result in decreasing the mechanical strength of



Superfluous insulating material is reduced to a minimum in the Aermonic anti-capacity valve-holder.

the component, it was found under the most stringent tests that this was not so. The insulating shell widens out into a large moulded circular base, provided with two holes for baseboard mounting.

The screws to which the soldering tags are attached screw directly into the metal valve sockets, thus ensuring good electrical contact.

The component is of good appearance, having several novel and interesting features, and can be thoroughly recommended.

40,000 ohm Type Variable Resistance

A variable resistance giving values from zero to 40,000 ohms has been submitted to us for test at our Elstree Laboratories by Messrs. the Marconiphone Co., Ltd.

It is claimed that this component has a very smooth variation of resistance from maximum to minimum. Furthermore, this resistance is kept constant by the contacts and the resistance element being both of the same material.

The component consists of a circular piece of ebonite with a centre spindle and bush to hold the contact arm. On the under-side there are two raised circular tracks, one inside the other, which are covered with a coating of graphite. This forms the resistance element. These two elements are connected in series with one another in such a manner as to give a maximum range of variation.

The contact arm is of an extremely substantial nature, and is arranged so that the two pieces of graphite which are mounted in it at either end are provided with springs to maintain a pressure on the element; these make contact separately on the outer and inner elements respectively. The whole of the back of the instrument is enclosed by a neat cover which is secured by two small screws in the edge of the ebonite. Soldering tags for connecting purposes are fitted. A knob and a dial of good appearance are provided.

On actual test, the resistance was found to be variable from a zero value to 40,000 ohms, its useful range being 399.9 ohms to 40,000 ohms. Smoothness of operation was very marked, and having found the reading for any particular resistance, this resistance could at once be returned to by the dial reading alone.

The workmanship and appearance of this component are extremely good. This resistance should prove exceedingly useful for controlling volume and tone in L.F. amplifiers by shunting it across the secondary of the L.F. transformer, and for controlling oscillation in H.F. circuits. It is supplied in two values, from zero to 40,000 ohms and zero to 500,000 ohms.

Vernier Dial

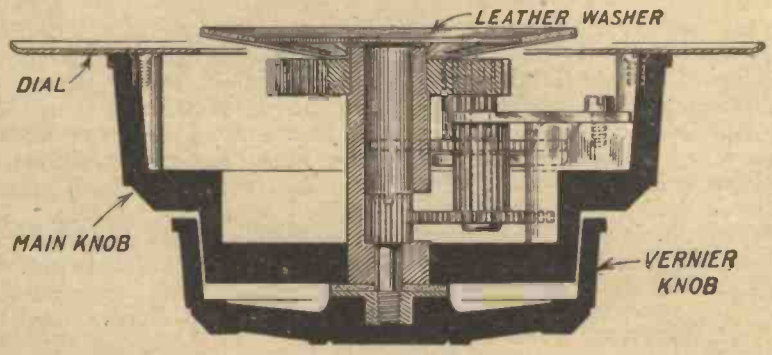
A sample of the "Accuratune" Micrometer Control has been submitted to us for test by Messrs. The Mydar Radio Co.

This vernier dial, which is 4 ins. in diameter, is provided with two large knobs, one for coarse adjustment, and another, slightly smaller, for rotating the vernier. Both knobs are hollow, one containing gearing which provides an 80 to 1 ratio. This gearing is of a very substantial nature, and means are provided to take up all backlash.

A cork pad of annular shape is incorporated to press against the panel, and holds the dial firmly in position, preventing wobble. The knob and dial are fixed on the condenser spindle by means of a set screw, and the frosted metal indicating dial is graduated from 0 to 180 degrees.

On testing this dial it was found that there was no appreciable backlash, and fine tuning could be performed readily. Ease of tuning was greatly facilitated by means of the large fluted knobs. The attached scale was clearly marked, a feature which is particularly useful in the case of a tuning control giving such fine adjustment.

This dial can be thoroughly recommended wherever fine tuning is necessary, and is particularly suitable for use in sets where selectivity or accurate adjustments are special features.



The vernier dial sent in by Messrs. The Mydar Radio Co. has a special gearing which provides an 80 to 1 ratio.

Multi Switch

Messrs. The Burner Insulator Co. have forwarded to us for test and report one of their "Bico" Multi Valve Switches.

These switches are made in three

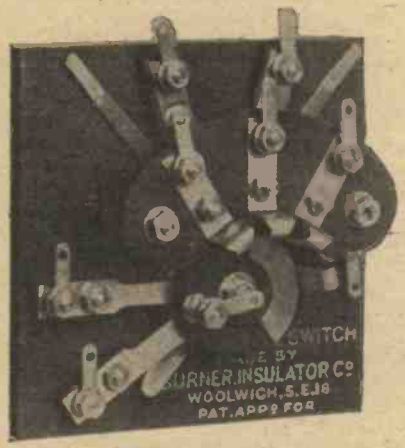
Apparatus We Have Tested

(Continued)

types. They are intended for controlling the switching of the valves in multi-valve receivers, and can be obtained for controlling two, three or four valves, where the first of these is a detector, the following valves being used for low-frequency amplification. The switch submitted to us was suitable for use with a detector and two stages of low-frequency amplification.

The switch is provided with a substantial knob and a brass pointer, and a scale is provided for fixing on the panel to indicate the number of valves in use. The switch may be mounted on the panel by means of one hole only, and connections are made by means of soldering tags. Means of connection is further provided by large nuts which can be used as terminals instead of using the soldering tags.

On test, the insulation resistance of



A "Bico" multi-valve switch submitted by Messrs. The Burner Insulator Co.

the switch was found to be infinity, and the resistance between the contact points negligible. The switch enables one, two or three valves of the receiver to be used at will, while a valuable feature is that the voltage applied to the detector valve remains the same, whatever the number of valves in use. A leaflet is enclosed with the switch giving a list of connections to the various contacts of the switch, which are numbered to correspond with the numbers on the list. The switch, however, can be put to a number of other uses.

It was noticed that the connection to the plate of the last valve (second amplifying valve) to point No. 1 on the switch was omitted.

Filament Resistance

We have received a Micro-Control Filament Resistance from Messrs. The London Electric Stores. This is a one-hole mounting component of the carbon compression type, the resistance element being contained in a fibre tube 1½ in. long and about 1 in. diameter. Soldering tags are provided for making connection to it.

This resistance has a range of between 1.3 and 28 ohms approximately, while it is smooth in action and can be used for controlling either bright or dull emitters. It will carry .75 of an ampere without appreciable heating, and its value only changes slightly in use, and then only during the first 10 or 15 minutes of its being switched into circuit. This is, however, quite a usual feature with this type of resistance.

This component is well finished, while the small amount of panel space which is occupied will recommend it particularly in many cases.

Grid Leaks and Fixed Condensers

We have received from Messrs. The Selezi Co. samples of the Therla grid leak and one Therla fixed grid condenser. The fixed condenser is provided with clips by means of which the grid leak may be placed in parallel with it, while three soldering tags are provided at each end for making connection. Its capacity is rated at .0003, and on test it was found to have exactly this value. Its insulation resistance was found to be infinity. The condenser plates are formed of brass sheet with mica dielectric, while the construction of this condenser is exceedingly robust.

When placed on test, the three grid leaks were found to be somewhat out as regards their actual value. The 3 megohm leak gave a resistance of 3.5, the 2 megohm a resistance of 3, and the 1 megohm a resistance of 1.4 megohms. When tested in a receiver these leaks were found to be satisfactorily noiseless.

Griffco Permanent Detector

Messrs. A. W. Gibson & Co. have sent us one of their Griffco permanent detectors for test and report.

This component consists of a short length of yellow insulating tubing, 1½ in. long, which carries a metal plug at each end. Each plug is provided with a terminal for making connection, the overall dimensions of the detector being just under 3 in. long by ½ in. in diameter.

When placed on test, the rectified current was found to be equal to that obtained with a carefully hand-set synthetic galena crystal detector. The results were, in fact, considerably superior to those usually obtained with this type of detector. The detector was subjected to rough usage without its sensitivity being in any way impaired. This component can be thoroughly recommended.

"Bloopers"

SIR,—I am a bit curious as to the reason for a statement which appears in "The Week's Diary" in *Wireless Weekly* for April 7. The author of this causerie, which I must confess that I read with interest every week, speaks of "the present absence of howls in the American ether."

I seem to remember reading in your pages (I have not the issue by me) that during the International Broadcasting Week earlier this year the American listener was as much troubled by "bloopers" at his door as by poor atmospheric conditions. Are we given to understand that a vast improvement has taken place in America in the past few weeks? I only wish that we could hope for such a change for the better in this country. In the meantime I beg to remain,—Yours faithfully,

PUZZLED.

Worthing.

Loud-Speakers Out of Doors

SIR,—Now that the summer is fast approaching and the season of out-of-door wireless is opening for many listeners, may I be permitted through your columns to make my plea against the indiscriminate use of loud-speakers in the country and elsewhere? I personally am specially concerned with the annoyance which can be caused by parties on the river.

I am the last person to wish to stop the enjoyment which broadcasting can give at all times, but I hope that holiday-makers will realise this year that there is great difference between using a loud-speaker within the confines of a house and allowing it to be heard far and wide over a normally peaceful countryside. Let them use head telephones by all means, but not be selfish enough to force the noise of a loud-speaker on unsympathetic ears. —Yours faithfully,

MARCUS REYNOLDS.

Maidenhead.

Observations in India

SIR,—The following table of times for best reception of different countries in India has been constructed from observations carried out during the last three months, and will probably be of interest to readers of *Wireless Weekly*:—

Time. G.M.T.

00.00-02.00.—Brazil, Holland, Great Britain, France. Italians fading out about 01.00 hours.

02.00-04.00.—U.S.A., districts 1, 4, 6 and 8, fading out about 04.15 hours. Russia, Philippines.

04.00-08.00.—All countries fading out. Russia remains audible until about 04.45 and the Philippines until about 05.00.

08.00-12.00.—Japan, China at their strongest about 11.30 hours. Australia and New Zealand begin to come in.

12.00-16.00.—Australia, New Zealand and Philippines, the two former fading out about 14.45 hours. South Africa coming in.

Monsieur Tellier, the musical director of the well-known broadcasting station, Radio-Belgique, is here seen playing from the church "Les Carmes," Brussels.

16.00-18.00.—South Africa, Finland, Germany, Holland, Palestine, Philippines at their best. England, France, Belgium, Sweden, Norway coming in.

18.00-20.00.—Belgium, England, France, Sweden, Norway all in strong. Italians coming in.

20.00-22.00.—European stations all strong but scarce.

22.00-00.00.—European stations still strong and very plentiful after 23.00 hours. Porto Rico coming in.

I should like to report that since receiving G2GO when his input was only 12 watts I have received confirmation from G2VY on my report to him and his input at the time of my reception was only 9 watts. I think that this is a record. I have also received SMTN, who, during his transmission, stated that his input was 4 watts; however, I have not yet received confirmation to my report.

Trusting that you will find this letter of interest, I will close, wishing *Wireless Weekly* continued success.—Yours faithfully,

R. J. DRUDGE-COATES.
(Radio Y-A2O and Y-DCR).

Rawalpindi, India.

The Status of Broadcasting

SIR,—I saw a notice in one of your journals recently to the effect that some of the sitting-rooms in the Hotel Cecil are now equipped with wireless. Recently, too, we have been hearing about the experiments carried out by the Great Western Railway Company in reception on their express trains.

Now, when I read about these developments in wireless, or, rather, in broadcasting, I realise, as I have no doubt that many others do, too, that broadcasting has passed the stage of being merely an amusement and that it is really becoming an essential feature of our daily life. In view of this fact, is not it about time for the various agencies, who at present seem intent on making things as difficult as possible for the B.B.C., to make a change in their attitude? Since the public now would certainly have something to say if anything serious occurred to prevent the transmission of the nightly programmes for which they have paid, in my opinion these agencies should be making every effort to adapt themselves to the new conditions, instead of trying to compel the new order of things to fall into line with their own obsolescent ideas.

I have a shrewd suspicion that part, at any rate, of the cause of their agitation at present is the publication of the report of the Broadcasting Committee, and the recommendation that a Government Commission be set up to replace the present company. The agencies see that there will probably be less hope of obtaining satisfaction from a Government Commission than from the existing organisation.

If the public would only express their views on this and kindred subjects in the pages of the technical Press, I

READERS' COMMENTS
(Continued)

think that the agencies would soon come to their senses.

It seems to me that this is a most important matter, and one which affects every reader of wireless publications.

I wish the new *Wireless Weekly* every success.—Yours faithfully,

BERNARD WICKHAM.

East Grinstead.

B.B.C. Wavelengths—A Suggestion

SIR,—I have been much impressed by the utility of the Calibration Scheme which has been made available to experimenters through the pages of *Wireless Weekly* from time to time.

I still do not understand, however, why the B.B.C. think fit to publish "official" or "nominal" wavelengths for their various stations, while actually transmitting on other wavelengths. Although the discrepancies are sometimes small, they are often too sufficient to render accurate calibration work useless, if the "official" wavelengths are accepted as correct.

I suggest that, in order to make the exact wavelength of a station known at any given time, the B.B.C. should make it a rule to announce this wavelength from each of their stations every day. The announcement would not need to be made often. It might conveniently be included in the News Bulletins. I cannot see that the B.B.C. have anything to lose by such announcements, and I am sure that they would be doing a great service to a large number of experimenters.—Yours faithfully,

London, W.1.

D. SCOTT.

Aerial Interaction

SIR,—I see that your correspondent, Mr. H. Dare, has described in your April 7 issue his experiences of interaction between a valve receiver and a crystal set. I have had something of the same experience myself, and I hope that details may be of interest to you. My aerial runs close to the aerial used for the crystal set, the receivers being on different floors in the same building.

Adjustment of the crystal set cat-whisker makes loud scratching noises in my telephones, and if I tune in a weak station, such adjustment will normally throw my set out of tune.

A further point of interest is that if I am listening on short waves—reading a faint C.W. station on 45 metres, for example—the same effect is produced by adjustment of the crystal. I have known occasions when my receiver was adjusted so as to be just oscillating for the reception of weak signals on short waves; under such conditions adjustment of the cat-

Readers' Comments

(Continued)

whisker has often caused my receiver to stop oscillating altogether.—Yours faithfully,

N. G. BARLOW.

London, W.2.

5XX and the Programmes

SIR,—As one who lives part of the year in the Manchester district and part in the 2LO district, I claim to be in a position to hold a less biased view of the subject of Daventry programmes than some of your readers and others.

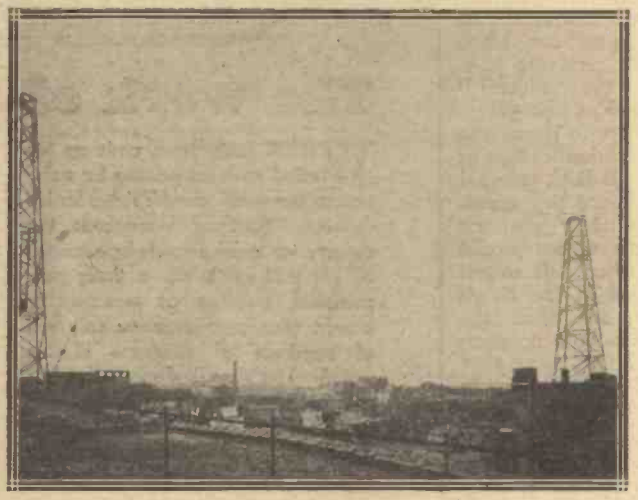
The first consideration seems to me to be that as Daventry has the greatest number of all classes (*i.e.*, valve, crystal, headphone, loud-speaker users) of listeners, it should be the first station to have the attention of the programme department of the B.B.C. Further, I do not think that the 2LO programmes are always the best, for, to take a case in point, I personally much prefer the 2ZY Augmented Orchestra—which is practically the Halle Band—to the London Wireless Orchestra, and I am constantly hearing both. Another point is that when criticisms are made, there seems to be a diversity of opinion as to whether a "London" or a "2LO" programme is what is wanted, and there is a difference, for supposing there were two London stations, they would both be transmitting London programmes, but probably quite distinct ones. If listeners would come to regard 5XX as a London station and not as a provincial one, the way of the B.B.C. would be simpler.

There is no doubt that as far as possible Daventry should transmit a programme alternative to all stations, at the same time giving those who are dependent on 5XX alone the best programmes available in the country, better, in fact, than any of the other stations because of our prestige outside this country. If the B.B.C. cannot afford to provide Daventry with wholly alternative "London" programmes, then the only thing to be done that will fulfil the requirements enumerated above would be for 5XX to relay in turn the other main stations. That is to say that Daventry on any one night would be relaying the best programme in the British Isles, unless it was S.B., when 5XX would have to give one of its own. Presuming, therefore, that the main stations have "best" programmes, equally alternative programmes would be available on nine days out of ten about.

Apologising for the length of this letter, which I think sums up the position fairly well,—Yours faithfully,

J. M. TOULMIN.

Earls Court, London, and
Preston, Lancs.



The aerial of the Brussels station, Radio-Belgique, is of the familiar cage variety.

Northolt and "Mush"

SIR,—There has been much talk recently regarding the "mush" from the arcs at the Northolt Station. The P.O. are said to have reduced considerably the interference from this source, but, residing as I do "under the shadow" of this giant aerial, allow me to point out that interference now is as bad, and, in my humble opinion, worse than it has ever been. The "sizzling" is by no means confined to one wavelength; and at my home, which is about 1½ miles from the giant aerial, I experience trouble throughout the range of my condensers.

During the recent Transatlantic Tests I determined to get up and "try my luck" at receiving American stations. From the moment of don-

Readers' Comments—*continued*

ning the 'phones (2.30 a.m.) until 4 a.m. Northolt must have held a real "birthday"; never have I experienced interference so bad.

I do think it is time that steps were taken to reduce this "mush" to a minimum, and I am sure that there are many fellow sufferers whose sentiments tally with my own.

In conclusion, I should be interested to hear whether other readers think the "mush" has increased recently.—Yours faithfully,

G. W. DUNNING.

London.

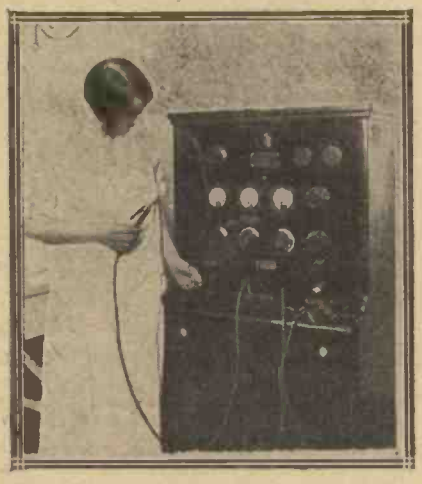
Choke Amplification

SIR,—During recent weeks I have spent many hours to gain maximum output from two stages of choke amplification, and feel that many of your readers would appreciate a brief outline of results and the means by which these are obtained.

Obviously, it is unnecessary to emphasise the importance of using an efficient L.F. choke.

It may be borne in mind that a very good indication is weight—a large iron core and a generous number of turns. Presupposing that your readers have two such chokes in their possession (and these are obtainable commercially), with a coupling condenser of about .1 μF and leak of about 1 megohm—certainly not less than .5 megohm—then one is well on the way towards an efficient choke amplifier.

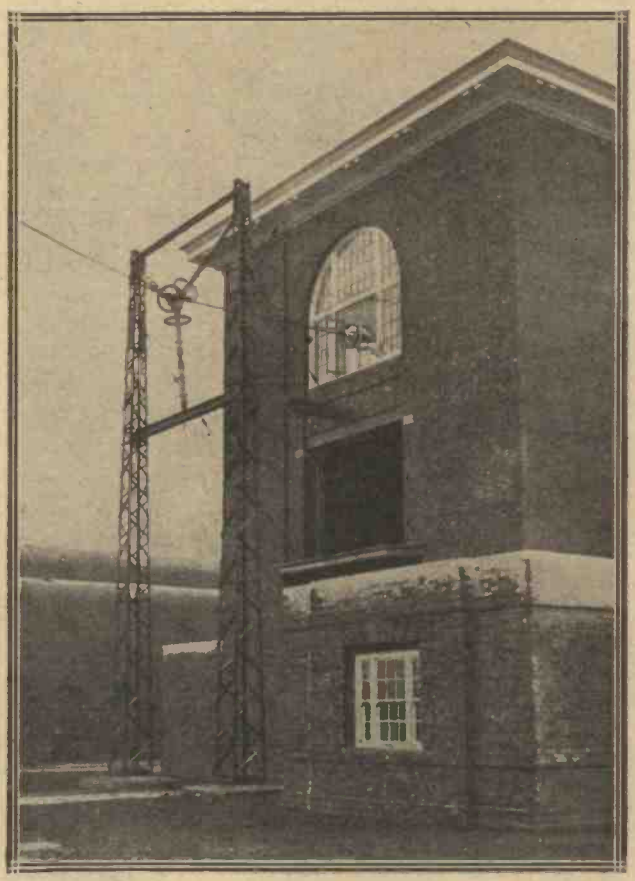
But this is not all. My earlier experiments were conducted with general purpose valves. In these circumstances only do three stages of choke



The "Radio Knife," operating by virtue of high-frequency currents, has been used with success for cautery purposes in the Vanderbilt Clinic, New York.

amplification equal two transformer-coupled stages.

The quality of reproduction, however, showed such an amazing improvement over any other former receiver that I had built that I was persuaded to invest in the correct valves for the purpose.



The lead-in wire at the Rugby station is supported near its end by a special structure consisting of two small masts.

I proved to my own satisfaction that this is the secret of obtaining maximum volume from choke amplifiers. You will recollect, of course, that to use the correct valves would be the most obvious thing to do.

Situated as I am, 3½ miles N.N.W. of 2LO, it is no mean performance to listen in comfort to several Continental stations which nightly come over at good loud-speaker strength. This is achieved without any H.F. amplification, without any form of wavetrap to eliminate 2LO, on a capacity reaction detector circuit with only two stages of L.F. choke amplification.

The volume obtained with this receiver, in addition to quality, is preferable to that given by a transformer-coupled receiver, for the reason that the quality of the choke method is so astonishingly pure and free from background noise.

Thus one is almost inclined to say, "The valve's the thing! "—Yours faithfully,

London. H. CLADEY.

A Reader's Results

SIR,—You will doubtless be interested to hear of some results obtained with sets from Radio Press designs.

(1) The "Universal Two," as described in the book, "Six Simple Sets," by Mr. Stanley G. Rattee.

I have kept to the instructions exactly, but have used two square-law condensers in place of the others mentioned. The following stations have been received so far on a very poor aerial:—Bournemouth, London, Cardiff, Daventry, Ecole Superieure, Radio-Paris, Hamburg, and, lastly, the new Dublin Station 2RN. I think this shows what a good little set this is, and I hope for still better results later on.

(2) The Amplifier by the same author, as mentioned in September, 1924, *Modern Wireless*. This works a loud-speaker perfectly in conjunction with No. 1.

(3) The "Cross Coil" Crystal Set as described in *Wireless*, October 17 issue, by Mr. Geo. T. Kelsey. Daventry comes in quite well with a No. 250 coil plugged in; also with shorting plug fitted Bournemouth and London can be heard faintly, but I cannot separate them from each other.

With best wishes to Radio Press and staff.—Yours faithfully,

A. C. BATE.

Hove.

PRACTICAL TOPICS

By G. P. KENDALL, B.Sc.

A condenser failing—dust covers—speed in wiring—using thin bare wire.

NOT very long ago I contributed some notes to *Wireless Weekly* on the subject of noises in variable condensers. Now, the fact that it could be regarded as desirable to furnish the reader with instructions for remedying such faults as noisy contacts, dust between the vanes, and so forth, cannot but be regarded as a condemnation of much of the current practice in condenser construction.

Dust Covers

Of all the components in a receiving set, the variable condenser is probably supreme in its power to make or mar one's pleasure in operating the apparatus, for there are few things more aggravating than a condenser which makes noises when turned, has loose bearings, or is stiff in its motion at one end of the scale and objectionably slack at the other. Of course, we all understand that the average variable condenser of to-day is produced within very close price limits, and we must not expect too much for our money, but surely it is not too much to demand that our components shall have a reasonable life of trouble-free service?

Take, for example, the question of dust. Now, no reputable maker would think of turning out a low-frequency transformer without some protection for its windings from atmospheric influence, yet almost every one of them is content to send out his variable condensers without the slightest protection against moisture and dust.

An Extreme Case

Only recently I met a keen experimenter who had the misfortune to be compelled to do most of his work in a rather damp outbuilding, and he told me that his choice of variable condensers is rigidly limited to those to which it is easy to fit a dust cover for oneself, and for this reason he has not tried any of the more recently developed patterns of so-called "low-loss" condensers. Surely, it would not add more than a shilling or so to the cost of a condenser to provide a reasonably effective dust and moisture cover?

Some of my readers will, no doubt, remember that the majority of the variable condensers in use in the Service equipment during the war were supplied with ebonite dust covers, and very effective they were.

Something large in condenser plates! It is one of those used in building up air condensers in the 50 kw. transmitter at WGY. It is dished to avoid distortion and consequent changes of frequency.

I feel sure that any variable condenser maker who will add a similar cover effectively to his standard patterns will find the additional outlay well worth while.

A Quick-Wiring Tip

Which is the quickest way of wiring-up a set? While perhaps not the quickest of all, the method which I use when I am in a hurry is one which takes a good deal of beating, and I would commend it to the notice of anyone who wishes to try out some special arrangement as speedily as possible. The method is simply to use quite a fine gauge of tinned bare wire, and to dispense with any form of sleeving or insulation. The wire being fine it is quite soft, and can be bent under terminals and nuts with one's fingers and all the nuts screwed down just "finger-tight" only. Then, when all the wiring has been done, one takes a pair of pliers and goes over all the terminals and nuts, tightening them up firmly.

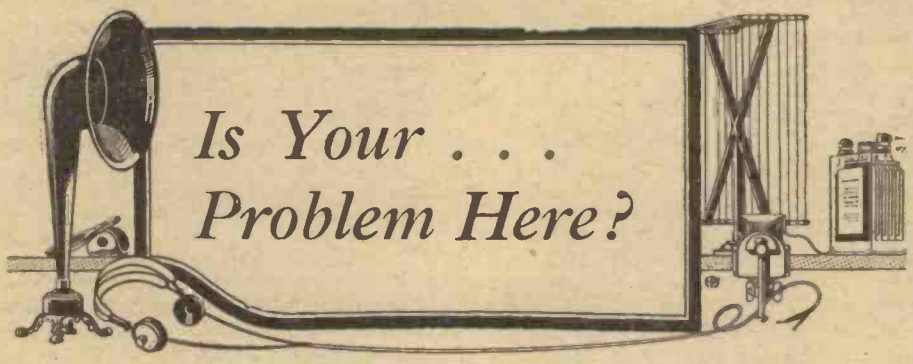
Untidy but Efficient

The fact that the wire is bare compels one to space it out fairly carefully, so that although the resulting job looks extremely untidy, probably it is quite as efficient as some of the highly ornamental work one sees put into sets wired up with square bus-bar wire or Glazite.

It may sound a very messy business, but its speed is an important factor to anyone who wants to try a particular lay-out of components without spending a great deal of time over wiring them up, and it must be remembered that little or no soldering will be needed. As an example of what may be done, I will recount a recent experience of mine. At the conclusion of my preliminary experiments with the six-valve superheterodyne which I mentioned in a recent letter in the correspondence columns of *Wireless Weekly*, I transferred all the parts to a slightly different layout in a specially-made portable cabinet, the former experimental work having been done upon a rough board lay-out.

Quick Work

Wishing to wire it up and test it during the Easter holiday, I had to rush the work somewhat, and finally found myself with the set ready for wiring up at 10 o'clock on the evening of the Thursday before Easter. Nevertheless, that set was wired up and tested to a sufficient extent to warn me that it was not working properly before I went to bed that night (or, rather, the following morning!). The result was that I was able to take the road the next morning with the complete set and also with a soldering outfit and certain spare components and materials which I employed during the Easter holidays to make certain alterations to get the receiver into working order.



Reaction with a Superheterodyne

"I have been informed that a considerable improvement in selectivity and sensitivity can be obtained without the addition of H.F. stages to a Supersonic heterodyne receiver if a centre-tapped frame and a small condenser is employed, and have been referred to the article by Mr. A. Johnson-Randall in 'Wireless Weekly' for February 3rd, 1926. I have tried this scheme but with my set it is not effective. Can you tell me where I have gone wrong? I enclose a circuit diagram of my receiver."

With the scheme which you have attempted to employ, namely, that of a centre-tapped frame, the centre tapping going to filament and the two ends of the frame respectively to the grid of the first detector and through a neutrodyne condenser to the plate of the same valve, the whole frame being tuned by a parallel condenser of .0005, it is essential that a radio-frequency choke coil be inserted in the plate circuit of the first detector valve. We note, however, that in this position a filter transformer tuned by a parallel fixed condenser of .0005 is inserted. This fixed condenser will act as a by-pass condenser to the fundamental frequency radio component and will prevent any reaction effects being obtained.

With your separate oscillator arrangement there is no reason making it essential that a fixed condenser should be employed across the primary winding of the filter transformer, excepting to bring this transformer into tune with the other intermediate-frequency transformers, and a solution of the difficulty at once becomes obvious. This is to interchange the position of the tuned filter and one of the intermediate transformers. The fixed condenser across the primary of the filter will still effect its object in sharpening up the tuning of the long-wave side, whilst the untuned primary of the intermediate transformer which is inserted in the plate circuit of the first detector valve will act as an effective radio choke, and will allow you to obtain the reaction effects desired.

If you do not wish to employ the scheme outlined above, another solution, although one which is not so effective, is to place a small coil in series with the grid end of the frame aerial and to react on to this with a small reaction coil inserted in the plate circuit of the first detector between the plate of this valve and the tuned primary of the filter transformer. In this case it should be observed that it is essential that a tuned filter be employed, since otherwise the primary will act as a choke, which in this case is not wanted.

Grid Bias Voltages

"Recently I consulted the makers' characteristic curves for certain small power valves in order to determine what I thought to be the correct grid bias to employ. This I found by considering the straight portions of the curve to the left of the zero grid-volts ordinate, and employing a grid bias voltage so as to work on the middle point of the straight portion.

Is Your Problem Here?

(Continued.)

On referring, however, to the figures for grid bias furnished with the valve I find these to be higher than the figure obtained by my method, and in fact in some cases it would seem that the employment of the advised voltage should result in the valve working at the lower bend of its curve, thus giving rise to undesired rectification effects. Can you explain this seeming discrepancy?"

The anode volts—grid volts characteristic curves published for various voltages for given valves are not obtained under working conditions, that is, they are taken without a "load" in the plate circuit of the valve, as must of necessity be there in practice. An external impedance or "load" in the anode circuit of any valve results in practical reception in the voltage on the anode of the valve continually varying as the anode current varies. Without going into a detailed explanation, which is somewhat outside our scope in this case, the effect briefly is considerably to decrease the working or "dynamic" slope as compared with the static slope of the curve given by the manufacturers. It follows, therefore, that a larger value of grid bias than that determined from the static curves will be possible under working conditions. It is this value which is generally advised by the makers.

Screened Coils

"I am contemplating building a portable receiver with two high-frequency stages and thought of using screened coils of the type designed by Mr. J. H. Reyner and marketed by several firms, but upon inspection find that these coils take up a considerable amount of room. Is it likely that any material loss of efficiency will result through reducing the size of the screens so that the internal clearance from the coils is lessened?"

It has been experimentally determined that the screens should not be too near the coils, since the screening effect is really produced by small eddy currents which are induced in the metal of the screens. These currents have the effect of producing small magnetic fields which are in the opposite direction to those produced by the coils, and they so adjust themselves that the field outside the screen is negligible.

If, however, the screen is placed too near to the coil in question, the eddy currents produced therein are so large as to absorb an appreciable amount of energy from the coil, thus increasing the effective resistance and neutralising to a large extent the benefits which ensue from the employment of the screens. There are certain limits within which the screen must not be brought if a suitable compromise is to be effected between the bulk of the coil and increasing the high-frequency resistance. The required distances of the screens from the coils will vary with different shapes of coils, and when this has been determined experimentally, as in the case of the special coils you mention, it should in no case be decreased.

Short-Wave Distortion

"Listening on the short waves below 200 metres I have from time to time heard a number of telephony transmissions which are so distorted as to be unrecognisable. Does it follow from this that the transmissions are from very distant stations?"

In practice it by no means follows that the transmissions you have heard are from distant stations, since often when receiving a comparatively nearby B.B.C. station on its harmonic the telephony may be distorted owing to a number of reasons, such as slight variations in frequency of the transmission, owing to aerial swing, etc., which may not be noticeable on the fundamental frequency of the transmitter, or to external sources, such as variations in the conditions of the upper atmosphere, etc.

AMATEUR TRANSMITTING NOTES

QRA's Found and Wanted.—QSL Cards Held.—Reports Wanted.—Change of Address.

QRA's Found

G-5SQ: A. P. McGrory, 58, Kirk Street, Campbelltown, N.B.

G-6GG: A. W. Eagle, 126, Rosebery Avenue, Tottenham, N.17.

A-5DA: S. R. Buckerfield, 4, Regent Street, Parkside, South Australia.

S-2NQ: R. Hangon, Borgströmin Huvila, Hanko.

G-6QH: A. J. Baker, 67, First Avenue, Bush Hill Park, Enfield.

G-2BQW: G. H. Kitley, 57, Vicarage Road, Plumstead, S.E.18.

A-3AD: J. A. Davey, 209, S. Kilda Street, Brighton, Victoria, Australia.

Y-1DS: "D" Div. Signals, Cambridge Barracks, Rawalpindi, India.

SMTK: H. Carlsson, Kullagatan 40, Hälsingborg, Sweden.

F-8JB: M. Viard, 10 Rue Gambetta, Langres, Hte. Marne, France.

G-6VO: D. Simpson, 18, Bank Street, Ferryhill, Aberdeen.

M-2X: J. Macouzet, El Oro, Mexico.

QRA's Wanted

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Wireless Weekly

Vol. 8. No. 10.

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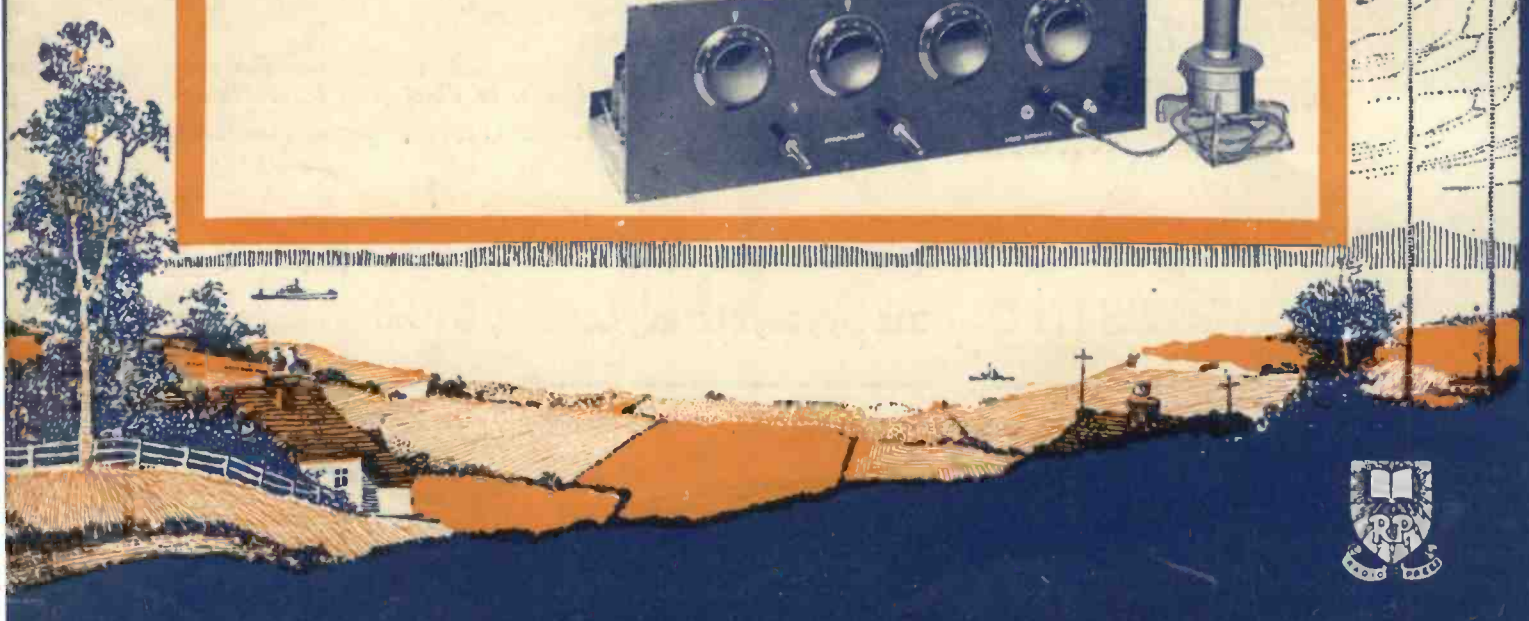
FULL CONSTRUCTIONAL DETAILS of a FOUR-VALVE SET

By C.P.ALLINSON, A.M.I.R.E.



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JOHN SCOTT-TAGGART

F.INST.P., A.M.I.E.E.

Technical Editor:

J.H.REYNER, B.Sc.(Hons), A.C.G.I., D.I.C., A.M.I.E.E.

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Have you Heard of the Schrott Effect?

NEW LIGHT ON AN OLD PROBLEM

By J. H. REYNER, B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

A controversy has long raged as to whether reaction really does compensate for a high-resistance circuit: the presence of an unsuspected "threshold" effect which modifies the position profoundly is explained in this article. It is likely to have an important influence on set design.

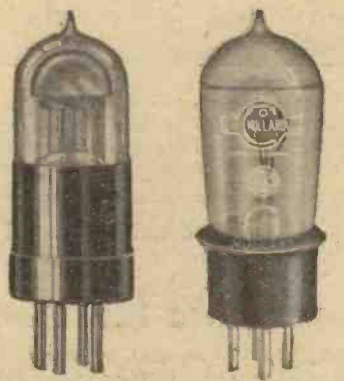
A QUESTION which has often been asked is whether the coils of a receiver need be of low-loss construction or whether equally good results can be obtained with a high-resistance coil and a suitable amount of reaction. Theoretically one would imagine that the application of reaction would result in an exactly equivalent state of affairs to that of a low-loss coil without such reaction.

Disagreement with Practice

Practical experience, on the other hand, seems to indicate that this is not the case. While on a comparatively local station there is little to choose between the two arrangements, there is usually found to be a distinct advantage when picking up distant stations in having a low-loss coil.

Practical Tests

Some attempts were described recently in these columns to find quantitatively the exact effect of reaction. A simple type of receiving circuit was connected up, and an audible signal was introduced from a local oscillator. The resonance curve of the arrangement was plotted so that the signal strength and the selectivity could be observed.



The "threshold" effect of a detector circuit is familiar to most of us, but few can have suspected that there is also a "threshold" value in the case of amplifying valves.

Added Resistance

On introducing resistance into the circuit both signal strength and selectivity became considerably worse, but the application of reaction enabled the receiver to resume its former condition of sensitivity. The tests were pursued still further by adjusting the receiver to the point of oscillation, firstly, without any added resistance, and, secondly, with an extra resistance in circuit, and in both cases there was very little to choose between the results obtained.

Certainly, the slight diminution would hardly appear to be sufficient to account for the definite discrepancy which is observed in practice, particularly on distant reception. The explanation of the discrepancy has recently been discovered by Schrott.

A Threshold Discovery

It has been found from actual delicate measurements that there is definite minimum signal which can satisfactorily be amplified or detected by a thermionic valve. If the incoming signal is less than this critical amount, then no amount of reaction will enable the signal to be amplified.

This is an important discovery, because it supplies a definite reason for various effects which have been noticed in practice from time to time.

There has long been an impression that some such limiting effect was called into play, more particularly as regards detector valves, and, indeed, for some time it was thought that below a certain point a detector valve (even if followed by a large number of stages of low-frequency amplification) was comparatively useless for any but the local station.

Is the "Square" Law Correct?

An analysis of simple theory, on the other hand, seemed to indicate that this view was not correct. If the detector valve obeyed the "square" law, then the detector would become increasingly inefficient as the incoming signal was reduced in value. One would imagine, however, that the only effect would be a very distinct weakening of the rectified current, so that the resultant current would be so small as to be below the sensitivity of the telephones employed for the reception.

Does L.F. Bring in DX?

If this were so, then the application of a sufficient number of stages of low-frequency amplification would result in the signal becoming audible. Moreover, since low-frequency amplification is usually greater per stage than high-frequency, one would imagine that the number of valves necessary to pull in the distant stations would be little, if any, more than the conventional arrangement wherein one or two high-frequency stages are employed before a detector.

Some recent experiments conducted by Mr. W. S. Percival, of the Radio Press Laboratories, indicated that this was the case to a large extent, and that a considerable number of distant stations could be received on a straightforward detector valve followed by four stages of low-frequency magnification.

Cause of the Schrott Effect

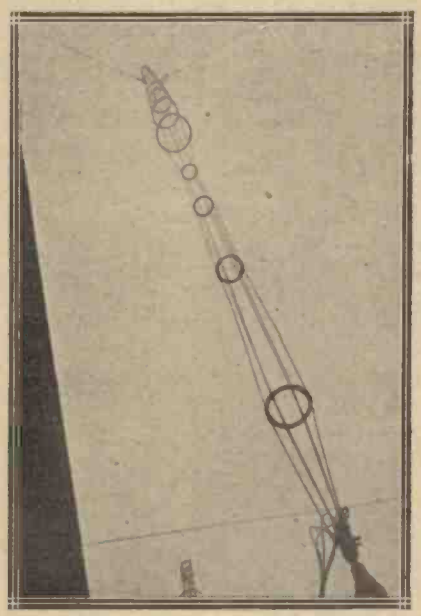
These results, however, were not uniformly consistent, and any particular effect could not always be repeated. This would point to some variable factor, and the discrepancy is explained in terms of the recent theory set out by Schrott, who has suggested that there is a definite minimum signal strength not only for the detector, but for amplifying valves as well.

The effect is thought to be due to slight unevenness in the emission from the filament. This means that the anode current, instead of being

HAVE YOU HEARD OF THE SCHROTT EFFECT?

(Continued)

quite steady, is always subject to very small variations, and if the signal to be received is smaller than these continual variations of the emission, then it will be appreciated that such signals could not be satisfactorily amplified, even if considerable reaction was applied to the circuit. The only effect of any reaction would be to magnify the variation of the steady anode current, which would manifest themselves simply as a rushing noise,



The new station at Rosenhugel, near Vienna, appears to be laid out on very elaborate lines. This view was taken looking up from beneath the down-lead.

and the signal could not be discriminated from the volume of noise.

An Advantage of the Dull Emitter

The theory receives considerable support from the fact that the threshold or critical value with dull-emitter valves is considerably less than with bright-emitter valves. It is well known that the emission from dull filaments is much more uniform than from bright filaments. Modern amplifiers employing dull-emitter valves are much freer from the crackling and other valve noises which used to be so troublesome in the old days. This is due to the much greater uniformity of the emission.

If therefore the variations of the emission are very much smaller, so we can reduce the input to a considerable extent before it becomes comparable once again with the variations of the anode current. Thus with a dull-emitter filament the critical limit for the Schrott effect is lower.

Low-Loss in the First Circuit

The existence of this effect, however, indicates the necessity for a low-loss circuit in the first stage of a receiver. Obviously, no amount of amplification will be effective if the first valve is suffering from this limiting effect. It is essential, therefore, that the voltage actually developed across the first valve shall be a maximum, so that as many stations as possible shall be above the critical value determined by the Schrott effect.

If this is done, then the subsequent stages can, if desired, be made less efficient, and any resistance therein may be compensated for by suitable reaction effects. If the theory is correct, therefore, the design of receiving equipment is somewhat simplified, for we need only have a really low-loss construction for the first coil, the subsequent stages being small and compact, so that they can be easily controlled.

Something to Try

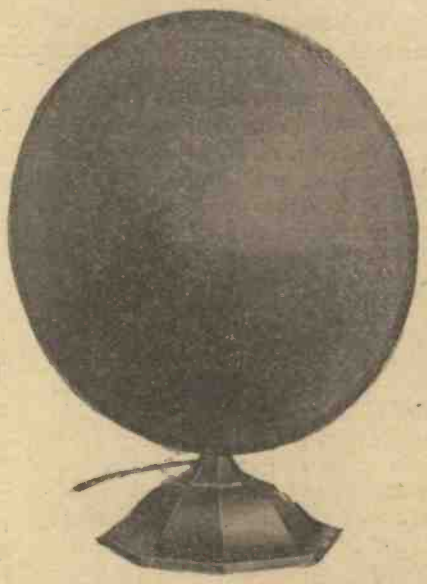
Those readers who are interested in the effect can endeavour to repeat for themselves the observation by placing a coil having a very low resistance in the aerial circuit, and tuning in to some extremely weak signal. The low-loss coil may now be replaced by one having a much higher resistance, so that the voltage produced by the distant station will be considerably less than before. It will be found on some occasions that distant stations can only be received with the low-loss coil, more particularly if a bright-emitter valve is employed for the first stage.

Whether the experimenter succeeds in verifying these conclusions for himself or not, the fact remains that a limiting effect has definitely been established by careful and accurate measurements, and it is one which will have a considerable influence on the design of receiving equipment.

Making Your Own Hornless Loud-Speaker

By Major A. G. LEE, M.C., B.Sc., M.I.E.E.

Major Lee is an enthusiast of the hornless type of loud-speaker, and he gives some very useful data in this article which will enable anyone to make up such an instrument with very little difficulty.



The "Kone" is one of the best known examples of a commercially-produced hornless type.

THERE is no doubt that, in the mind of the music lover, the loud-speaker is the most horrible part of wireless. The low-brow may listen to his raucous horn and be content, while the high-brow gives it up in disgust, and hies him to his favourite concert hall. This, perhaps, is as it should be, for otherwise the concert hall and its band of musicians might have to give up the struggle for existence. A cynic once said that the art of broadcasting was the art of transmitting the worst possible music to the greatest possible distance. If this man had heard a good type of hornless loud-speaker I think he would have reversed his dictum.

Objections to the Horn

Now why is the horn type of loud-speaker so often an abomination? In the first place, it is frequently run with a badly-designed amplifier, perhaps too much reaction, low-frequency transformers with a poor characteristic, and, more often than not, overloaded valves taking grid current in the last stage.

Secondly, the horn type functions as an air resonator: the volume of air inside the horn resonates very much in the same way as a tuned aerial resonates electrically, but the ordinary domestic or parlour loud-speaker suffers from the defect that its wavelength is too short. In other words, it will not respond to the low bass notes, because in order that it may produce these satisfactorily it should be at least six feet in length, which is rather an awkward dimension for a London flat, to say the least of it.

Virtues of the Hornless Type

This is where the hornless type scores; it can be made to occupy a very small space, and yet will reproduce a great part of the musical scale with extreme fidelity. There are a number of very good hornless loud-speakers on the market, such as the pleated diaphragm type and the various types of cone loud-speaker. The construction of these loud-speakers offers some difficulty to the amateur experimenter if he is to ensure the best results, and I propose to describe some simpler types, and the practical principles underlying their construction, which are quite within the range of the amateur constructor.

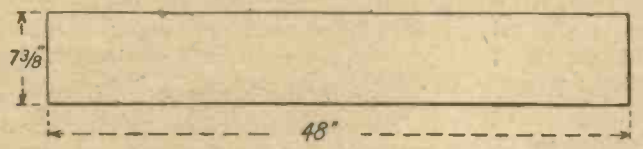


Fig. 1.—These are the dimensions for a strip of paper from which a pleated diaphragm can be made.

Start with the Amplifier

First of all I must hark back to the amplifier. I assume that the man who takes the trouble to build a cone loud-speaker is interested in getting very good reproduction, and the starting-point of this is a good faithful amplifier. It is outside the scope of this article to go into the amplifier question, but though personally I have a preference for the resistance amplifier with a power valve at the end of the chain, yet I am prepared to admit that there are some very good intervalve transformers on the market, which, if worked with the requisite anode volts and grid bias, will give excellent results.

Pleated Diaphragm Type

I will assume that a telephone mechanism with an armature of the reed type is available, as this is far and away the simplest and most effective type with which to experiment. It is not, however, necessary to scrap one's existing loud-speaker mechanism, as a reed can be fitted quite easily in place of the standard stalloy diaphragm.

Choosing the Material

Now with regard to the construction of the paper diaphragm. The first point is the selection of a suitable paper. I have found that a good quality of foolscap writing paper is suitable. Suppose we decide to make the finished article 15 inches in diameter, then the circumference of the diaphragm will be 47

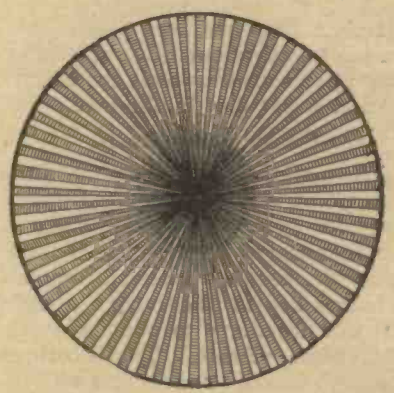


Fig. 2.—The finished diaphragm ready for mounting.

Making Your Own Hornless Loud-Speaker—*continued*

inches, and the radius will be 7½ inches. From our foolscap we construct (see Fig. 1), by pasting pieces together, a strip of paper 7⅞ inches wide by 48 inches long, to allow a small overlap for joining the two ends together. By making the paper slightly narrower than the radius of the disc we make provision for a small hole at the centre of the diaphragm.

Now commence the pleating, with pleats ½ inch wide. It is desirable to mark out the pleats before folding, in order to get them even, and it will be found preferable to do the pleating of the small sections before they are pasted together to form the long strip, but in this case allowance should be made for the overlaps in the total length. After the

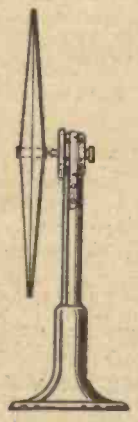


Fig. 3.—The diaphragm and its actuating mechanism can be mounted upon some sort of pedestal.

complete strip has been pleated and pasted together one edge should be gently pressed in towards the centre, so that a flat disc is obtained.

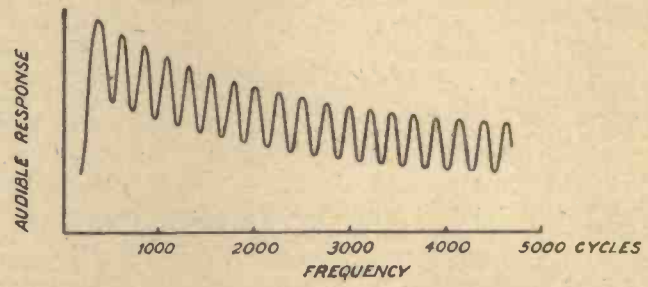
Centre Attachment

The mounting of the centre is the next point. I have found metal discs for gripping the two sides of the diaphragm together to be undesirable, because a certain amount of flexibility in the centre attachment is necessary to allow the diaphragm to vibrate. Two or three thicknesses of paper pasted together, and then cut into circular washers 1½ inches in diameter, form a good means of gripping the two sides of the diaphragm. These paper washers may be gummed to the diaphragm, and the nuts on the rod from the reed are gently screwed up on to these washers. This construction is a trifle fragile, but it gives excellent quality, and that is its excuse.

Mounting

The finished diaphragm may now be mounted into a ring at the edge, but here again I prefer a free edge as being simpler to construct and giving better quality. The stand for the telephone is easily constructed out of Meccano parts for experimental purposes, though, of course, a more finished article is desirable.

Fig. 4.—The cone type gives a response curve indicating a large number of minor harmonic resonance points (this drawing is not to scale).



Now for some of the difficulties which meet the constructor: they are usually of two types, a rattling noise with loud notes and pronounced resonance at a certain high note. The rattling noise is due to looseness of some part of the paper, usually at the centre, and careful construction is the only cure. Dust getting into the centre is also said to cause rattling, and should be blown out with a bellows periodically.

Remedies for Resonance

The resonance effect, though a little more subtle, is more easily

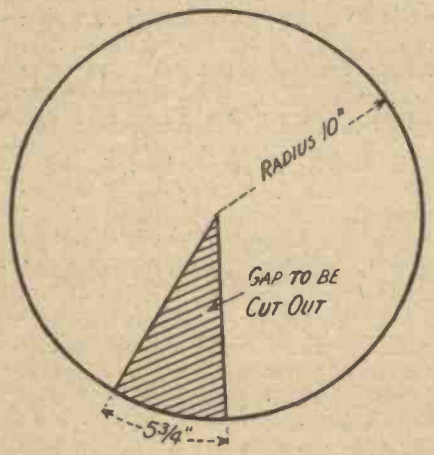


Fig 5.—A cone diaphragm can be cut to these dimensions.

cured. Most of these paper diaphragms, including the cone type, function by means of a wave motion which is started at the centre by the action of the reed, and which travels to the edge, where it is reflected and sets up what is known as a stationary wave. The lowest mode of vibration of a paper diaphragm is the fundamental, which should be well down in the bass register, and, in addition to this, the diaphragm will vibrate on all the harmonics of the fundamental note.

Fig. 4 is a curve showing the audible response of a cone loud-speaker at different frequencies. The harmonic resonant points in this case were about 30 cycles apart, indicating that the fundamental was 30 cycles. Now the reed has a mode of resonance of its own, and if the frequency at which it resonates happens to be the same as one of the harmonics of the paper diaphragm, then pronounced resonance of a certain note will occur.

Shifting the Resonance Points

The remedy is either to alter the resonant frequency of the reed by loading the rod in the centre with a heavier washer, or to alter the fundamental frequency of the paper diaphragm, and therewith the spacing of its harmonics, so that in either case the frequency of the reed does not coincide with that of an harmonic of the diaphragm.

It may be as well, at this point, to say a word or two in regard to the points which determine the fundamental frequency of a pleated diaphragm. The following points *lower* the fundamental frequency: large diameter, wide pleats, thick, heavy paper, while, conversely, the frequency is raised by having a smaller diameter and narrower pleats. In order to alter the fundamental frequency of a pleated diaphragm which has been built, and with which annoying resonance is noted, the simplest plan is to trim off an eighth of an inch at a time all round the circumference until the defect is removed.

Making Your Own Hornless Loud-Speaker—*continued*

The Result

The reproduction from a pleated diaphragm loud-speaker is very crisp and clear cut, and gives a very pleasing musical effect, which I find

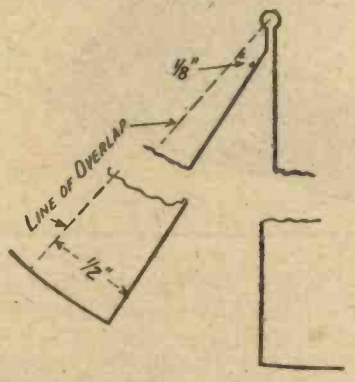


Fig. 6.—In cutting the gap allow an overlap like this.

to be an enormous improvement over the average horn type of loud-speaker. The process of pleating is, however, laborious, and the cone type of loud-speaker will be found much easier to make, and gives excellent reproduction, from the lowest bass notes upwards.

Cone Type Loud-Speaker

To make the cone type loud-speaker, first procure a sheet of the best quality hand-made drawing paper. The paper should not be too stiff, like, for example, Bristol board, but should be the same grade as is used for engineers' drawings. Hand-made paper is preferable, because the fibres lie in all directions, and the cone will retain its shape better in use.

The finished cone is to be 18 inches in diameter across the open mouth. A circle should be marked on the sheet of paper with a radius of 10 inches. A piece of string fixed to a pin in the centre will serve in lieu of a pair of compasses, and, with a pencil tied to the string, a fairly good circle can be drawn.

Making the Cone

Next cut out the circle, and after this is done measure off a length of $5\frac{3}{4}$ inches along the circumference, and then cut out a V-shaped gap on the paper, as shown in Fig. 5. The two edges of this gap should then be pasted together, allowing an overlap of $\frac{1}{2}$ inch at the outside and about $\frac{1}{8}$ inch near the centre.

Fig. 6 shows the details of the cuts for giving this overlap. After the paste or Seccotine is dry the cone is ready for mounting on the reed. In this case there is no drawback to the use of metal washers under the nuts on the rod, and $\frac{1}{2}$-inch washers cut out of tin or brass will serve to hold the cone firmly, enabling it to be supported by the rod without sagging.

Mounting

As in the case of the pleated type, I prefer the reproduction when the diaphragm is not supported at the outside edge, and the telephone mechanism may either be fitted with a solid stand, as shown in Fig. 7, or, a much easier plan which has many advantages, suspended from the picture rail. In the latter case, the cone should point slightly down-

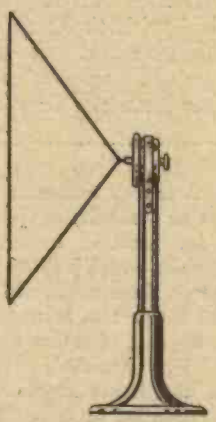


Fig. 7.—A single-cone type completed.

wards towards the listeners, and it is desirable to arrange a bracket or strut so that the cone is at least 6 inches away from the wall. In such a position the loud-speaker is, to a great extent, immune from accident.

Alterations of Tone

The remarks on rattle and resonance under the pleated type apply also to the cone type, and the fundamental note of the cone can, if necessary, be raised by trimming off the circumference of the cone, and thus reducing the diameter slightly.

Here again the larger the diameter the lower the fundamental mode of vibration. A flat-angle cone has a lower resonance than a sharp-angle cone, and the frequency

A commercial version of a single-cone loud-speaker (this a "Sferavox," the other commercial instrument illustrated in the heading of this article being a "Kone").

is also affected by the weight and stiffness of the paper. It is very instructive and interesting to make cones of different angles and sizes, and to compare the results of reception. A man's voice, which may be in each case quite intelligible, may be completely altered in quality by two different cones of varying size or angle. A further experimental model which has given very interesting results is shown in Fig. 8. This consists of a comparatively

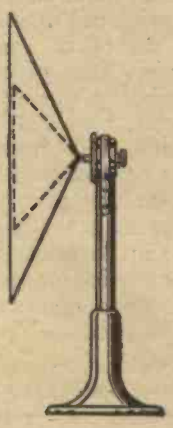


Fig. 8.—A double-cone arrangement possesses certain very good features.

small diameter wide-angle cone, which reproduces the low bass notes, and in the centre is a still smaller cone of smaller angle for reproducing the high notes.

This Week's Interview

No. 7—PERCY W. HARRIS, M.I.R.E.

This week Mr. Harris is the subject of our condensed interview, which will be found to consist of the usual series of terse questions and answers on subjects of universal interest.

SET DESIGN AND THE HOME CONSTRUCTOR

Q.—What do you think of the future of the home constructor, Mr. Harris?

A.—Conditions for home building improve every month. The home builder is far better catered for this year than last, and all the signs point to a steady improvement in this direction.

Q.—How does the British home constructor compare with his confrere in the United States?

A.—On the whole, he is decidedly better off. A year or two ago the reverse was the case, but since the British manufacturer has taken pains to give the public really sound articles, and has studied what has been done on the other side of the Atlantic, Great Britain is fast coming to the front. In one thing only we are still backward over here—or rather the component manufacturer is backward—the manufacture of really good and well-designed high-frequency transformers of the low-loss type. It is upon these that the home constructor must mainly depend in his hunt for selectivity, which now is as important in this country as it is in America.

Q.—Why are American home-built and factory-built receivers on the average so much more selective than those produced over here?

A.—For no other reason than that I have just given. Fortunately, owing to the enterprise of one or two far-sighted British manufacturers, it is now possible to obtain components in this country which will give the home-built receiver as great a selectivity as any built in America, while fortunately our audio-frequency transformers are on a distinctly higher level than most of those produced in the States.

Q.—Is it true that American valves are much better than ours and help to produce a better selectivity?

A.—No! It is time that myth was exploded. Americans have entirely abandoned the bright-emitter valve, and the manufacturers of valves there have very considerately brought their prices down to a reasonable level. While a fair number of 2-volt valves are sold in the States, the majority are either 5-volt ¼-ampere small-power valves or 3-volt .06-ampere dull-emitters. Although the bases of the American valves are different from the British bases, the electrical characteristics of the valves themselves are identical with those of our own 5-volt ¼-ampere and our own .06-ampere valves respectively. In addition, we have the very excellent high-impedance valves used for resistance-capacity and choke coupling, while Americans have only just been able to obtain these.

Mr. Harris is well known to every reader as an authority on the design of sets for amateur construction, and the views which will be found expressed on these pages will carry particular interest as being to some extent a forecast of future developments. His knowledge of the needs of the home constructor is equalled by few.

Q.—How do American valve prices compare with British?

A.—Both the ¼-ampere and the .06-ampere valves are 10s. each, so that you see the ¼-ampere valve is less than half the price of its equivalent here.

Q.—I see in some of your recent sets you are using only one filament resistance for two or more valves. Do you consider this good practice?

A.—With our modern valves, decidedly so. In fact, I formed the opinion some time ago that thousands of dull-emitter valves are ruined each year through the abuse of the variable filament resistance. Personally, I am inclined to favour fixed resistances, and shall probably use a number in my future sets. With modern valves which are not at all critical in filament current, there is no need to fiddle with filament resistances.

Q.—If there is no filament resistance, how can you allow for the drop in voltage of your accumulator?

A.—When such a condition arises, it is time to have your accumulator re-charged. If you examine the discharge curve of an accumulator, you will find that it remains practically constant at 2 volts per cell until nearly the end of the useful discharge. When the voltage begins to drop below 2 it drops very rapidly, and with the .06-ampere valve it is very easy to discharge an accumulator far beyond the safe point.

Q.—How do you mean "beyond the safe point"? Surely if the cell will give you the current you require, you may as well have it before sending it to be re-charged?

A.—This is a common fallacy. If an accumulator is discharged beyond the point when each cell is giving 1.8 volts *on load*, the useful life of the accumulator will be considerably shortened. The bad effects of over-discharge are not noticed for some little time, but they are inevitable, as any accumulator manufacturer will tell you.

Q.—What criticisms would you make on the home-constructed sets you have seen in the last year or so?

A.—On the whole, they are quite well made, but there are still a number of home builders who think it unimportant to follow the layout of the sets they construct from magazine articles. While it is true

in some cases that evil effects are not found by departing from the design, in modern highly sensitive and selective receivers, particularly those of the neutralised type, a few inches difference in the length of a lead will upset the design completely. In many cases, of course, designs for home constructors can be modified, but such modifications require considerable knowledge, and should not be attempted by the novice. Then, again, bad soldering is a fault found on many well-built sets. Misuse of soldering flux is the cause of a great deal of trouble, and I am sure that many home builders think that the more flux they use the better the joints will stick! The only way to make a good soldered joint is to file the metal bright, use only the slightest trace of flux, and use a really clean and very hot soldering iron.

Q.—Which do you prefer, superheterodyne or "straight" receivers?

A.—I have no special preference. Both kinds of receivers have their uses and their disadvantages. The superheterodyne scores heavily in the simplicity of its controls, but it is difficult to get really good-quality reproduction with many makes of intermediate transformer. Again, the superheterodyne principle does not become really useful until a number of valves are used. The multi-valve "straight" receiver, on the other hand, while being somewhat more difficult to tune, has several advantages of its own, particularly since a high efficiency per stage is now possible with many of the new neutralising methods.

The Byrd Arctic expedition is being very comprehensively equipped. The two operators are seen here testing some of the receiving gear at Messrs. Grebe's works before installation.

THIS WEEK'S INTERVIEW
(Continued)

Q.—What do you think of reflex sets?

A.—The particular advantage of reflex sets is the economy in valves, but since the modern valve takes so little filament current, this advantage is not so important as it was in the bright-emitter days. A properly designed reflex set can be a very practical instrument, but it must not be forgotten that such receivers are rather prone to troubles on the audio-frequency side, particularly if unsuitable low-frequency transformers are used.

Q.—I am afraid you will think me very curious, but there is one question I would very much like to ask. What becomes of all the sets you make after they have been published?

A.—I usually keep about half-a-dozen on hand for comparison purposes, but beyond this they are gradually taken to pieces again. All kinds of circuit improvements are tried, and I am afraid many experiments with sets are of a drastic nature and involve all kinds of changes which are not good for the appearance of the sets altered! After a set has been tested by myself and by the Elstree Laboratories, and is ready to be given to the public, some new circuit may be invented and the receiver in question may offer a good opportunity for trying it after certain modifications have been made. If the experiments are successful, an entirely new receiver may be made, the old one taken to pieces and its components stored away.

Q.—What is the starting point in your designs?

A.—Most of my experiments start from a desire to take a particular existing theoretical circuit and to find some new or simplified way of interpreting it. For example, before Radio Press existed and when I was building some of my first sets, series-parallel switches were very popular among amateurs for changing from parallel to series with the aerial tuning condenser. I thought out the matter and devised the three-terminal method of connection which has since been so widely copied. This led me to think out other methods of avoiding switches or rather switching complications. The "Four-Valve Family Receiver" contains a number of these. The "Transatlantic" receivers, another popular line of instruments, arose from a scheme of obtaining simplicity of control by the use of twin condensers.

An automatic transmitter will probably be used in maintaining communication between the Byrd Polar expedition and Long Island.

Q.—I notice that practically all your multi-valve sets now contain a neutralising condenser. Why is this?

A.—To get real efficiency in stages of high-frequency amplification, it is very desirable that the stability shall be obtained not by introducing heavy damping losses, but by neutralising the unwanted valve and other capacities. There are a number of methods of doing this, and I am sure a number more will be invented. I do not think that even the potentiometer method is quite bad, for if we avoid stray fields from our coils by using astatic or other forms of coil with limited external field, or the shielded method which has been recently developed so successfully by Mr. J. H. Reyner, a great deal of the cause of instability can be removed. After this a very slight positive bias is all that is necessary.

Patents and the Home Constructor

WHAT IS THE REAL POSITION?

By A BARRISTER-AT-LAW.

Are we all infringing master patents? What constitutes infringement? Do patents prevent the genuine experimenter from testing new inventions? This article gives authoritative answers to these questions, and deals particularly with the original patents of Senatore Marconi and the other key patents now held by the Marconi Company.

AS a general rule the man in the street is not very interested in the intricacies of patent law. He is, of course, aware that inventors usually protect themselves by taking out Letters Patent, and that in some cases quite a lot of money is made in this way. Probably the working of the patent system comes home to him most forcibly when buying a safety razor or some other gadget that could apparently be made for a fraction of its selling price. If he ventures to express an opinion to this effect he is informed by way of explanation that the article in question is patented and carries a royalty charge.

A Result of Broadcasting

One result of the sudden and universal popularity of broadcasting has been to bring the wireless public, somewhat imperceptibly perhaps, but nevertheless quite definitely into personal and intimate contact with the operation of the patent system and the legal rights of patentees.

Wireless is unique amongst other popular enthusiasms in that the general public has absorbed in a quite amazing manner the principles and technique of what is undoubtedly a difficult and in many ways an abstruse science. The result is that instead of being content to leave the task of supplying their needs in the shape of broadcast receivers to professional engineers and manufacturers, a very considerable number of listeners have taken this job upon their own shoulders. Not only so, but they build their sets with a keen discrimination of the latest improvements and a high degree of skill.

A Much-Patented Subject

Now, wireless as a commercial institution is a field that has been ploughed and harrowed both by professional inventors and by various manufacturing interests who have literally sown it with patent rights. Some of these are foolish or futile, whilst others are in mutual conflict, so that it is perplexing to know with certainty to whom royalty fees are due. There remains, however, certain patents which are of fundamental importance, and which carry the full force of the law behind them.

It can be taken for granted, at the present time, that no amateur constructor can build a standard single or multi-valve set for broadcast reception without coming within the scope of at least one or more of these master patents, of which perhaps the most important are those covering the use of reaction, grid-leak rectification, and various forms of inter-valve coupling.

Rights of Patentees

This being so, it may perhaps be of interest to consider for a moment exactly what rights and privileges the law gives to the holder of letters patent for an invention. In the early middle ages it was the recognised prerogative of the Crown to grant monopolies to favoured individuals or corporations, giving them the sole right to trade in certain industries such as weaving, glass-making, and the like. In the course of time this practice led to such abuses that Parliament in 1624 passed the famous Statute of Monopolies, which swept away all existing monopolies and forbade the grant of any others *except those in favour of the inventors of any "manner of new manufacture."*

An Ancient Form

Subsequent Acts of Parliament have further defined both the duties and the rights of a patentee, but the present monopoly rights of an inventor are really founded upon this ancient statute. Provided that he succeeds in getting his specification accepted by the Patent Office, and that the invention is original and useful, and is fairly described, the inventor secures from the Crown the grant of Letters Patent, which read, somewhat quaintly, as follows:—

"Know ye therefore, that We of our special grace, certain knowledge, and mere motion do by these presents, for us, our heirs and successors give and grant unto the said patentee our especial license, full power, sole privilege and authority that the said patentee by himself, his agents or licensees, *and no others,* may at all times hereafter during the term of (sixteen) years make, use, exercise, and vend the said invention within our United Kingdom in such manner as to him or them may seem meet, and that the said patentee shall have and enjoy the whole profit and advantage from time to time accruing by reason of the said invention.

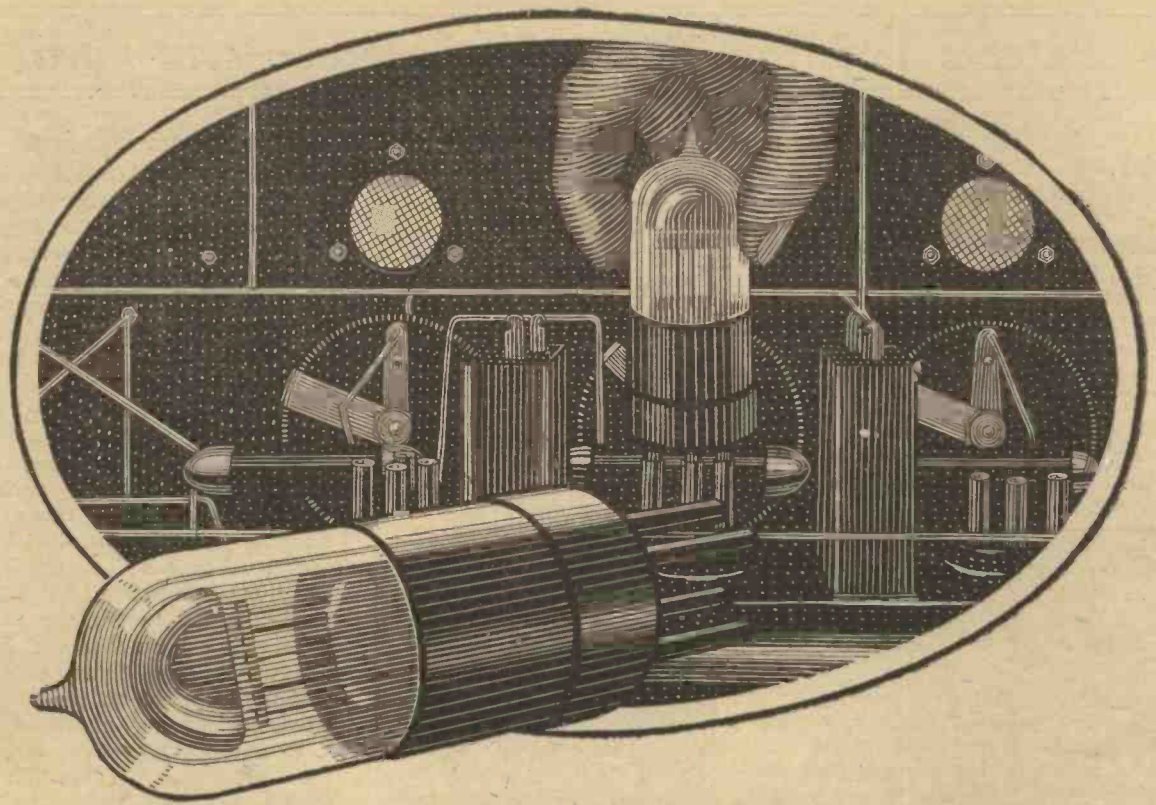
"And to the end that the said patentee may have and enjoy the sole use and the full benefit of the said invention, We do strictly command all our subjects that they do not *either directly or indirectly make use of or put in practice the said invention or any part of the same* . . . without the consent, license, or agreement of the patentee . . . on pain of occurring penalties . . . or of being answerable according to law for damages."

All this seems to be very drastic, and, taken literally, might be held to place many innocent persons in peril. In the first place, however, it must be remembered that the mere issue of Letters Patent is not in itself a guarantee that they are valid and of full effect.

Difficulties of Enforcement

Many a patentee has, to his cost, found the contrary to be the case when attempting to enforce the monopoly rights set out above. If

(*Continued on page 304*)



"Mellowed by the stealing hours of Time"———

FUNDAMENTALLY there is a great gulf between the Wuncell and other Dull Emitter valves. For in the Wuncell there is utilised a filament which actually improves with use. A filament which is built up layer upon layer until it is practically as stout as that used in a bright emitter valve. A filament, moreover, which successfully functions at a temperature glow which is almost invisible.

After all, the cost of a valve depends not merely on what you pay for it—the length of service you obtain determines whether that valve has been cheap or expensive. Measured on that basis, the Wuncell valve is by far the most economical Dull Emitter that can be bought—*because it lasts longer.*

Heat is the great destructive influence which brings most valves to an untimely end. In the ordinary Dull Emitter low current consumption has been obtained by whittling down the diameter of the filament almost to the point of fragility. But the temperature at which that filament is operated is still very little less than that used in the average bright emitter. And so inevitably there is a tremendous stretching and contracting every time the current is switched on which finds the first weak spot and culminates in a fracture.

Quite apart from the technical superiority of the Cossor design—the electron-retaining Grid and Anode system—which is freely admitted, the Wuncell filament offers you three distinct advantages. An unusual robustness which precludes the possibility of early burn-out. A rigidity—due to its unique three-point suspension—which entirely eliminates microphonic noises.

And, finally, a prolific emission of electrons which tends to increase as the valve becomes mellowed by use. Truly the Wuncell sets a new and higher standard in valve economy. The moment you use one you will appreciate its outstanding merit.

Types and Prices:

*W.1. For Detector and L.F. use - 14/-
1·8 Volts. Consumption: ·3 amps.
*W.2. (With red top) for H.F. use 14/-
1·8 Volts. Consumption ·3 amps.
W 3. The Loud-Speaker Valve - 18/6
1·8 Volts. Consumption ·5 amps.

*Also in special base with resistance to suit 2, 4- or 6-volt Accumulator 16/-

Cossor Valves

Issued by A. C. Cossor, Ltd., Highbury Grove, London, N.5 *Gilbert Ad. 5034*

Patents and the Home Constructor—*continued*

his patent comes before the Court it is possible that the alleged invention can be shown to be old and not original, or it may be that the inventor has not described it in sufficient detail, or has given a misleading or inaccurate description in his patent specification. Any of these defects, as well as certain others, may be sufficient to destroy the validity of the patent grant and render it null and void.

If, however, it is able to survive such attack, then the patentee's monopoly rights are those set out in the wording of the grant, and the Courts will enforce them in his favour, and award damages and other penalties for infringement. In this connection it should also be borne in mind that the mere possession of letters patent is *prima facie* evidence of their validity, and that in order to contest a threatened action for infringement it is necessary (*a*) to attack the validity of the grant on one of the grounds mentioned above, or (*b*) to prove that there has been no trespass, in fact, upon the particular field covered by the patent concerned.

Much important short-wave experimental work has been done by amateurs, and their position in regard to key patents is clearly defined. This is one of the latest views of "2OD," showing a 1,500-volt bank of C.A.V. accumulators used in some recent experiments with Australia. An increase of 25% was reported on switching over from rectified A.C. to the pure D.C. supply.

An Important Exception

There is, however, one definite exception from the patentee's monopoly rights which is of particular interest to the wireless experimenter. Sir George Jessel, Master of the Rolls, as long ago as 1879, decided that patent rights were never granted to prevent persons of ingenuity from exercising their talents in a fair way. So long as there is neither using nor vending of the invention for profit, the mere making *for the purpose of experiment*, and not for a fraudulent purpose, ought not to be prohibited.

This ruling is plain commonsense, as well as good law. The whole object of the patent system is to encourage invention, and thereby stimulate trade and industry. If experimenters (who are potential inventors) are prevented from repeating the work already done by earlier inventors, there is an end of all progress. Development in any field of industry mainly consists in making use of the latest improvement as a stepping ground to a still further advance.

Those Warnings

With these considerations in mind, it is interesting to consider the effect of certain warning notices recently issued to the general public by the Marconi Co., who control the master patents previously mentioned as covering the construction of the standard type of broadcast receiver.

The first warning issued early in the present year states that any person "supplying or receiving by way of sale, gift, or exchange," unlicensed broadcast receivers embodying patents controlled by Marconi's Wireless Telegraph Company, renders himself liable to legal proceedings for infringement.

This, it will be observed, is aimed directly at any home constructor who makes a set for the purpose of either exchanging, giving, or selling it to another person. Unless the specified royalty fees are paid on such a set, both the maker and the recipient of the set are liable to be sued for infringement.

The Second Notice

This notice was followed a few weeks ago by a further warning, which contained the following paragraph :—

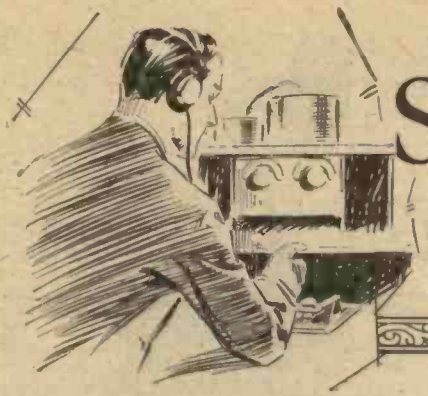
"As far back as 1922 the Marconi Company placed at the disposal of the *bona-fide* experimenter or amateur the use of their patents. Whilst the Company has no intention of withdrawing this, they cannot consider persons who make up receivers at home merely for the purpose of obtaining amusement from broadcast programmes as "experimenters," and therefore the concession referred to above is not applicable to them."

It is rather difficult to understand exactly what is meant by this pronouncement. So far as the first notice is concerned the Company are undoubtedly well within their rights in prohibiting what has come to be known as unlicensed "amateur trading."

In the first place the home constructor who makes and sells unlicensed sets to other people is competing unfairly with the legitimate trader who is compelled to pay the patent royalties or face an action for infringement.

So far as the *bona-fide* experimenter is concerned, he is excepted

(*Continued on page 326.*)



SHORT-WAVE Notes & News

DURING the last week or so the writer, having been in the convalescent stage, has had a good chance of studying the conditions of short-wave work during the afternoon and early evening, and has been surprised in more ways than one. It is not generally realised what a " peak " occurs in reception conditions (on the 6,667 kc. band) at about 6 p.m. Signals are quite good at mid-day, and keep at a steady strength until about 4,30 or 5 p.m., when they suddenly begin to increase in strength, reaching a maximum at about 6.30 p.m., after which they fade out very slowly until, at about 11 p.m., only the distant stations, such as North Americans and Brazilians, are audible with any degree of regularity. All these remarks apply, of course, only to this time of year, as in the winter the European signals have mostly faded out by 6 p.m.

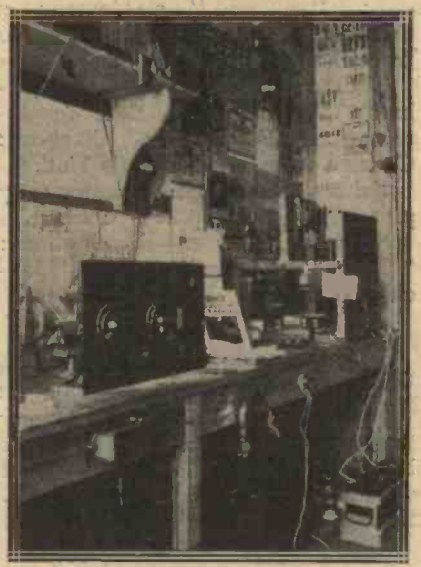
Afternoon Activities

A surprising number of British and French stations are to be heard working in the afternoons; quite a lot of useful work is being done at this time in the way of " local " tests, some of the Northerners being particularly active. 5KZ, of Keighley, is another user of a *Wireless Weekly* transmitter, and he has been doing excellent work with input powers never exceeding 16 watts. His signals have been reported in India as " heard many times R4-5 and steady." He has also done some good work with Cairo and Palestine, his signals being reported at the former place as " R9+ " on 23 metres when he has been working on 6,522 kc. (46 metres)!

2VO, of the same district, has often been heard by the writer when he has been using telephony with low powers of the order of 6 watts. Telephony carries surprisingly well on short waves in spite of the tremendous amount of interference met with on the 6,667 kc. frequency-band at the present time.

" Horizontal " Work by 6QB

6QB has been carrying out some experiments on horizontal transmission and reception, the principles of which were outlined in these columns some time ago. He reports very interesting results in his preliminary tests, and is hoping for great things in the future. Several other stations are investigating horizontal reception, but no one seems to be doing much work on the transmission side, except for the users of the so-called " Hertz " antenna, which apparently works on similar lines.



The transmitting equipment of Belgian U3 is very methodically laid out. " QST " apparently reaches Belgium!

Our friends the " Yanks " have apparently broken all low-power records that have ever been made by a piece of work done by U-2GY, who communicated with U-9CCQ with receiving valves and an input power of .04 watts to the anode! The " miles-per-watt " figure given by this work comes out at 25,525, which nearly doubles the previous record of 14,000.

Ireland

The Irish stations are now to be heard " on the air " in force, and the quality of their transmissions seems to be very high. 5NJ has not been doing quite so much as usual, but 6MU seems to be making up for his absence, and is working all manner of DX with fairly low powers. 6YW is the " star " low-power station, however. He has *worked* Porto Rico with an input of 2 watts (from 180 volts of dry batteries), and has also been in telephonic communication with all parts of the British Isles, and Ostend. 2IT is still putting out his well-known ear-splitting signals, and also seems to be working everyone he hears.

Scotland

A large number of the Scottish stations are at present working on the 2,000-1,500 kc. (150-200 metre) band, but there are still quite a few to be heard on the higher frequencies. 6WG, of Glasgow, is another user of the " Inexpensive Short-wave Transmitter," and has worked nearly all Europe with 6 watts input, having also received a report of " R7 " signals from P-3FZ, at Madeira.

2VX, of Aberdeen, has worked Brazilian 6QA with 12 watts input, and was reported R5. 5YG has also been doing good work with 5 watts input.

A New Station?

The writer has frequently heard a station giving the call-sign SS-8LBT of late. This station appears to be keeping a schedule with FI-8QQ (Saigon, Indo-China), but his QRA is at present unknown.

American Broadcasting

Several readers report reception of a station with the call-sign 2XAS, transmitting telephony on 9,091 kc. (33 metres), some of the reports giving the signal-strength as high as R8. We believe this station is one of the experimental branches of WGY, and should be glad to receive any reports or information,

Wireless News in Brief.

Pictures by Wireless

Recent experiments in the transmission of pictures by wireless from Königswusterhausen to Vienna were fairly successful. We gather that difficulties of synchronisation made the transmission slower than had been anticipated. The transmission of handwriting was quite promising, this offering problems of less magnitude than the faithful reproduction of pictures.

* * *

We understand that it is stated by the Ministry of Health that while it is not proposed to issue any instructions with regard to wireless aerials, they are prepared to consider proposals put forward by local authorities.

* * *

Summer Programmes

During the coming summer the B.B.C. are proposing to relay open-air concerts from the London parks. The first occasion on which this will be done is May 5.

* * *

Rugby Telephony

With reference to a statement that Rugby's telephony tests with America were due to control of Rugby by the United States, the Post Office authorities have now pointed out the reason for these experiments. It appears that America alone possesses the necessary apparatus for satisfactory tests.

* * *

From the Programmes.

Sunday, April 25.—London: 3.30 p.m., Tchaikovsky programme, by the Wireless Symphony Orchestra, conducted by Sir Hamilton Harty. Birmingham: 3.30 p.m., American programme.

Monday, April 26.—London: First of the Spring Series of Chamber Concerts, from the Chenil Galleries. Belfast: The "Bubbles" Concert Party.

Tuesday, April 27.—Daventry: Request programme by "The Roosters." Cardiff: Song and Pianoforte Music. Bournemouth: Orchestral Reminiscences.

Wednesday, April 28.—London: 9 p.m., Syncopated Concert. Cardiff: "Billeted," a Comedy in three acts. Separate programmes from the relay stations.

Thursday, April 29.—Birmingham: "Maritana." Belfast: International Folk Song. Glasgow: Concert from St. Andrew's Hall.

Friday, April 30.—London: 7 p.m., "Daily Graphic" Concert.

Saturday, May 1.—Birmingham: "Listening Time" Revue. Manchester: "May Day Merriment."

* * *

Edinburgh's Birthday.

On May 1 the Edinburgh station will celebrate its second birthday. Among the speakers on this occasion will be the Rt. Hon. The Lord Provost of Edinburgh and Captain P. P. Eckersley.

* * *

The Opera Season.

During the coming season several relays are to take place from Covent Garden Opera House. Among the operas to be broadcast will be Acts from "Figaro" on May 10, "Valkyrie" on May 14, and "Gotterdammerung" on May 19.

* * *

At intervals in the future Sunday afternoon broadcasts are to be given from King's College Chapel, Cambridge. The first of these will take place on May 2, when the afternoon service will be relayed to listeners.

* * *

Broadcasting a Football Match.

The progress of the football match between Wales and France in Paris was broadcast throughout France. A microphone was installed on the ground, and an announcer gave a continuous account of the movements of the match.

* * *

Polar Airship.

During the flight of the airship *Norge*, which is to convey the Amundsen-Ellsworth expedition in an attempt to reach the North Pole, from Pulham to Oslo, communication was maintained with the land by wireless. Various messages recording the progress of the airship were received at the Air Ministry.

* * *

On April 13 dance music transmitted by WGY, Schenectady, New York, was again relayed by the B.B.C. This attempt was even more successful than the previous one, the music coming through with little atmospheric interference or fading, and the voice of WGY's announcer being particularly clear.

* * *

A "Wireless" House.

A house at St. George, Staten Island, New York, completely equipped with broadcast receiving apparatus, was "opened" last week by Captain P. P. Eckersley via wireless from Radio House, London. In this "ideal home" the wireless equipment, with loud-speakers in seven rooms, is built into the walls, no wires showing externally. Switches on the walls provide for the operation of the receivers.

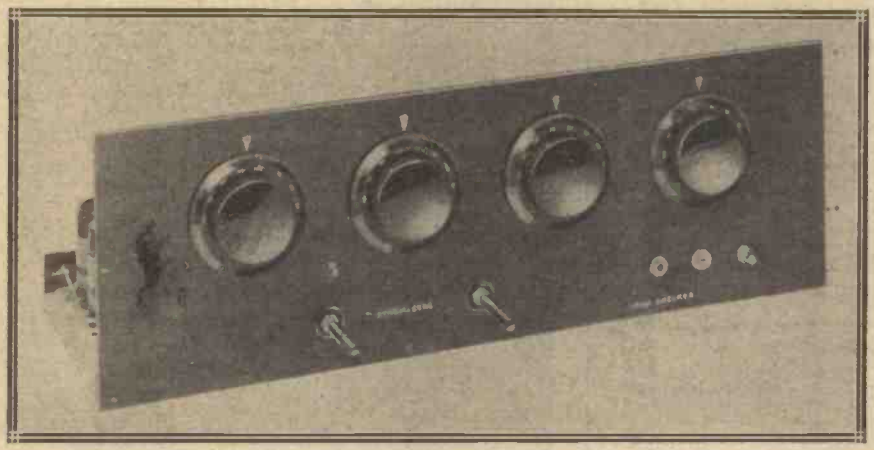
* * *

Mr. R. H. Ranger, of the Radio Corporation of America, who arrived in this country last week, is to give a demonstration shortly, in conjunction with the Marconi Wireless Telegraph Co., of the commercial possibilities of the transmission of pictures by wireless.

ELIMINATING DIRECT PICK-U

HOW TO BUILD A "TW SET WITH TWO

By C. P. ALLINS



Although there are four dials on the panel only three of these are actual tuning controls.

SOME months ago the writer started a series of experiments with fieldless coils, with a view not only to reducing interaction between H.F. stages of a receiver but also to eliminating direct pick-up from the local station, which in this case is situated within 2 miles distance or less.

To take the more important of the points which were investigated, the first dealt with was that of stability. Though it was found that the stability of the receiver was greatly improved by the use of fieldless coils when employed in conjunction with valves of the D.E.5 type which function so well as H.F. amplifiers, the high capacity of these valves was nevertheless liable to produce self-oscillation, especially at the lower readings of the tuning condensers.

Parasitic Oscillation Troubles

Since it was intended to produce a receiver which should be inherently stable so that, what one may call, "positive" reaction could be employed, it was decided to use the split grid coil method of neutralising to obtain the desired stable conditions. This was found to be satisfactory at the higher readings of the H.F. condensers, but at the lower the H.F. valves broke into short-wave oscillation when more than one stage was used.

At this point of the work a curious effect was noted, namely, if the grid returns of the H.F. valves were left free a greater degree of H.F. amplification was obtained. The question of obtaining freedom from short-wave oscillation was shelved for the moment and this new point investigated. Curiously enough, the solution to both these problems was the same. After a number of experiments had been carried out it was found that placing a choke in each of the grid returns resulted in the extra amplification first observed with free grids being retained. At the same time the use of the chokes as indicated resulted in the short-wave oscillations being got rid of.

Direct Pick-up

The question of direct pick-up was next considered, and it was found that when using two stages of H.F. followed by a detector valve with reaction the signals from 2LO, not 2 miles away, were only audible at very poor strength without aerial or earth. A single valve receiver using conventional coils was found to bring this station in at excellent strength however, and the improvement obtained by the use of fieldless coils was thus extremely great.

Designing the Coils

There only remained to design a satisfactory fieldless coil for general use, those which had been employed on the experimental work not being suited to all valves. The object aimed at was to proportion the windings in such a way that with a given neutralising setting the amount of regeneration in each stage would be nearly constant over the whole range of the tuning condensers, while it was necessary for the winding in the anode circuit to have a high enough inductance to allow the .06 type of valve to be used successfully, without its being so large as to result in difficulties when low impedance valves of the small power type were being employed. At the same time the coupling had to be fairly tight since the stabilising system employed requires this to be so.

These points have been successfully dealt with, and the particular coils which are actually used in the receiver to be described have been made by Messrs. Lissen, Ltd. It is interesting to note that the secondary windings of these coils, which have an inductance of 210 microhenries, have an H.F. resistance of only a little over 7 ohms, thus giving an R/L ratio of just on .034.

The Final Circuit

The theoretical circuit of the receiver finally constructed is shown in Fig. 2, in which L1, L2, L3, L4, L5 and L6 are fieldless coils of the same type; the chokes in the grid returns are shown at L8 and L9,

SPECIAL FEATURE

This receiver employs specially desi eliminate direct pick-up of strong l remains good even at short distance coils need not be wound by the const comp

Another feature of the set is the met adopted. The L.F. valve is coupl combination of choke coupling and is found to give v

UP IN THE TUNED CIRCUITS

IN-COIL" FOUR-VALVE H.F. STAGES

ON, A.M.I.R.E.

An extra terminal is placed on an additional piece of ebonite against the standard strip of battery terminals.

these going to a common bias battery for applying a negative potential to both H.F. valves, the battery being suitably shunted by a condenser. Reinartz reaction is obtained from the plate of the detector valve in the manner indicated, the anode winding L5 of V2 acting also as a reaction coil in a manner similar to the simplified Reinartz scheme where the same coil serves both as aerial and reaction coil. Leaky grid condenser rectification is employed, and a variable grid leak was found of great use in obtaining maximum signal strength.

L.F. Coupling

An unusual form of L.F. coupling is used, this being the choke-battery method. Battery coupling is generally employed with resistance in the plate circuits of the L.F. valves since this not only enables an aperiodic circuit to be obtained but also enables the size of the coupling batteries to be kept small.

ES OF THE SET.

gned twin coils which practically ocal signals. Selectivity, therefore, s from a powerful station. These ructor, since they can be purchased ete.

hod of low-frequency amplification d to the detector by means of a form of the Prince circuit, which ry good quality.

It was found, however, that with one stage the extra amplification obtained by reducing the value of the resistance in the plate circuit was well worth the slightly increased size of the coupling battery necessitated. A choke was therefore employed since not only did it enable a high degree of amplification to be obtained, but it also resulted in a very high order of quality of speech and music as reproduced by the loud-speaker. It should be noticed that no grid leak is connected between the grid of the last valve and L.T., and that none is needed.

The Lay-Out

If the photographs of the front and interior of the receiver are examined in conjunction with the circuit diagram practically all the various components may be identified. The only controls that appear on the front are the four variable condensers and the two neutralising condensers, while the two jacks for plugging in 'phones or loud-speaker are visible below the reaction condenser, which is the right hand one when viewed from the front. The three H.F. chokes are to be seen in the back of panel views, and are fixed to the baseboard under the three tuning condensers; the fourth choke, which is on the extreme left, is the L.F. choke. The coupling battery is connected externally.

In order to eliminate unnecessary controls fixed resistances have been used for regulating the filament temperature, while the variable grid leak is connected directly across the condenser behind the panel for, once this is set for use with any one valve, it need not be touched again till the valve is changed. The withdrawal of the plug from jack No. 1 automatically switches on the last valve, while a master switch, shown at S, controls the L.T. for the whole receiver.

Components

Below is a list of the components used in the construction of this receiver, and for the convenience of anyone who may wish to make an exact copy of the receiver the makers' names have been given.

One Radion panel, 24 by 8 in., black polished (American Hard Rubber Co., Ltd.), with baseboard 8¾ in. wide.

One cabinet for same.

Three Fieldless coils (Lissen Ltd.).

Three .0005 "Cam Vernier" variable condensers, and

One .0003 "Cam Vernier" variable condenser (Radio Communication Co., Ltd.).

Four Antiphonic valve holders, and

Four fixed resistors, with mounts (Burndept Wireless, Ltd.). The values for these resistors will depend on the valves and batteries used, and the matter is dealt with further on in the article.

Three high-frequency chokes, and

One low-frequency "Super" choke, and

One variable grid-leak (Beard & Fitch, Ltd.).

Two Neutrovernia neutralising condensers (Gambrell Bros.).

Two fixed condensers, .002, type 620, and

Eliminating Direct Pick-up in the Tuned Circuits—*continued*

One fixed condenser, .0003, type 620 (Dubilier Condenser Co., Ltd.).

One fixed condenser, .0001 capacity (Watmel Wireless Co.).

One double-circuit double filament jack, and

One open-circuit jack, and

One plug (Igranic Electric Co., Ltd.).

Not less than 16 lengths of Glazite for wiring up.

Radio Press panel transfers.

Drilling

The first step in the construction is to mount the components on the panel, which should therefore be drilled for this purpose. The dimensioned drawing shown in Fig. 1 will give the positions for these components. The three .0005 variable condensers are mounted to the left, the one on the right being of .0003. The two neutrodyne condensers, the two jacks, and the L.T. switch are then fixed in position and the panel is laid aside for the moment.

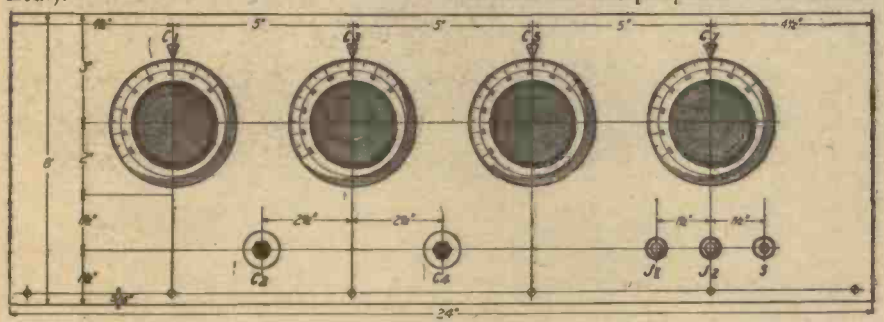


Fig. 1.—The simplicity of the panel lay-out is partly due to the omission of filament rheostats.

One fixed condenser, 1 microfarad (Telephone Condenser Co., Ltd.).

One on-off switch (Igranic Electric Co., Ltd.).

One Magnum terminal strip (Burne-Jones & Co., Ltd.).

Four Decko indicators (A. F. Bulgin).

One strip of ebonite, 3½ in. by 1¾ in., and three terminals for aerial-earth terminal strip.

The baseboard should now have mounted on it the components that go thereon, and Fig. 3 may be consulted as an aid not only to determining their actual positions (this drawing is to scale, and therefore provides an accurate means of placing the parts on the baseboard), but also as to the wiring, which may be commenced next, the terminal panel for aerial and earth terminals having been made and fixed.

The second and third fieldless coils should not be mounted on the baseboard at first, since the greater part of the wiring may be done without them in position, and a number of the connections will be more readily got at.

Wiring Order

The L.T. circuits should be wired first, and as many of the leads to the terminal panels as possible. The fieldless coils are then placed in position, and such further connections completed as remain. It should be noted that the grid leak is connected direct across the grid condenser, and since it need only be adjusted once its presence on the panel is not necessary.

Next fix the panel to the baseboard and the wiring can be finished off entirely. The only part of the wiring that calls for any special care are the connections going to the first

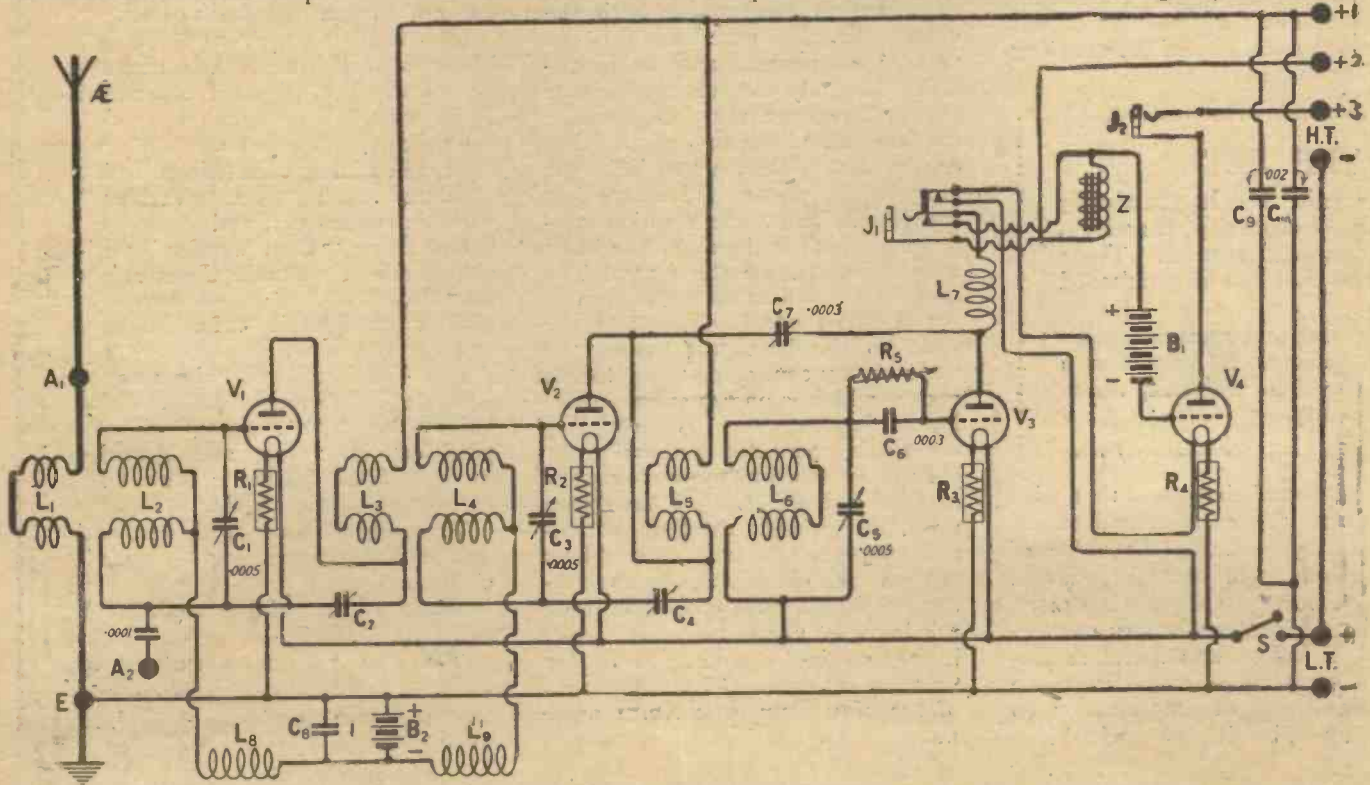


Fig. 2.—A slightly simplified version of the circuit. The terminal A2 permits the aerial to be auto-coupled.

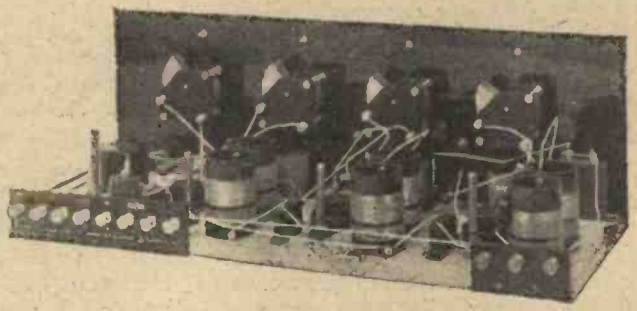
Eliminating Direct Pick-up in the Tuned Circuits—*continued*

jack, but provided these are carefully bent to shape before soldering and a clean hot iron be used they should not present any difficulty. It will be seen from the photographs that the wiring has been well spaced in this receiver, especially on the H.F. side, and this is easily done since the lay-out conduces to easy access.

Filament Regulation

A point that now needs consideration is the question of the values of the fixed resistors to be used. If the quarter-ampere type of valve is to be used throughout, then 4 ohms will be the value to use with a 6-volt accumulator. If it is desired to use .06 valves with a 6-volt battery the correct value is 50 ohms, and with a 4-volt battery using these valves the resistance would need to be 17 ohms. It is not possible to give all the various resistances to be used with the different types of valves with different L.T. voltages, and once the valves and voltages have been decided on the experimenter can easily calculate for himself the correct resistances to use.

Although the coils are of the semi-fieldless type they have been well spaced out.



Precautionary Tests

Before placing the set on aerial test the L.T. and H.T. circuits should be tested out. First connect the L.T. accumulator, screw in the resistors, insert the valves and switch on the set. With the 'phone plug in jack No. 1 the first three valves should light up, and when the plug is removed the last valve should be switched on. The L.T. side of the receiver being in order the H.T. circuits may be tested. For this purpose, the three H.T. terminals should be linked together and a small voltage applied first, say, about 6 volts, so that should a short occur at any point no damage will be done. If the valves do not alter

(*Continued on page* 325.)

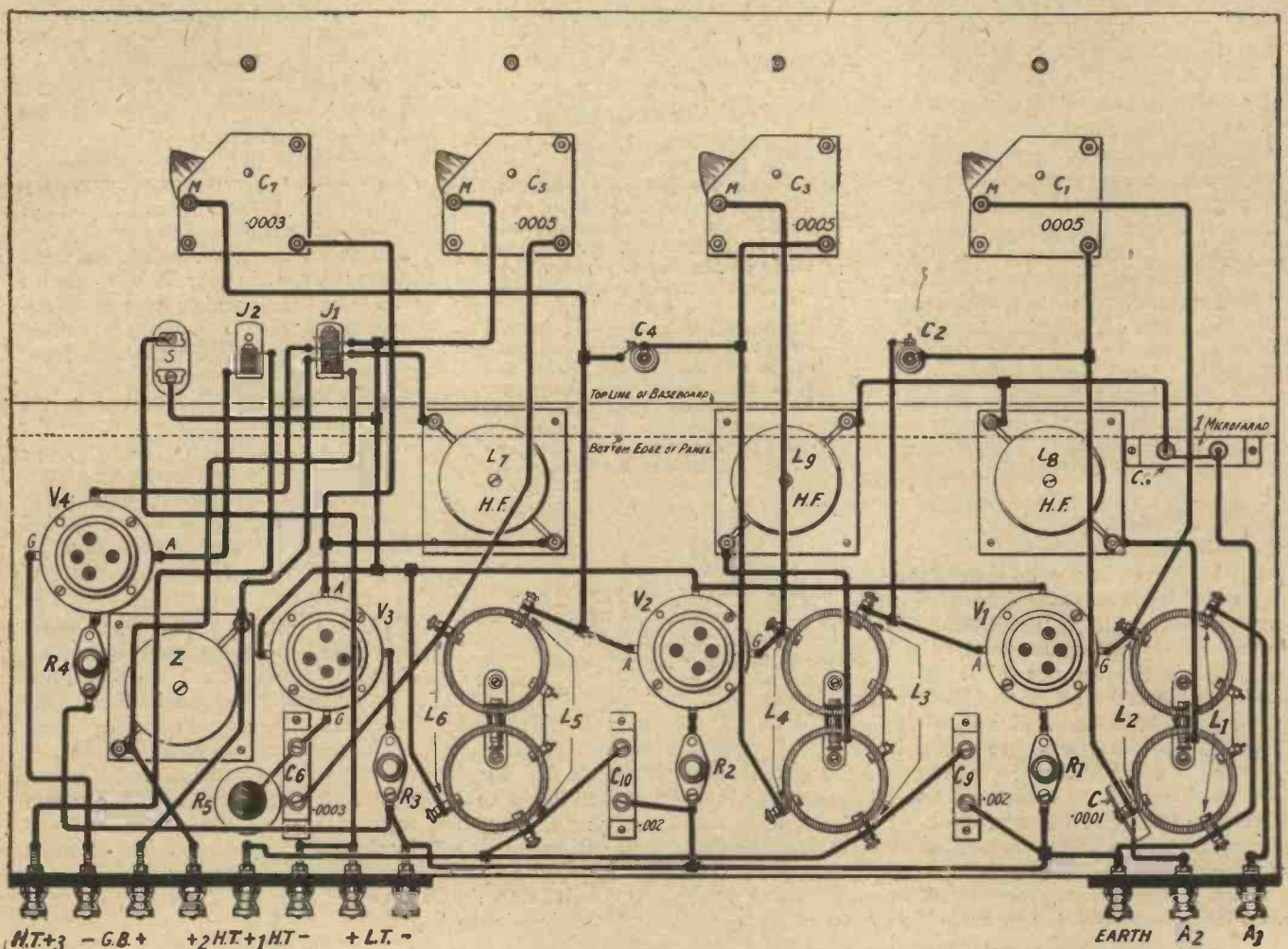
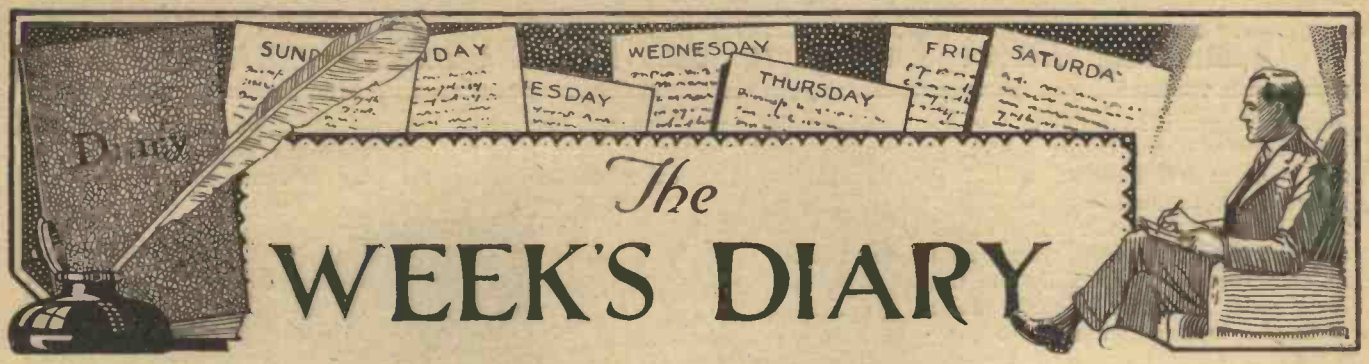


Fig. 3.—The condenser C8 should be shorted with a piece of wire when no grid bias is being used.



The WEEK'S DIARY

BEING, as the newspapers expressed it, "among those invited" to the Radio Press demonstration of non-radiating receivers at the Elstree Laboratories recently, I had the opportunity of chatting upon the subject of howling with the representatives of the great daily and evening papers present. It was particularly gratifying to note that in the majority of cases, the leading journals are careful to send really experienced wireless men to such demonstrations, and the care with which a number of them investigated the various instruments, proving for their own satisfaction their non-radiating qualities, was most marked.

* * *

I WONDER how long it will be before the possession of a receiver capable of radiating will be in a sense against the law? In New York a number of apartment houses ("U.S.A." for blocks of flats) are now exhibiting notices signifying that the landlord will terminate the tenancy of any resident if he or she uses a radiating set. In some of these big blocks of flats there are 50 or 60 broadcast receivers operating every night—the majority on indoor aerials—and interference between sets is practically unknown.

* * *

IT is a remarkable fact that after being consistently bad for many months, receiving conditions from America have recently improved a great deal, enabling the B.B.C. to give one or two quite good relays of WGY, the famous high-power radio station of the General Electric Co., at Schenectady. I notice the announcers often refer to it as if it were spelt Shenectady, whereas the local pronunciation is as if spelt Skenectady. The pronunciation of American place names is almost as erratic as those of England: for example, the S is pronounced in St. Louis, one of the great cities of the Middle West, while it is silent in Louisville, Kentucky.

NOW that relaying distant stations is becoming more general, and as the re-broadcasting of European stations is comparatively simple, I wonder how soon the B.B.C. will give us something really spectacular in the way of foreign broadcasting. There is no particular thrill in listening to "Valencia" being played from the Rome station, for we can easily hear it played (and probably much better) from our own stations in England. An address by Mussolini, accompanied by the roaring cheers of the populace, would be much more thrilling. We have had something from the League of Nations Assembly, but however estimable the work of this famous Assembly may be, the League itself has never captured the public fancy, as have the dramatic activities of Italy's leader.

THE AERIAL COIL.

Experimenters are sometimes heard to say that they have tried one of the latest low-loss coils and could not discover the slightest improvement in results: investigation usually reveals the fact that the coil was tested in the aerial circuit, which is quite the wrong place for such work.

Remember that there is in this circuit in addition to the resistance of the coil that of the aerial and of the earth connection. These may be much greater than that of the coil, and therefore it is usually a waste of time to make up ultra low-loss coils to use here.

* * *

THANKS to the activities of a great journal, wireless in hospitals is fast coming to be looked upon as a necessity, and I am told that medical opinion is very much in favour of the installation of such apparatus, in all places where convalescent patients have little to do to pass the time. Dropping in to see an old friend the other day, I found him busily engaged with a big roll of electric lighting flex and a mouthful of staples, tacking twin wire along the picture rail of each of his rooms and along the hall to his study upstairs. "It is so convenient," he said, "to have loud-speaker wiring in every room. The leads to each room are in parallel, and the scheme enables a loud-speaker to be connected up in a moment in any part of the house. During a recent attack of the measles, my children were delighted to be able to hear the Children's Hour every day, while on Sundays, when the drawing-room is used more frequently than at other times, we take the speaker there."

* * *

I NOTICED that his wiring was of the simplest character, the flex costing about 2d. a yard, and there were no switches needed. Up at the instrument end, a pair of leads were connected to the receiver, and as all the wires to the different rooms were in parallel, those to which a loud-speaker was not connected at the moment were simply out of use. If I remember rightly, he told me that the whole cost of wiring, including the cost of wires and staples, was under 12s. 6d., and this provided for leads going from his study to the dining-room, drawing-room, kitchen and three bedrooms. A small hole was drilled through the frame of each door to allow the entry of the lead.

* * *

DO the public really want good loud-speakers? You may wonder why I ask this question, but I am feeling pessimistic as the result of listening to the opinions of a number of people on half a dozen different loud-speakers on show. To my mind, half of them were poor and the other half (all by leading makers) were of quite good quality. Yet for some reason which I cannot fathom, half the people who listened to the demonstration preferred the four inferior instruments, and seemed to like the

The Week's Diary—*continued*

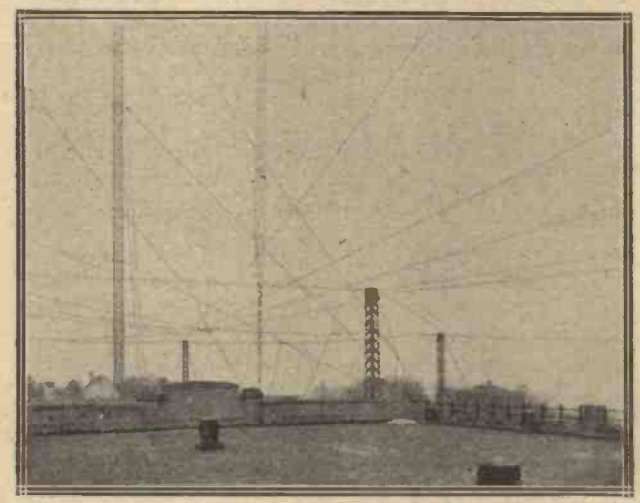
peculiar kind of distortion which one of them introduced. Volume seems to have more effect on many people than quality, and given a pair of loud-speakers, one of which gives 20 per cent. better volume and 50 per cent. lower quality than the other, six people out of ten will choose the louder instrument. At least that is my experience, which may have been particularly unfortunate.

* * *

I DROPPED in the other evening to hear Mr. Kendall's new superheterodyne set, a *really* portable superheterodyne set, which he is describing in the next issue of *Modern Wireless*. It is certainly a fine instrument, both in selectivity and in quality (properties which by no means always accompany one another in the superheterodyne). After we had tuned in goodness knows how many stations in Europe, not to mention this country, we took it out for a "mile-a-minute" spin in Mr. Kendall's sports car. I had some fears for its safety (not to mention *mine*), but we both survived the ordeal satisfactorily. I have met several so-called "portable" sets which would have been put right out of action by some of the roads we went over.

* * *

AFTER this a visit to Mr. Harris, who does not live very far away, found him busy on a new multi-valve receiver, which he will not allow me to say anything about, but for which I prophesy a very big success in the autumn. I am only allowed to tell you the name—"The Nighthawk"—a delightfully suggestive title, which I think you will agree with me is more intriguing than any that have yet emanated from that well-known designer.



A view of the aerials of the new Rosenhugel station. The down-lead illustrated on page 296 is here seen from a different angle.

* * *

DANCE enthusiasts are not only well catered for, but seem very satisfied with the dance music now broadcast from the British stations. The Savoy Bands, of course, still remain the favourites, but the London Radio Dance Band well deserves the praise it is now getting, and seems to have improved its technique appreciably since it first began broadcasting.

A radio interview: the "movie" star, Laurala Plante, being interviewed by Mr. Malcolm Kraft, with the co-operation of certain well-known British transmitters.

* * *

THE quality of reproduction, too, is particularly good from this band, as, of course, it is completely under the control of the B.B.C., and can be arranged in the studio to the best advantage, whereas the other dance bands are "picked up" by a microphone placed so as to get the best possible reproduction from a band which, primarily, is arranged to suit the particular room in which it is to perform.

* * *

THE microphones now being used by the B.B.C. are a distinct improvement on those in use a year ago, and if one has a really good receiving set and loud-speaker, the improved reproduction of the lower notes and the percussion instruments is most marked. I am also glad to find that the B.B.C. has at last realised how much the public appreciate echo effects, as giving a natural reproduction quite different from the old "flat" effect due to the complete draping of the studio. 2LO, of course, has a number of studios with different degrees of draping, so that the best acoustic effects can be obtained.

* * *

HERE is the latest wireless story: An old lady, on being asked her opinion of broadcasting, said it was very interesting and elevating, but it made your hands so dirty! Upon the puzzled inquirer showing his bewilderment, the dear creature explained that it was "earthing the aerial" every night that was so annoying and messy. It appears that her idea of earthing the aerial was to go outside (rain or fine), pick up a handful of mould, and rub it over the leading-in insulator!

WAVE-TRAP.

PRACTICAL TOPICS

By G. P. KENDALL, B.Sc.

Are filament rheostats necessary?—The dangers of over-running—Difficulties with dull-emitters—Fixed resistors—Barretters.

I WONDER how much longer it will continue to be almost standard practice in home-constructed sets to provide an adjustable filament rheostat for each valve? One of the principal justifications for the use of the adjustable type of filament rheostat at the present time seems to be that there are so many types of valves available that a good high-value filament rheostat is necessary if one is to be able to use any of the various types with a 6-volt accumulator. This argument has always seemed to me a fallacious one.

A Risky Proceeding

As a matter of fact, none of the rheostats in common use would permit a valve of the .06 type to be used on a 6-volt battery, and even supposing that they were capable of doing this, the fact remains that it is a dangerous proceeding to run a low-consumption dull-emitter valve from a 6-volt accumulator with an adjustable rheostat, since it is so very easy to over-run the valve and destroy its emission.

No doubt, in the case of a really careful user, it is safe enough to turn up the rheostat from the maximum resistance position until the valve just begins to work, and to depend on the care of the operator not to go beyond this point, but the fact remains that most of us get somewhat careless in these matters, and it is a great temptation to turn the valve up just a little brighter to see whether results are not better, with a consequent risk of damage.

Difficulties of Current Adjustment

The fact that the various types of dull emitter require to be run at a very different degree of relative brilliance, or perhaps one should say dullness, renders the problem all the more difficult, since it is really impossible to judge by eye just how much current to give any given valve. A sensitive high-resistance voltmeter is the only safe way of making adjustment when there is a considerable reserve of voltage which may be applied by mistake, and this is a troublesome procedure which not many of us will go through.

When we remember that modern types of valves are not at all critical as to their filament current, that is to say, that so long as they are adjusted definitely to the rated voltage, they will give perfectly satisfactory results, it seems more than ever unnecessary to provide variable resistances if it is intended to use a single type of valve only, and upon many of the latest types of sets it will be noticed that rheostats are being definitely omitted.

A very popular device in the United States is the form of Barretter marketed under the name of "Amperite."

Fixed Resistances

A fairly convenient alternative is to be found in the use of interchangeable fixed resistances, which can be changed when a different type of valve is used, although a little arithmetic is necessary in working out the correct value for a given purpose. A possible objection to this method, although not in my experience a very serious one, is to be found in the fact that as the voltage of the accumulator drops, it is impossible to make a slight re-adjustment of the resistance itself to maintain the valve at its correct brilliance. If the resistance is of so low a value that the valve will still function correctly when the battery has dropped to its minimum voltage before recharging, it is arguable that the valve is being over-run when the battery is freshly charged.

A Safeguard

This objection does not seem to be a valid one, since the actual range of working voltages of an accumulator which is being properly looked after is not very great, and if the resistance chosen is of such a value that it limits the current to a safe value when the accumulator is fully charged, the arrangement simply serves to compel the user to have his battery re-charged in plenty of time, instead of running it down too far.

Barretters

Possibly the solution of the problem will be found in the use of the appliance known as a "Barretter." Very simple in construction, the Barretter serves to perform a function which one might at first sight think could only be discharged by a complicated piece of apparatus. Briefly, what it does is this. Within certain limits it will permit only a certain definite current to pass, regardless of the voltage which is applied to it, thereby taking the place of a variable rheostat and a skilled operator.

A Commercial Example

There is such an appliance on the market in the United States, where it has been given the trade name of "Amperite," consisting of a little cartridge not unlike a grid-leak in appearance, interchangeable in a clip mounting. What one does is apparently to secure a stock of these Amperites, passing the various standard filament currents, and insert them as required according to the type of valve in use, a proceeding which is no doubt quite easy in America, where almost all the valves fall into one of two classes, that is to say, taking either a quarter or .06 of an ampere.

Difficulties with British Valves

These current limiters are being imported into this country, and I believe are now actually on sale, but their adoption here will no doubt not be quite so easy on account of the fact that we have such a wide variety of filament currents which have to be dealt with, there being at least five main classes which must be catered for if the device is to be really practical.

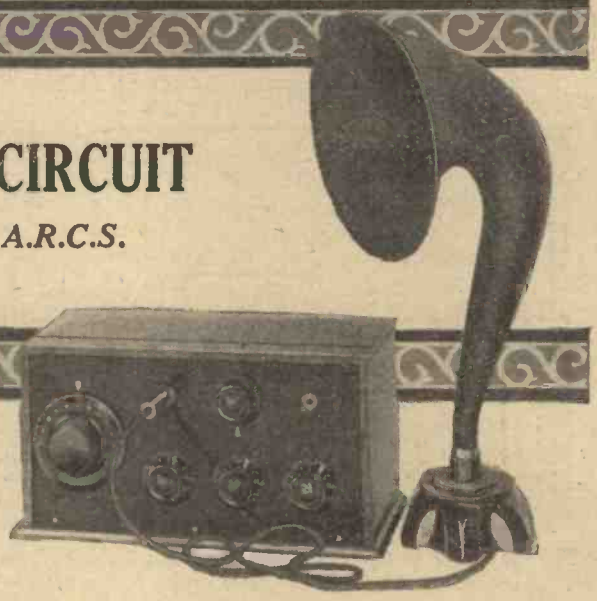
□ □ □

NON-RADIATING CIRCUITS

Are you interested in circuits which will give good results without the risk of interfering with your neighbours? Look out for the interesting new circuits now being developed, which will be described in future issues of *Wireless Weekly*.

REFLEXING THE PRINCE CIRCUIT

By W. S. PERCIVAL, B.Sc. (Hons.), A.R.C.S.



Following on the article last week which showed how reaction could be added to the Prince "trigger" circuit with a consequent increase in sensitivity, Mr. Percival now explains how one of the valves may be reflexed.

IN a previous issue of *Wireless Weekly* methods were described of introducing reaction into the Prince circuit, which has become so justly popular because of the excellent reproduction it provides from the local station. The introduction of a reaction control enables a certain amount of "DX" work to be done, and thus considerably increases the value of the circuit.

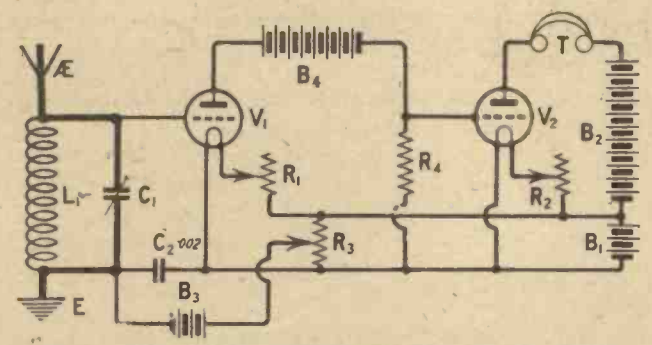


Fig. 1.—This is the conventional form of the Prince circuit, with separate valves for each function.

A Desirable Improvement

In order still further to adapt the Prince circuit for long-distance reception, attempts were made to reflex the second valve, which in the ordinary way acts solely as a low-frequency amplifier. This article describes the evolution of a circuit which was ultimately found to be successful.

A Comparison

The usual Prince circuit is shown in Fig. 1, where it will be seen to consist of a two-valve receiver, the first valve acting as a detector and the second as a battery-coupled L.F. amplifier. Now if we compare this with a conventional detector and one stage of low-frequency amplification, it is clear that it should be possible to cause the low-frequency valve to amplify at high frequency as well. In other words, it should be possible to reflex the receiver.

Designing the Prince Reflex

In any high-frequency valve it is necessary, unless choke or resistance coupling is employed, to tune the grid and anode circuits. The tuned anode is also, however, effectively in the grid circuit of the following valve.

The simplest circuit in which the Prince receiver is reflexed is shown in Fig. 2, which can profitably be compared with Fig. 1, the former being drawn so as to render comparison easy.

It will be seen that a condenser C_2 is used to couple the anode of the reflexed valve V_2 to the grid of V_1, which is the detector, while a small condenser C_4 of, say, .00005, is placed in series with the grid-leak to the tuned aerial circuit, so as not to by-pass low-frequency currents.

How the Circuit Works

The action of the circuit is as follows: High-frequency potentials are applied to the grid of the valve V_2, and are then amplified by the same valve. The

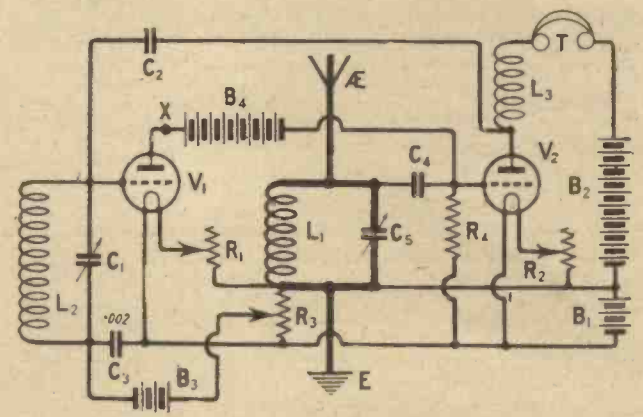


Fig. 2.—In this reflexed version "Parallel Feed" H.F. coupling is used.

condenser C_2 enables these amplified potentials to reach the grid of V_1, by which they are rectified, the resultant low-frequency component being amplified by V_2.

Reflexing the Prince Circuit—*continued*

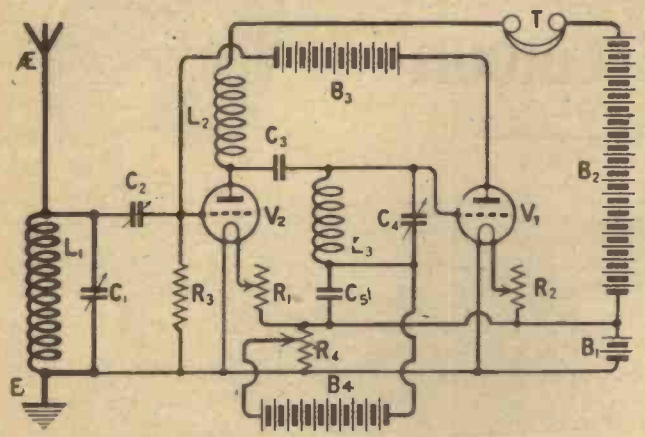
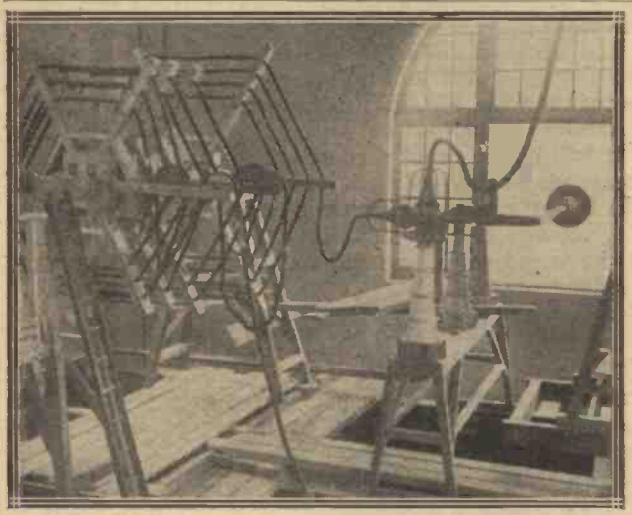


Fig. 3.—This is the circuit of Fig. 2 re-arranged in the manner usual in drawing reflex circuits.

A Re-Arrangement

Before introducing any stabilising arrangement, it is desirable to draw the circuit again, as in Fig. 3, in which the input from the aerial system is on the left. The similarity to an ordinary reflex will now be more evident, the low-frequency feed-back being, however, by means of a battery instead of a transformer.



The careful arrangement of the lead-in at Rugby might well be taken as a model by the amateur transmitter.

When this circuit was first connected up it was found that it could be quite easily stabilised by decreasing the capacity of the condenser C_2. It was realised, however, that this was not desirable, as it resulted in decreasing the high-frequency potentials applied to the first grid. In other words, it was one of those methods of stabilisation which result in loss of efficiency.

Neutralising

An attempt was therefore made to neutralise the reflexed valve V_2, as in Fig. 4, where C_6 is the neutralising condenser.

This was found to be quite satisfactory, and excellent results were obtained with the receiver. Several stations were successfully tuned-in on the loud-speaker, and one or two of these gave quite moderate loud-speaker strength.

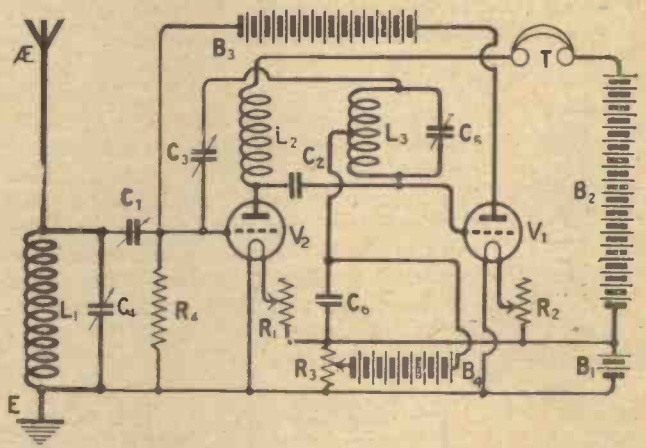


Fig. 4.—The final development was a neutralised version.

Two particular features of the circuit will recommend themselves to experimenters and broadcast listeners alike. In the first place, the excellent reproduction given by the ordinary Prince receiver is retained, and secondly, owing to the absence of any low-frequency resonant circuit, the note-frequency howl associated with many reflexes is absent.

Scope for Experiment

As in the case of most new circuits, there is still considerable scope for experiments. Thus, different methods of neutralising may be used, and it is possible that improved results may be obtained in this way.

Experimenters may like to try substituting a large low-frequency choke for the grid-leak. This was found in practice to result in a decided increase in volume, quality being almost unimpaired.

Amateur Transmitting Notes

Reports Wanted

MR. R. POLLOCK (5KU), of 4, Glenhurst Avenue, N.W.5, wishes to make some observations in connection with fading effects at sunset on short waves. He will transmit simultaneously on 6,667 kc. (48 metres) and 13,044 kc. (23 metres), at 18.15, 18.45, 19.15, 19.45 and 20.15 G.M.T., and would be glad of co-operation in these tests. He will be pleased to forward stamped addressed envelopes for weekly reports to anyone willing to help.

QRA's Found

SMWS: Gustaf Linde, Karl Johansg. 6, Hälsingborg, Sweden.

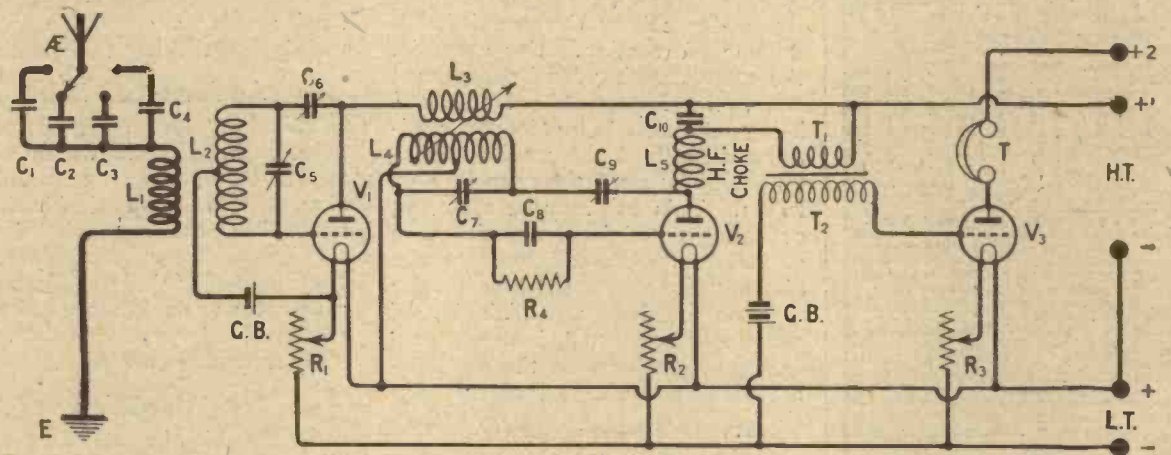
SMTX: Carl August Hultin, Hyddan, Huvudsta, Sweden.

K-W1: Funkverein, Halle a Salle, Reiltsr. 128, Kruschwitz.

F-81Y: M. Guillemin, Wassy, Haute Marne, France.

CIRCUITS FOR THE EXPERIMENTER

No. 11—A NON-RADIATING THREE-VALVE CIRCUIT



IT has been possible for some time to arrange a thoroughly efficient receiver in which a variable reaction control is provided upon a circuit which is not connected to the aerial, either directly or through intervalve couplings, in such a way that a serious amount of radiation will take place when the set oscillates.

Use of Neutralising Schemes

Quite a number of types of neutralised circuits lend themselves to arrangement as a non-radiating scheme, reaction being provided upon the grid circuit of the detector valve, and the neutralising arrangement serving to prevent any oscillations generated here from getting back into the grid circuit of the high-frequency valve, and so to the aerial. Although it would be perhaps somewhat rash to claim that radiation is in this way absolutely and entirely prevented, yet such radiation is likely to be very small in amount, and the circuit can be described within limits as "non-radiating."

A Simple Example

Circuit No. 11 is arranged to show a very simple form of non-radiating circuit, which can be put together without winding special coils. Centre-tapped coils are required, and these, of course, are now available in several makes.

Taking first the circuits of the H.F. valve, it will be seen that a tight-coupled semi-tuned aerial circuit is provided, with a series of fixed condensers of suitable capacity, ranging from perhaps .0001 to .001, the small coil L1 being coupled to the centre-tapped coil L2 as tightly as possible. L1 may be the usual No. 25 or 35, and L2 a No. 60 or 75 or equivalent.

It will be seen that the centre tapping of this coil is connected to the filament circuit, and the two ends of the tuned circuit are connected, one to the grid of the valve, and the other through a neutralising condenser to the anode. In the anode circuit of the H.F. valve is a small coil acting as the primary of an H.F. transformer, which can again be of the plug-in type, about No. 25 being suggested, although a smaller size still will probably be found to give improved results once the circuit has been brought into working order.

CIRCUIT No. 11 SPECIAL FEATURES

1. **No specially-wound coils required.**
2. **Fully adjustable reaction without serious risk of radiation.**
3. **Condenser control of reaction.**
4. **Sharp tuning in the grid circuits of both valves.**

Reaction

A variable degree of coupling between this coil and the secondary L4 is not essential, but in some cases it may be found a convenience. The secondary is of the usual size, that is to say, a No. 60 or 75, and the same scheme of connections is adopted as for the grid circuit of the H.F. valve, but this time a reaction condenser is provided of such a size as will enable a positive degree of reaction to be obtained, a capacity of .0003 being suitable for the purpose. Also in the anode circuit of the detector valve is the usual high-frequency choke and the primary of a low-frequency transformer, coupling this valve to the next, which acts as a low-frequency amplifier.

Possible Troubles

The use of a centre tapping in the grid circuit of a detector valve is beneficial, in that it reduces the grid-current damping, and so improves selectivity, but it is possible that the fact that there are centre tappings provided in the grid circuits of both the valves may give rise to trouble from parasitic oscillations, for which difficulty there are several practical remedies.

For example, the trouble can often be removed by using slightly different sizes of coils for L2 and L4, say, a No. 60 for L2 and a No. 75 or perhaps a Gambrell centre-tapped B coil for L4.

Alternative Reaction Schemes

If this expedient does not remove the trouble, it may be necessary to dispense with the centre tapping upon the second grid coil, namely,

Circuits for the Experimenter

(Continued)

L4, and use instead some different scheme of reaction. For example, the centre tapping can be dispensed with, the lower end of the coil being connected to filament positive, and a third coil provided coupling with L4 upon the opposite side to L3. This coil may be a No. 25 or No. 35, and its connections are as follows: One end goes to the filament circuit and the other to the reaction condenser, which is, of course, disconnected from its present position between the anode of the valve and the end of the grid circuit.

Coil Spacing

Instead, the reaction condenser will be connected between the upper end of the reaction coil and the anode of the valve, the high-frequency choke being required just as before. This expedient usually completely eliminates the parasitic trouble, although it complicates the receiver somewhat, and makes it more than ever necessary to space the two sets of coils, namely, L1 and L2, L3, L4, and L5, well away from each other. Thus, L1 and L2 should be placed at one end of the baseboard, the three coils constituting the intervalve coupling arrangement and the reaction upon the detector grid circuit being placed as far away as possible without unduly lengthening their leads.

An Important Point

This is a particularly important point in all circuits which are intended to be of a non-radiating character, for it is desirable that the neutralising condenser shall be used to eliminate the effects of inter-electrode coupling in the first valve rather than to remove also the effects of a large number of strong stray magnetic couplings.

Operation

As regards the operation of this circuit, it will be observed that the tuning of both the grid circuits should be fairly sharp, when the correct adjustment of the reaction and neutralising controls has been made. As a matter of fact, the tuning will probably be found so sharp that slow-motion drive to the two tuning condensers will be desirable.

The Condensers

If it is intended to make up a permanent receiver on these lines, it is advised that variable condensers be chosen of a type in which the spindle of the knob is actually insulated from the moving plates, so that hand-capacity troubles may be minimised.

G. P. K.

A Press Demonstration of Non-Radiating Receivers at Elstree

Non-radiating receivers are by no means a new development, quite a number of designs for such receivers having been published in Radio Press journals. A very successful demonstration of certain of these sets was given to representatives of the Press at our Elstree Laboratories.

A DEMONSTRATION of non-radiating receivers of Radio Press design was given at the *Wireless Weekly* Elstree Laboratories on April 9 to a large number of representatives of the daily Press.

The receivers demonstrated, which have appeared already or are shortly to be described in the Radio Press journals, are designed in such a manner that even when they are set in violent oscillation, no interference with other receivers can be caused.

Practical Conditions

At the laboratories a replica, as far as possible, of the conditions experienced by the average listener was arranged. In one of the Laboratory buildings about 100 yards away a sensitive four-valve receiver was tuned-in to Birmingham and connected to a loud-speaker in the demonstration building.

For purposes of comparison a two-valve, high-frequency and detector receiver was first tuned-in to Birmingham, and in the process it was allowed to oscillate. Loud howls and whistles were audible from the loud-speaker of the four-valve set.

Successful Tests

Non-radiating receivers, with from two to six valves, were then tuned-in to Birmingham. Although these receivers were allowed to oscillate freely, it was impossible to detect any audible interference with the loud-speaker set.

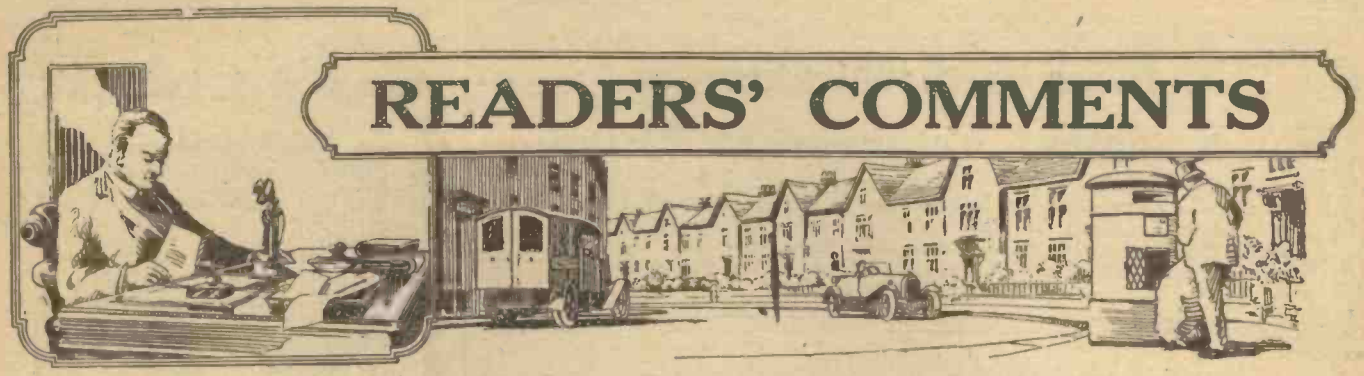
The Press representatives were invited to test these receivers for themselves, choosing their own instrument from those demonstrated. Free manipulation of the controls failed to produce any howls from the loud-speaker, showing that the aerial a few yards away was totally unaffected.

Convincing Results

After this demonstration the guests were invited to request the reception of any particular station, an extremely exacting test at any time. Using the "Elstree Six" Receiver, designed by the Staff of the Laboratories, station after station was received with certainty and without a trace of the distortion suggestive of the excessive use of reaction. With this receiver it is possible to receive all the B.B.C. main and relay stations at full loud-speaker strength in broad daylight.

(*Continued on page 326.*)

The "Huntsman Two," designed by Mr. Harris, was one of the receivers demonstrated, the designer being seen here with the instrument.



READERS' COMMENTS

QSL Cards for India

SIR,—As Radio GB1 could not get my QRA he asked me to QSL *via* the *Wireless Weekly*. I will be very much obliged if you will kindly forward the enclosed card and forward that of GB1, which the latter will send to you in return. I am very pleased indeed to see that the *Wireless Weekly* is starting a QRA section, and is taking more interest in short wave work. I hope to be able to forward a list of Indian amateurs at a very early date for publication; in the meanwhile, if you or any readers of the *Wireless Weekly* have cards for any of us I will be only too pleased to forward same.—Yours faithfully,

R. J. DRUDGE-COATES.

Short-Wave Reception

SIR,—My Easter experiments might be of interest to your readers.

On the night of Saturday-Sunday, April 3 and 4, I tuned in the station which relays WGY's programmes on 42.75 metres wavelength. A card game was in progress—auction bridge—when I got on first. Afterwards there was a fine concert relayed from Carnegie Hall. The "New York Philarmonic Orchestra" was playing a selection of Beethoven compositions.

We next had some tenor songs—"A Kiss on the Way"; "Sicilian Mountain Song," which was sung in Italian; and a song, "For You," by Cadman; then a talk by Prof. Hunt, "Forecasting a Storm." Afterwards the Hotel Valhalla (?) Orchestra played dance music. I was surprised to find it was 4.45 a.m. G.M.T., so I went to bed. Altogether the reception was perfect, except for slight fading, but the strength was so good that the transmission was never lost.

At 11.15 G.M.T. on Monday night, April 5, I received the "Market Reports," followed by the "Press Reports." Afterwards they transmitted dinner music from the Hotel Valhalla. I was in bed at 12.25 a.m., which goes to show the penetrative power of the short waves.

This station is a development of WGY, and the Company is to be congratulated on the perfect modulation. I used ordinary D.E. valves and ordinary components, detector, followed by two note magnifiers. The signals were at greater strength than I can get 6ST, the Stoke-on-Trent station, on a crystal set, and I am just over a mile distant. My aerial is 80 ft. in length and 24 ft. high.—Yours faithfully,

J. H. RUSHTON.

63, Waterloo Street,
Hanley, S.O.T., Staffs.

Frame Aerial Work

SIR,—Mr. A. D. Cowper's postulates of much experience and extreme care, *re* his excellent 1924-25 frame aerial work, were scarcely calculated to stimulate less expert experimenters to work in this direction, so it is hoped that what follows shows that some measure of success is possible under ordinary conditions.

A metre diameter hexagonal frame was built more or less to Mr. Cowper's prescription, except that it was bare No. 14 wire. A 2-ft. side square frame of close wound No. 16 d.c.c. was also made, also a 9½-in. diameter hexagonal frame of No. 22 enamelled wire.

A single valve set on the lines of Mr. Rattee's short-wave 2-valver (*Wireless Weekly*, June 24, 1925) was built (from components that happened to be at hand), so was a small resistance capacity L.F. panel that could easily be coupled to the former. A L.F. unit containing a Pye 6:1 transformer was also available, together with a straight single valve circuit (made long ago), a crystal detector and, last but not least, two D.E. 5B valves and a D.E.5.

At 33 miles from 2LO at least, the 2-ft. frame in four different azimuths across the short-wave detector and two L.F.'s brought in one afternoon some 30 stations, probably not all different, but easily read on 'phones, and also 2LO rather weakly on a small loud-speaker. Even the 9½-in. frame brought in 2LO on 'phones and other carriers.

The metre frame tuned by a condenser with vernier gets 2LO readably on 'phones on either of the single valve sets alone, and I have heard 2LO's tuning note with only the crystal across this tuned frame.

Anyone should certainly improve on these results with ordinary care. Success lies chiefly in (1) the valves used; (2) really smooth reaction control. Tuning is certainly fine, but surely no finer than anyone expects nowadays.

Anyhow, my experiments were purposely done in a "hook-up" fashion without undue care to see if there was any room for laxity, and they convince me of two things: (*a*) Moderate results are easily attainable if basic principles are not outraged; (*b*) the original straight valve detector with reaction takes a lot of beating if given a fair chance.—Yours faithfully,

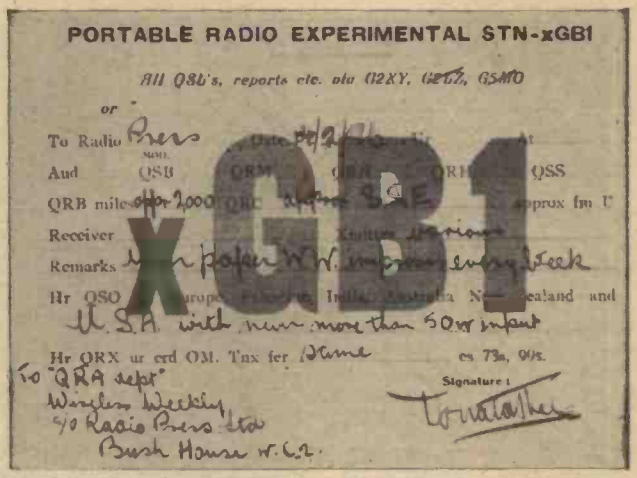
E. A. PHILPOTS.

Felstead.

"Bloopers"

SIR,—If I may be permitted to suggest an answer to the question raised by your "Puzzled" correspondent in your issue of April 14, I think the

The mysterious "GB1" has been moved to send us one of his cards with some complimentary remarks about 'Wireless Weekly.'


PORTABLE RADIO EXPERIMENTAL STN-xGB1

All QSL's, reports etc. via G2XY, G2UZ, G5MO

or

To Radio Press

Aud QSB QRM QRA QRH QSS

QRB miles approx 2000 QRC approx fm U

Receiver

Remarks

Hr QSO ... U.S.A. with ... more than 50w input

Hr QRX ur crd OM. Tnx fer Name cs 73s, 90s.

To "QRA sept"
Wireless Weekly
c/o Radio Press Ltd
Bush House W.C.2.

Signature:

Readers' Comments

(Continued)

explanation is quite simple. This is that normally nowadays the American ether is fairly clear of "bloopers." During the Tests Week such was the enthusiasm of the American listeners, egged on by the offer of attractive prizes for feats of reception, that every receiver from which they could "get a squeak" was temporarily put in commission. The result of this was that plenty of "squeaks" got out and annoyed listeners in most districts of the U.S.A.

As is very probably the case over here, the under-powered receiver forced up to and beyond its limit caused most of the trouble.—Yours faithfully,

PURSER.

Liverpool.

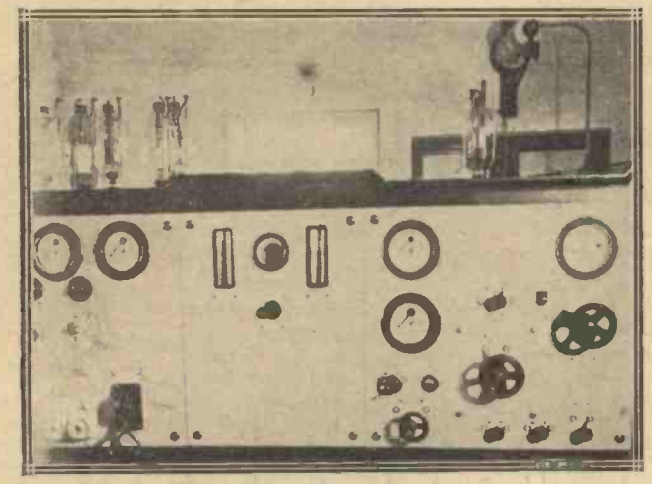
Alternative Programmes

SIR,—The author of the article, "Three Frequencies or Twenty," in the issue of *Wireless Weekly* for April 7 seems to me to overlook one point which will always appeal to people in different localities. There is little doubt that most listeners would like some satisfactory system of broadcasting giving them a choice of programmes. At the same time, I think it is impossible to get away from the "local" spirit, which makes the inhabitants of any locality prefer as a general rule the programmes and artistes properly belonging to that locality. There is a story by O. Henry, known probably to your readers, which makes admirably clear the fact that everyone retains a natural pride in his own home town, however "cosmopolitan" he may fancy himself.

For this reason I cannot imagine that the people of this country would ever take kindly to a scheme on the lines suggested in the article. From the other side, too, there would not be nearly so much time available for the artistes to do their broadcasting, and this art has become a means of livelihood for quite a large number of people, who for various reasons are unable to reach their audience so effectively from the ordinary platform or stage.—Yours faithfully,

D. W. BARRY.

Cardiff.



A portion of the power control apparatus at the Rosenhugel station (near Vienna); as seen from the front.

The High-Power Station

SIR,—Your correspondent, Mr. J. M. Toulmin, whose letter on "5XX and the Programmes" you publish in your issue of April 14, doubts whether the 2LO programmes are always the best.

Now, I have always understood that the B.B.C. have a very good reason for regarding 2LO as a sort of "Headquarters" station for their organisation. Although we all know of the aspirations of Manchester, and perhaps other big centres, too, in this direction, London remains the "capital" of England. This position is not merely a "geography book" one, since it is in London that the principal musical, theatrical and other institutions of the country have their headquarters. It is therefore obviously easiest to provide 2LO with the leading artistes and speakers, and since presumably it is the best that the average listener wishes to hear, is it not natural to relay 2LO's programmes from Daventry?—Yours faithfully,

F. H. MILLER.

Balham, S.W.12.

Operating the "Centre-Tapped Coil" Receiver

By JOHN W. BARBER

Adjustments of coupling—Matched dial readings—Searching—Effects of coupling variations—Some results—Test report.

IN the initial stages of operating the receiver described in last week's issue, it will be found to facilitate tuning considerably if the secondary coil of the loose-coupled transformer, that is, L3, be set at about 45 degrees to the primary coil. This, of course, reduces the selectivity of the arrangement, but as it is very difficult to find any station at all in the initial stages, this will hardly be a disadvantage.

Matched Readings

The three tuning condensers should be set at approximately the same reading, near the middle of the scale, and slowly rotated by means of the friction drive, the aerial condenser being now and then independently moved over a few degrees, leaving the other two stationary. This is necessary owing to the fact that the aerial condenser reading for a given station may be somewhat different from that of the other condensers.

Record Your Settings

Having found the readings where a given station comes in, it is advisable to make a note of the settings of each condenser, in order that the transmission may be picked up again with least possible loss of time. If a wavemeter is available it should most certainly be employed for tuning purposes, as the operation will thereby be considerably facilitated.

Sharp Adjustments

Should no such instrument be available, however, each condenser should be advanced or moved backward very slowly by means of the friction drive, when other transmissions will be picked up. When first operating the set the author experienced considerable qualms, owing to the difficulty of finding stations, but after a little time the feel of the set was obtained, and the difficulties decreased considerably. I would emphasise, however, that the set is by no means one for the beginner, and should not be attempted unless some experience in handling receivers with a fair degree of selectivity has already been gained.

Variations of Coupling

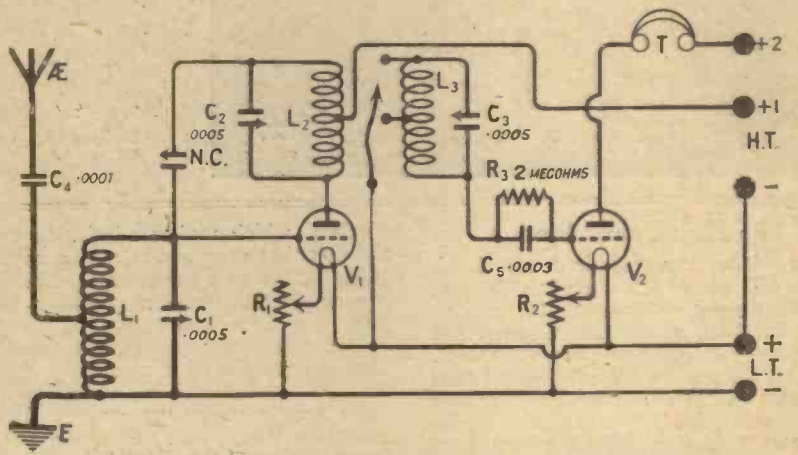
Tuning will be sharpened to a very large extent as the coupling between L2 and L3 is loosened. With the coupling at, say, 75 degrees, tune in a station and note over how many degrees on each side of the loudest point the signal may be heard. Then weaken the coupling by increasing the angle to approaching 90 degrees, and it will immediately be apparent how the tuning has been sharpened.

By setting the condensers at the position of loudest signals with coils at about 75 degrees, it is possible completely to lose the transmission by increasing the angle to 90 deg., the position of theoretical minimum coupling, and it is then quite instructive to endeavour to find the station again.

Valves

The set was tried out with various types of valves, including D.E.2's, D.E.5B type, Cosmos Shortpath, and Nelson Multi, and satisfactory results were obtained in all cases, the valves most suited to the circuit being the D.E.5B type, when ordinary dry-cell high-tension batteries are used.

Stations heard included Bournemouth, Birmingham, Dublin, Radio-Belgique, and Radio-Berne. The receiver will provide many interesting hours for the enthusiast, but, as previously stated, is not recommended to the beginner.



The circuit is repeated for reference purposes. Note that L3 is the movable coil.

Test Report

In the course of its tests at Elstree this set was found decidedly selective, and consequently required some skill in operation. Bournemouth could be received with 2LO only just audible in the background.

Signals at telephone strength were obtained from Bournemouth, Birmingham, Münster, and Dublin.

APPARATUS WE HAVE TESTED

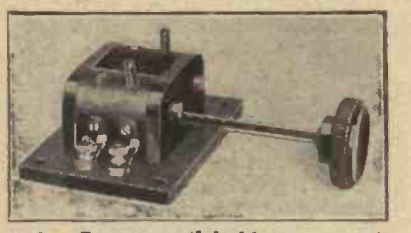
Conducted by the Radio Press Laboratories, Elstree.

Coil-Holders

We have received from Messrs. Penton Engineering Co. three of their coil-holders for test and report.

One of these is a two-coil holder with a brass finish, another is a geared two-coil holder with nickel finish, and the third is a three-coil holder, also nickel finished. All of them are provided with ebonite bases, making them suitable for baseboard mounting should it be desired. The two-coil holder with the brass finish is constructed of polished ebonite, the moving-coil holder being controlled by a milled ebonite knob on the end of a spindle over 2 in. long. Connections are made to both the plugs and sockets by means of screws and washers, while a tensioning device is incorporated so as to allow the friction to the moving-coil holder to be adjusted, in order that large or weighty coils may be supported.

The geared two-coil holder is constructed of similar material, but the plug and sockets of both fixed and moving coils are carried in two barrels, a rubber roller controlled by a knob and spindle pressing against the barrel of the moving-coil holder, thus giving a reduction in gearing as an aid to making fine adjustments. Four terminals are provided for making connection to the holders, the connection



In the Penton coil-holder connection is made to the moving holder by means of metal strips.

between the coil-holders and these terminals being made by means of flat flexible metal strips.

The same insulating material has been used for the construction of the three-coil holder, which is of the conventional pattern, with one fixed coil-holder in the centre and two moving ones on either side of it. Connections are made to the sockets by means of small screws and washers, the usual method employed on coil-holders.

When mounted horizontally, the spring washers and lock-nuts allow of the tension on the spindle being adjusted so that large and heavy coils may be supported.

On test, each of these coil-holders showed an insulation resistance of infinity between plug and socket, while

The C.A.V. transformer is of the shrouded type.

a number of standard plug-in coils were tried in the coil-holders and were found to be a good fit, no signs of looseness being noticeable.

Valve-Holders

We have received a sample valve-holder from Messrs. Harlie Bros. for test and report. This component is intended for use in receivers where the valve is mounted on the panel. It enables the base of the valve to be sunk below the surface, thus reducing the distance which the valve projects above the surface of the panel.

It consists of a moulded shell of insulated material which carries a circular flange 2 in. in diameter at the top. The internal diameter of the shell is 1½ in., while it is 1¼ in. deep, the whole forming a cup-like construction. At the bottom of this is the valve-holder proper. This consists of four short pieces of thin brass tube moulded into the base. The solid insulating material between the pins has been removed as far as possible so as to reduce the capacity between them. Soldering tags or screws are provided for making connection, and three small screws are provided for mounting the component on the panel.

The insulation resistance of the base and socket was found to be infinity, and various makes of valves when tried in the holder were found to be a good fit. This component is well finished, and notwithstanding its light construction, it appears to be robust enough to stand rough usage.

We have also received from Messrs. Harlie Bros. a base-mounting valve-

A valve-holder of novel design submitted by Messrs. Harlie Bros.

holder. This consists of a circular base of black insulating material with two fixing lugs on opposite sides. This carries four valve pins which are insulated with a black insulating material on the outside, thus obviating any risk of connecting the filament across the H.T. Screws and soldering tags are provided for making connection, and the construction is such as to reduce the capacity between the pins as far as possible. Various makes of valves were tried in this holder, and proved to be a good fit, while the insulation resistance between adjacent legs was found to be infinity.

Insulating Materials

We have received from Messrs. The Pomona Rubber Co. a stick of Chatterton's Compound, a roll of black adhesive tape, and a roll of Empire Tape for test and report.

The Chatterton's compound consisted of a stick of black material about half an inch in diameter, which on being warmed can be melted in a similar manner to sealing wax. It provides a means of fixing small-components (such as fixed condensers) to the underside of the panel, a slight smear of the compound being sufficient to hold them firmly. Other uses to which it may be put are for filling holes in panels, covering the heads of countersunk screws, mending accumulator and battery tops which are filled with pitch and have cracked.

The black adhesive tape is useful for

Apparatus We Have Tested

(Continued)

covering and insulating joints in high- and low-tension leads, loud-speaker leads, etc. The roll submitted was used for several pieces of work of this description, and was found to be thoroughly adhesive. Joints carefully made were found to be watertight, and could be placed in exposed places without leakage taking place.

The Empire tape consisted of a roll of fabric-like material impregnated with some form of varnish. This is chiefly employed by the wireless experimenter for covering inductances of various descriptions, separating layers in multi-layer windings, covering low-frequency transformers, etc. The sample submitted was employed on work of this description, and was found to be quite satisfactory.

Transformer

Messrs. C. A. Vandervell & Co. have sent us one of their "All Purpose" L.F. transformers for test and report. This instrument, which is of the shrouded type, is provided with two perforated lugs by which it may be fixed to the baseboard with screws. Connections are made to the primary and secondary windings by means of terminals. The metal case in which the transformer is contained is a single stamping.

When placed on test on our standard transformer test panel, this instrument was found to give excellent amplification in the first stage, the actual degree of amplification being somewhat above the average. The quality was good, but was somewhat higher in pitch than that given by the standard instrument, while a satisfactorily quiet background resulted. In the second stage the degree of amplification obtained was not quite so great as that given by the standard transformer, which had a fairly high step-up ratio. The quality was very good, while the background was silent.

The makers' claims for this instrument as an all purpose transformer are certainly justified, and the component can be thoroughly recommended.

Two-Way Coil-Holder

Messrs. The Goswell Engineering Co., Ltd., have submitted to us for test and report at our Elstree Laboratories a sample of their "Quality" two-way coil holder, with push-and-pull action and fitted with a vernier.

It is claimed that this coil holder has a minimum of metal used in its construction and that detachable, different coloured terminals are fitted to the coil holder for the purpose of reversing the connections to it.

This two-way coil holder is designed for back of panel mounting, and is provided with two screws for fixing it to the panel. It is also necessary to make a small slot in the panel for the purpose of accommodating the spindle. When in the position of maximum coupling the two coil holders of this component are parallel to each other, and also parallel to the plane of the panel. In the position of minimum coupling the moving coil holder is almost at right-angles to the fixed coil holder.

A very ingenious arrangement is provided whereby a coarse and fine adjustment is provided by the same knob. The fine adjustment is actuated by revolving the knob, which at the same time revolves the screw attached to a swivel on the moving coil holder, thus moving the latter at a very slow rate. By depressing the main knob the spindle can be moved backwards and forwards so that the moving coil holder can be easily moved from its position of minimum to maximum coupling with the greatest of ease.

On test, it was found that the insulation resistance of this component was infinite, and that it provided an excellent fit for most types of coils. The backlash of the vernier was very small, and the method of mounting the moving coil holder resulted in the mechanical strength being slightly below the average.

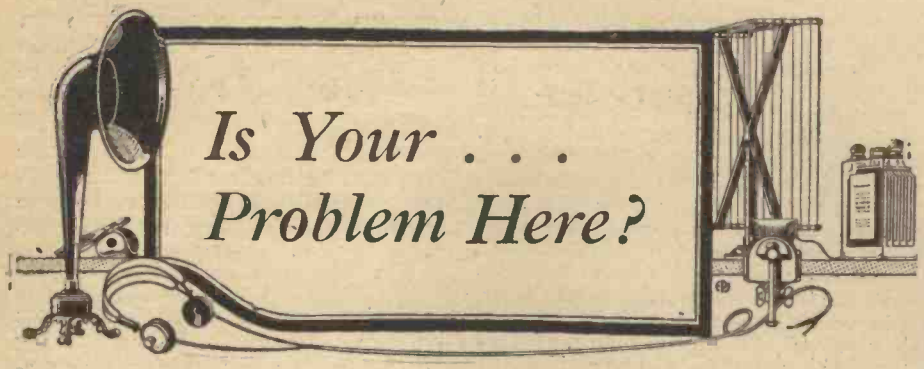
This two-way coil holder is a very ingenious product involving several novel features. It can therefore be thoroughly recommended.

Anti-Vibration Valve-Holder

Messrs. The Goswell Engineering Co., Ltd., have submitted to us one of their Anti-Vibration Valve Holders for test and report.

The component is similar to their well-known "Quality" valve holder, only instead of the valve pins being solidly mounted in the insulating material used, they are sprung for vertical movement on light brass springs, and a certain amount of lateral movement is allowed for. A short length of rubber tubing is slipped over the brass sockets which form the valve pins so as to provide a means of damping out any excessive side play.

When placed on test it was found that the insulation resistance between adjacent valve pins was infinity, while the various makes of valves which were tried in the holder were found to be a nice easy fit. The springs were somewhat on the light side, however, for use with the larger types of valves, while there was a definite limit to the travel of the sprung sockets in either direction. The component is well finished, and if provided with a slightly stiffer spring should prove extremely useful for all types of valves which are liable to suffer from microphonic noises.



An L.F. Howl

"I have a 4-valve Family receiver built from the design given by Mr. Harris in Radio Press Envelope No. 2, and whenever the second note magnifier is switched into circuit the set howls badly. I have tried all the standard remedies to overcome this difficulty, such as that of reversing primaries, secondaries, trying a resistance across the secondary of the second transformer, and of earthing the cores, all without success. I have tried altering the positions of the two transformers but still the howling persists. Can you tell me what to do next?"

Where the standard remedies for oscillation at low frequency fail in this set, the first component to suspect is the potentiometer, and the leads to this component should therefore be disconnected and that which previously went to the slider should be joined to the lead from low-tension positive, the third lead being left free and not touching any other part of the wiring. If with this arrangement the set functions in the normal manner, although it is not particularly sensitive, you may take it that the potentiometer is at fault and it should be changed, unless it can be repaired.

The position of the break in its winding can be located by the well-known telephones and dry cell test, by joining the dry battery to one end of the winding and by tapping along the bared portion with the free telephone tag. Loud plonks will be heard until the break is passed. With certain types of potentiometer by suitably baring the wire near the break and applying a hot soldering iron a satisfactory join can be made.

Anode Rectification

"I wish to employ anode rectification in my tuned anode receiver. Must I alter the set to transformer coupling between the H.F. and detector valves, or can the tuned anode arrangement still be retained?"

There is no need to alter the set to employ H.F. transformer coupling in order that provision may be made for anode rectification. If you examine the present wiring you will observe that the filament end of the detector grid-leak goes either directly to the positive filament leg of the detector valve or to low-tension positive. The connection between the filament end of the leak and L.T. positive or the positive filament leg of the valve should be broken, and a flexible lead should be taken from the grid-leak to a grid-biasing battery, which may conveniently be a 9-volt battery tapped in 1½-volt steps, the positive end of the latter being joined either to low-tension negative or to the slider of a potentiometer connected across the L.T. battery. The latter arrangement, of course, gives somewhat better control than is obtained by the employment of a grid-bias battery only. In practice, however, by carefully adjusting grid-bias and the high-tension voltage applied to the plate of the detector valve perfectly satisfactory rectification effects may be obtained without incorporating a potentiometer. With a given plate voltage, the value of grid-bias required

(Continued on page 326)

Eliminating Direct Pick-up in the Tuned Circuits

(Continued from p. 311)

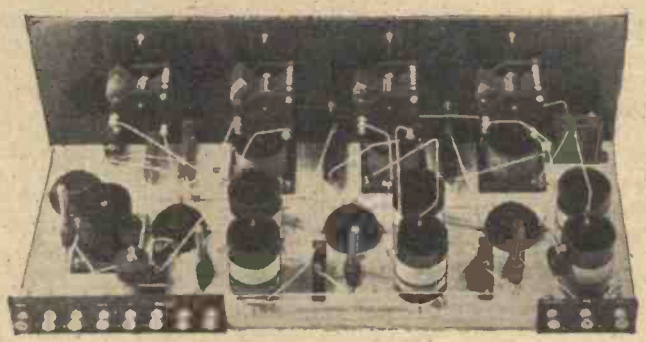
in brightness a slightly larger voltage should be tried, and finally about 60 volts.

Capabilities of the Set

It should be found that under favourable conditions numerous distant stations may be tuned in on the loud-speaker at night, although actually this set is intended for long-distance work on the headphones coupled with extreme selectivity. If conditions allow of this being done, the transmission should be brought up to strength with the reaction just a little below the best setting, and the effect of connecting a small grid battery on the H.F. side may be tried. This will be connected across the one microfarad condenser mounted on the base-board at the left-hand end, and its value will probably not need to be more than 3 volts.

The L.F. Circuits

With regard to the L.F. side of this receiver it will be found that within quite broad limits the greater the H.T. applied to the last valve the greater the amplification obtained, and it was found that with about 180 volts on a D.E.5 the limit of increase had not been reached. More H.T. was not available, however, to determine what the limit was. It must be borne in mind, however, that excessive voltages are not recommended by the makers of dull-emitting power valves of certain types. The purity of signals was found to be of a very high order, and it should be noted that the value of the variable grid leak as well as affecting signal strength and quality, also has an effect on the correct setting of the coupling battery.



This view was taken to show how certain wires are taken above the general level to improve the spacing out.

Next Week

Fuller details as to the results obtained with this receiver will be given next week, but an indication of its performance will be obtained from the fact that at about 1½ miles from 2LO it has been found possible to read "Union Radio," Madrid, above the interference from 2LO, while Manchester was very nearly clear of this station. About ten stations have been received on the loud-speaker at various degrees of loudness, among them being Birmingham, Bournemouth, Munster, and Radio-Toulouse.

(To be continued.)

Is Your Problem Here?—Continued

for bottom-bend rectification will be greater than is necessary if a valve is employed as a low-frequency amplifier, since it must be worked on the bottom bend of its characteristic curve and not on the mid-point of the straight portion to the left of the zero grid volts ordinate.

The Tropadyne Oscillator

"I have wired up a 6-valve Super-sonic heterodyne receiver with Tropadyne oscillator, two Number 400 coils being employed for the filter transformer, of which primary is untuned. For the long-wave transformers ordinary 2,500 to 7,000-metre type H.F. Trans-formers tuned by a dual condenser are used. I am thus able to bring these transformers into tune with the filter transformer. The set functions fairly well, but I thought to improve selectivity by employing certain coils, not of numbered make, but of equivalent inductance to the two Number 400's, for the filter transformer. The long-wave side now goes into oscillation easily, but on rotating the oscillator condenser the usual heterodyne whistles cannot be obtained."

In order that the Tropadyne oscillator may function it is essential that a certain by-pass capacity be in parallel with the primary of the filter transformer, which otherwise acts as a choke and prevents oscillation. It would seem that in your case that the Number 400 coils had sufficient self-capacity to allow the oscillator to function, whilst obviously the coils which were substituted for them have less self-capacity, thus stopping the oscillator from working. A small by-pass condenser should therefore be connected across the primary of the filter, in which position a capacity of .0001 or .0002 should be ample. This arrangement should be a perfectly satisfactory one, since the two intermediate transformers can be brought into tune with the filter by tuning on the dual condenser.

PATENTS AND THE HOME CONSTRUCTOR

(Continued from page 304)

from the field of the patent, although it must be admitted that the number of wireless enthusiasts who could fairly claim to come within this definition from a legal point of view is very small indeed.

The Amateur Trader

In the second place, the "amateur trader" is neither an experimenter nor a *bona-fide* amateur, and therefore does not come within the protection either of Sir George Jessel's dictum or of the licence originally given by the Marconi Company in 1922. In fact, he appears to be threatening the present privileged position of the genuine home constructor who merely builds a set for his own personal use at home.

It is probable that the real object of the Marconi Company is simply to put a stop to the growing practice of making unlicensed sets for surreptitious sale in competition with the regular trade. They admit having placed their patents at the disposal of the *bona-fide* amateur in 1922. At that time, and since, the term "amateur" has been generally accepted to mean the home constructor who builds a set for his own use at home (but not for disposal to others, either by sale or otherwise).

Finally, it will be noticed the Company definitely assert that they have no intention of withdrawing their original concession as regards the *bona-fide* amateur, and it is to be hoped that they will be content to let matters rest as they are in this respect.

A PRESS DEMONSTRATION AT ELSTREE

(Continued from page 319)

Good Reproduction

A feature remarked on by the guests, among whom was Mr. Whitehouse, of the B.B.C., was the wonderful purity of reproduction given by all the receivers demonstrated.

The five receivers of non-radiating design which were used for the demonstration were:—

The "Huntsman Two," by Mr. Percy W. Harris, M.I.R.E.

The "Torostyle Two," by Mr. Percy W. Harris, M.I.R.E.

The "Neutroflex Two," by Mr. N. J. Gibson.

The "Neutrophase Four," by Mr. J. H. Reyner, B.Sc. (Hons.).

The "Elstree Six," by the Laboratory Staff.

Press Comments

From among the reports of the demonstrations which have appeared in the Press we quote the following:—

"The latest development in a circuit design which lays legitimate claim to a removal of the above difficulties was demonstrated by the Radio Press, Ltd., at their laboratories in Elstree last night, and the intention to provide the home constructor with reliable non-radiating sets seems to have materialised. Three receiving sets were used to demonstrate the new circuit, viz., a six-valve laboratory receiver, a specially-designed two-valve set ('The Huntsman'), and a so-called toroidal two-valver.

"On a loud-speaker the product of over-oscillation was demonstrated by mishandling and the introduction of the usual 'howl,' and this was entirely absent, no matter how one attempted to produce it, on the several types of the new receiver. The circuit as designed may certainly claim to have accomplished its purpose, and in the case of the reception from Birmingham, and also that from Brussels, no trace of interference, except by telegraphy, could be detected.

"It says much for the industry of the research engineers that they have succeeded so far as they have in constructing even a two-valve set with these undeniable improvements, which were obvious even under last night's conditions of reception, and I was informed that it was hoped shortly to apply the new principle to a one-valve set. One of the greatest merits of the new idea is that it can be incorporated into any ordinary receiving set at a very small cost. The whole principle consists in the application of condensers under certain given conditions, and as the condensers are exceedingly small the question of space does not arise."—*Daily Telegraph.*

"The apparatus showed that, while it is possible to take full advantage of reaction, no amount of mishandling could produce that disturbing aerial oscillation known as 'howling,' which interferes so seriously with broadcast reception, and for which a remedy has now been provided."—*Times.*

B.B.C. Appreciation

We are authorised by the B.B.C. to state that they look with favour on any efforts towards the reduction or elimination of the possibility of interference from oscillating receivers, and are appreciative of the research work of this nature which is being carried out by our laboratories.

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Wireless Weekly. April 28th, 1926.

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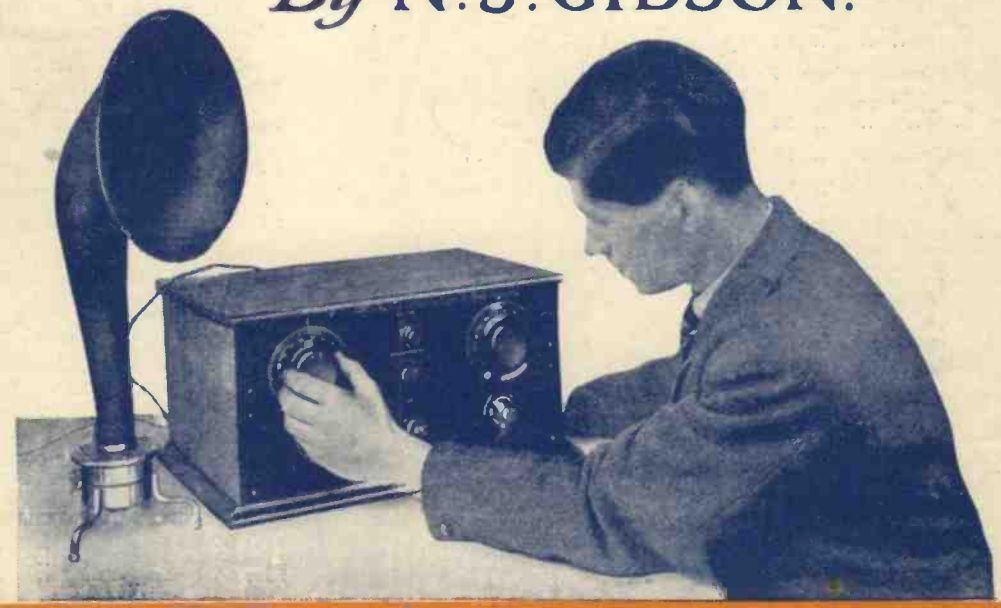
Wireless Weekly

Vol. 8. No. 11.

THE 100% VALVE PAPER

A SPLIT-CONDENSER TWO-VALVE REFLEX

By N. J. GIBSON.



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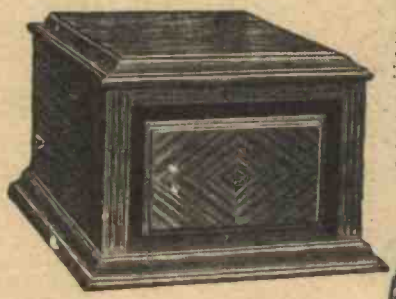

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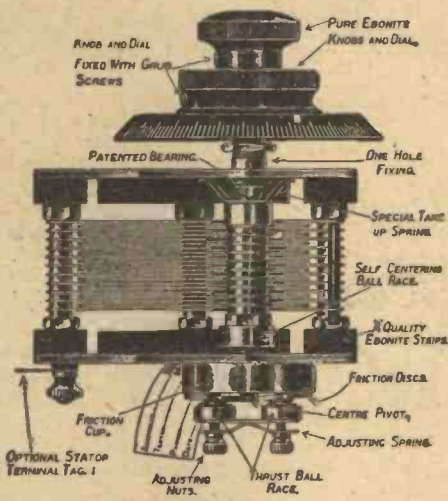

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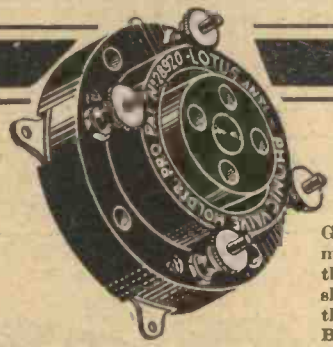

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Wireless Weekly
Edited by
JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.
Technical Editor
J. H. REYNER
B.Sc.(Hons.) A.C.G.I., D.I.C., A.M.I.E.E.

A Split-Condenser Two-Valve Reflex

The "Neutroflex Two"

By N. J. GIBSON.

The merits of double variable condensers for use in symmetrical neutralised circuits were discussed in a recent issue of "Wireless Weekly." This set is a practical example of the application of this important development, being an entirely new type of reflex in which the majority of the disadvantages common to this form of circuit have been overcome.

IT has been found that the majority of reflex receivers designed up to the present, whilst possessing the distinct advantage of economising in valves, also possess numerous disadvantages. The most noticeable of these, perhaps, is the inability to obtain smooth reaction without low-frequency oscillations being produced, this being particularly annoying on DX work. A further disadvantage common to many types of reflex circuits is the flatness of tuning.

Efficient Neutralising

It will be seen, however, in the circuit described below that the above disadvantages are eliminated. In the first place, thoroughly efficient neutralising has been obtained in the first valve by the employment of the split-condenser method, as shown in Fig. 4 of the recent article, "Some New Uses for Split-condenser Circuits" (*Wireless Weekly*, Vol. 8, No. 8). For purposes of reference this circuit is reproduced in Fig. 1 on the next page.

It will be seen, on comparing this with the circuit diagram of the receiver in Fig. 2, that the 10,000-ohm resistance employed for grid return has been replaced by the secondary of the reflexing low-frequency transformer. Now since the centre point of the coil is at the same high-frequency potential as the moving plates of the double condenser C_1 C_2, it will be seen that no high-frequency currents will pass through the low-frequency transformer, thus eliminating one of the causes of low-frequency howling in reflex receivers, and also removing the damping of the low-frequency transformer from the high-frequency tuning arrangement, and making greater selectivity possible.

Simplicity characterises the panel of the set.

Valve Coupling

In place of the high-frequency choke in the anode circuit of the valve V_1 in Fig. 1, this receiver utilises a coil for high-frequency coupling to the detector valve. This method of coupling, whilst being sufficiently close for passing on the high-frequency currents to the detector valve, is unable to pass any low-frequency currents, so that when the low-frequency current in the anode of the detector circuit is returned to the grid of the reflex valve for further amplification it will not be passed on to the detector valve via the high-frequency coupling, thus pre-

A Split-Condenser Two-Valve Reflex—*continued*

venting any form of low-frequency reaction taking place.

The Detector Circuit

The detector circuit is tuned in a similar manner to the high-frequency circuit, with the difference, however, that the neutralising condenser in this case is employed for reaction purposes. It is to be noted that with this arrangement extremely smooth control is obtained, while the reaction setting remains constant over practically the whole of the tuning range. Anode bend rectification has been employed, it having been found that both greater selectivity (owing to the absence of grid damping) and greater clarity are obtained with this type of rectification.

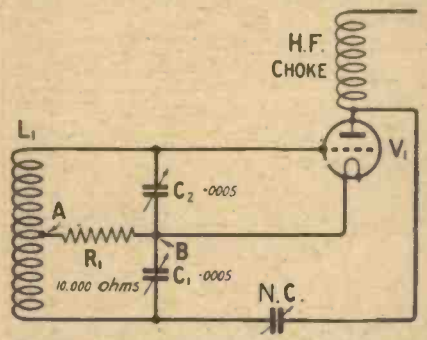


Fig. 1.—Illustrating the split-condenser method of neutralisation.

Anode Bend Rectification

The necessary grid bias for anode bend rectification is provided by a grid bias battery, connected in series with the 100,000-ohm resistance and the slider of a potentiometer which is connected across the low-tension supply. It may be noted here that, as a 300-ohm potentiometer has been employed, it is placed in such a position in the circuit that, when the low-tension on and off switch is in the off position, the low-tension supply to the potentiometer is disconnected, thus avoiding the possibility of leaving the potentiometer passing a small amount of current when the set is not in use.

It will be seen from the above description of the circuit that it is in all ways similar to a straight three-valve circuit (high-frequency, detector, and note-magnifier). The first valve acts as a neutralised high-frequency amplifier coupled to a detector circuit employing smooth reaction. The detected signals are returned to the grid of the first valve without in any way interfering with its high-frequency functions, and at the same time without the possibility of low-frequency reaction taking place and so causing a howl.

In a later paragraph it will be seen that it is possible to obtain a large number of stations at good telephone strength, as well as several stations on the loud-speaker, including, of course, excellent strength and quality from the local.

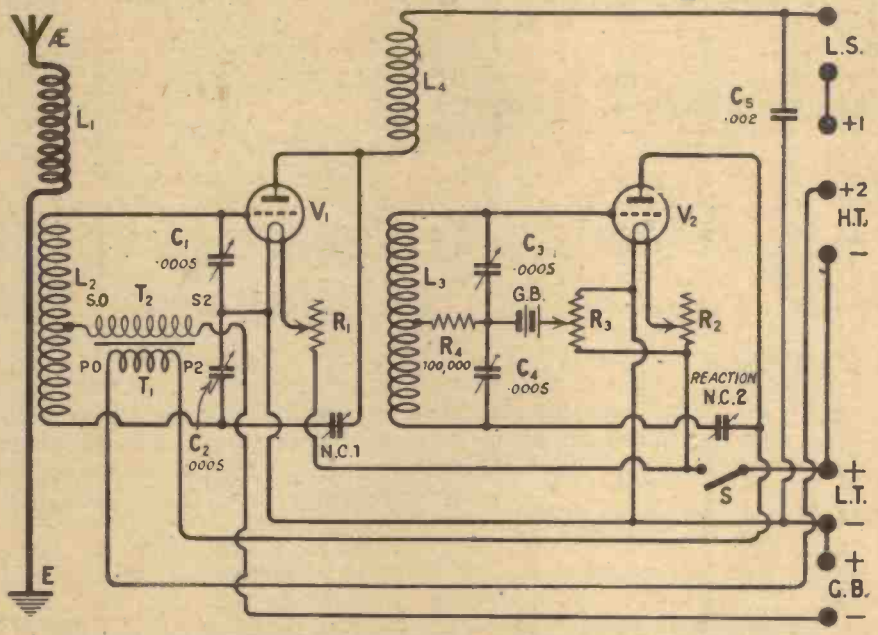
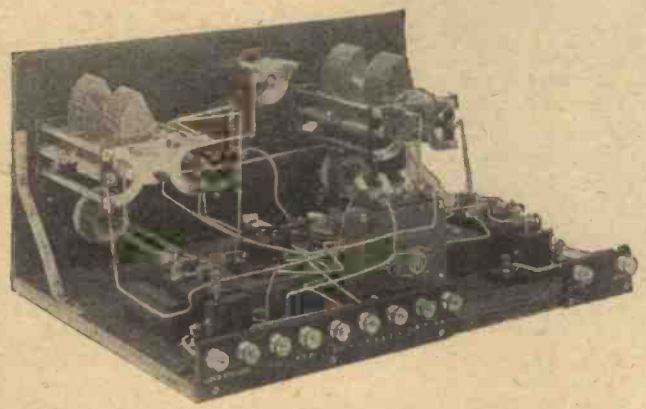


Fig. 2.—Anode bend rectification is employed, reaction control being provided by means of the condenser NC2.



The terminals for the aerial and earth connections are mounted on an ebonite strip well separated from that for the battery terminals.

List of Components

The following is the list of components employed in this receiver. It will be noted that the names of the manufacturers are given in brackets after each item, although doubtless suitable components of other makes would be found quite satisfactory, with the exception of the low-frequency transformer, on the constants of which the circuit largely depends. The secondary of this particular transformer acts effectively as a choke to any *parasitic* high-frequency currents which may tend to be produced by half of the circuit oscillating by itself. Other transformers having a low self-capacity might be found satisfactory, but the make of transformer employed here has been found eminently suitable.

Two .0005 Cyldon double variable condensers and dials (S. Bird & Sons).

One Peto-Scott panel mounting neutralising condenser (Peto-Scott Co., Ltd.).

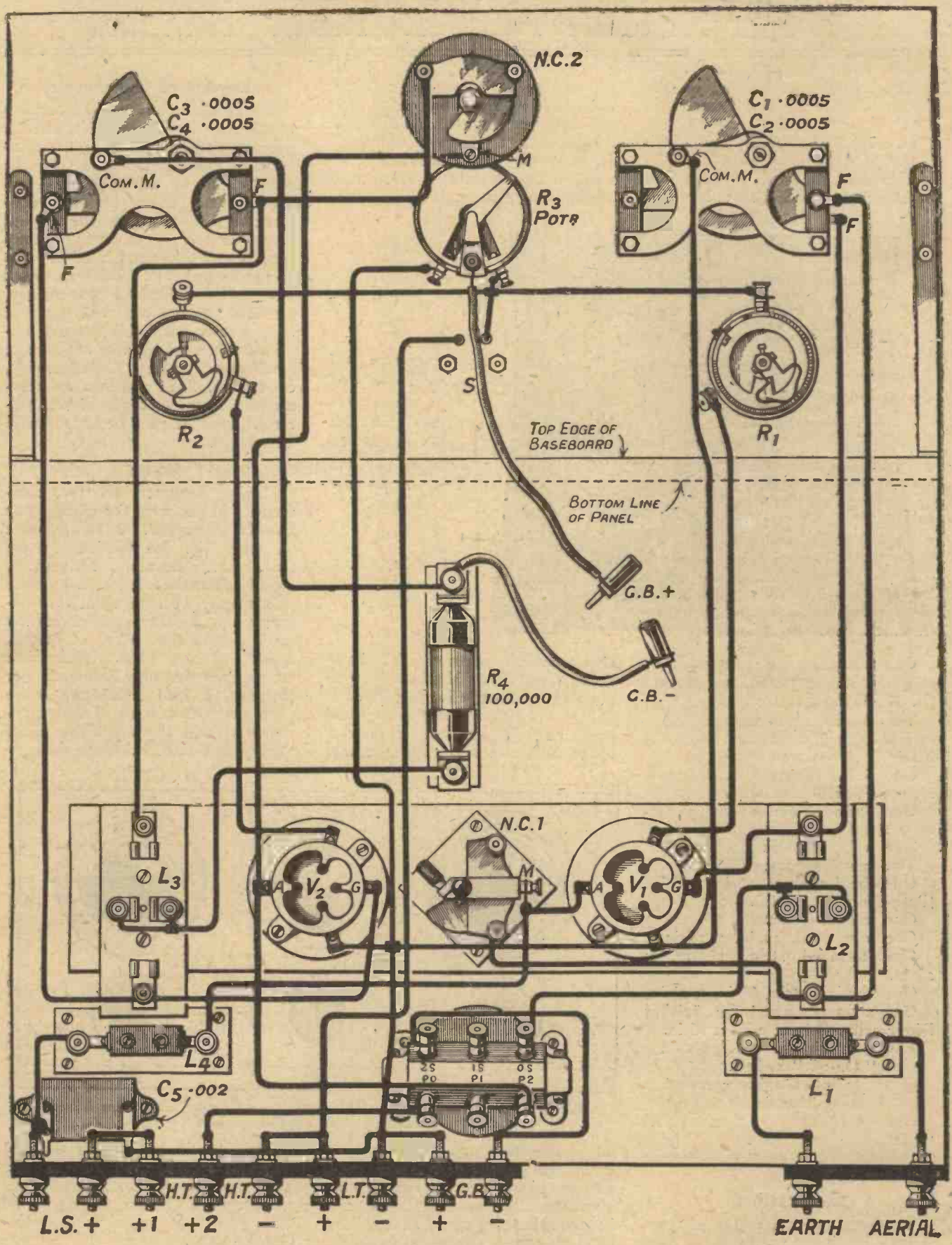


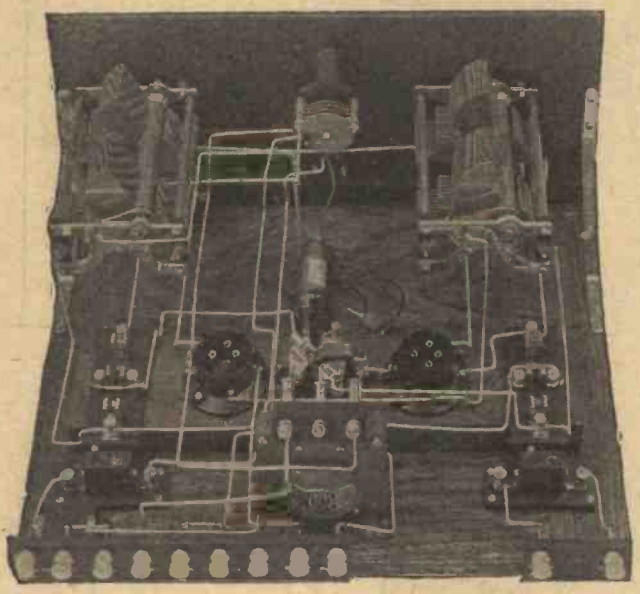
Fig. 3.—The low-tension portion of the wiring should be connected up first.

A Split-Condenser Two-Valve Reflex—*continued*

One baseboard mounting neutralising condenser (Peto-Scott Co., Ltd.).

One .002 fixed condenser (Dubilier).

Two dual rheostats ("Cosmos," Metropolitan Vickers).



The symmetrical arrangement of the components clearly shown here should be followed if the best results are desired.

One potentiometer (Lissen).

Two "Dimic" coils and mounts (L. McMichael, Ltd.).

Two baseboard-mounting single-coil holders ("Success," Beard & Fitch).

One R.I. Multi-ratio L.F. transformer (Radio Instruments).

One 100,000-ohm anode resistance (Varley Magnet Co.).

Two valve holders (Aermonic).

Two panel supports (Eddystone).

One ebonite panel, 16 in. x 8 in. (Peto-Scott Co., Ltd.).

One cabinet (Artcraft).

One baseboard, 12 in. x 16 in.

One terminal strip, 1½ in. x 2¾ in.

One terminal strip, 8¾ in. x 1½ in.

One strip of wood for raising Dimic coils, 1⅛ in. x 3 in. x 16 in.

Eleven terminals.

One "On-off" switch.

Quantity of Glazite connecting wire (London Electric Wire Co.).

One set Radio Press panel transfers.

Quantity of usual small screws and nuts.

Construction

The first operation to be performed in the construction of this set is the marking out and drilling of the panel. This can be readily accomplished from the accompanying diagram if the above makes of components have been employed. If, however, other makes have been used, it may be necessary to make slight modifications. The panel should now be secured to the baseboard, and the baseboard components mounted in position. It will be seen that a length of wood has been employed to raise the level of the Dimic coils in such a manner as to facilitate coupling between them and standard plug-in coils. For purposes of simplicity in construction the valve holders and baseboard-mounting neutralising condenser were also mounted on the raised wood.

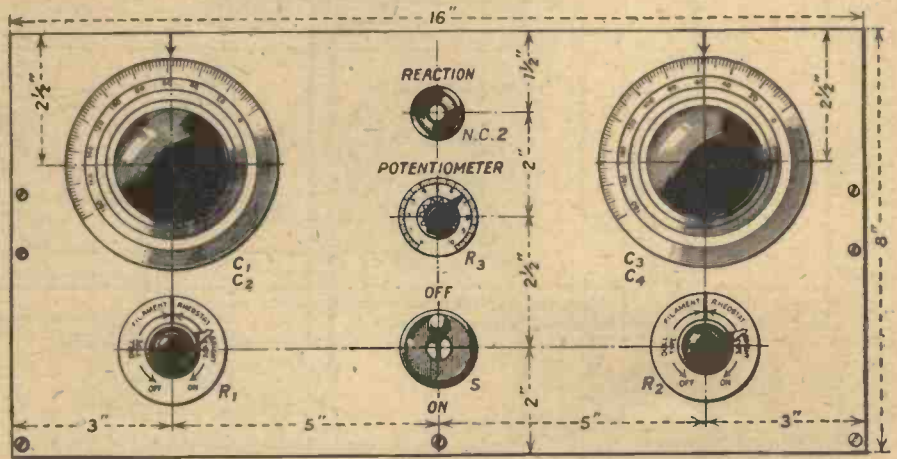


Fig. 4.—There are no terminals on the front panel, and there is comparatively little drilling required.

Lay-out of Components

When all the baseboard mounting components have been secured in position the remainder of the components can be mounted on the panel. It is advisable, in laying out the units, for the constructor to see that the layout shown in the accompanying photographs and diagrams is adhered to as far as possible. Dual rheostats have been provided for convenience, but it should be observed that the best results with this set are obtained when using the .25-ampere small power valves. Alternatively, of course, fixed resistors or automatic filament controls of the barretter type might be used with advantage.

Wiring

Having mounted all the components in position, the wiring may now be attempted. It is advisable to wire the low-tension system first, *i.e.*, filament resistances, switch, potentiometer, etc., as these points may become somewhat inaccessible, if other connections are made previously. This, of course, applies to any other inaccessible connections that may be noted. For instance, a lead should be taken from the centre point of the potentiometer, and the negative end of the 100,000-ohm resistance for connection to the grid bias battery which is incorporated in the set. This separate grid bias battery has to be used, of course, owing to the employment of anode bend rectification, and as once the correct value of bias for this has been

A Split-Condenser Two-Valve Reflex—*continued*

ascertained it will not be necessary to alter it. This battery may conveniently be placed on the baseboard.

A Note on the Coils

A further point that might cause some mistake, and that should be noted, is the fact that as the Dimic coils consist of two identical windings which are not joined in the middle, in any circuit where it is desired to use the Dimic coil as a centre-tapped coil, it is necessary to bridge the two terminals on the centre points of the mount when connecting up.

Transformer Connections

The remainder of the wiring will be quite clear from the accompanying diagrams, but it should be noted, however, that with the valves recommended for use later in the article, the most suitable connections for the R.I. Multi-ratio transformer are as follows:—The terminal marked PO should be taken to positive H.T., whilst the terminal marked P2 is taken to the anode of the detector valve. SO is wired to the centre point of the high-frequency grid tuning coil, and S2 to the grid bias terminal provided on the terminal strip.

When the wiring has been completed the set is ready for test.

Testing the Receiver

Having connected up the batteries, etc., suitable coupling coils should be inserted. These should be of the order of No. 50, greater or less selectivity being obtained when the receiver has been adjusted by plugging in smaller or larger coils as required.

Now place the reaction condenser at a minimum, and with the aerial disconnected, so as to avoid interference, proceed to adjust the neutralising condenser. Place both dials at similar readings, say about 60, and place the neutralising condenser in such a position that oscillation ceases. Now try varying the tuning condensers both together over the scale, resetting the neutralising condenser should oscillation take place during this operation. When a position has been obtained, where the set is stable over the complete tuning range, the aerial may be attached and the local station tuned in, and the reaction condenser can be increased until the maximum volume is obtained. Both grid bias batteries can now be adjusted, until maximum volume, quality and smoothness of reaction are present. It may be necessary to vary the grid potential of the detector valve according to the strength of the signals being received. This can be accomplished by means of the potentiometer provided.

Tuning

When the receiver is correctly adjusted it can be tuned in a normal manner with the H.F. and detector grid tuning condensers, first bringing these in tune with the station required, and then bringing the signals up to full strength by means of the reaction condenser provided. It will be noted, over the greater part of the waveband, that the reaction control need not be readjusted, and again that for any station the two dials will have practically identical readings.

Non-Radiating Properties

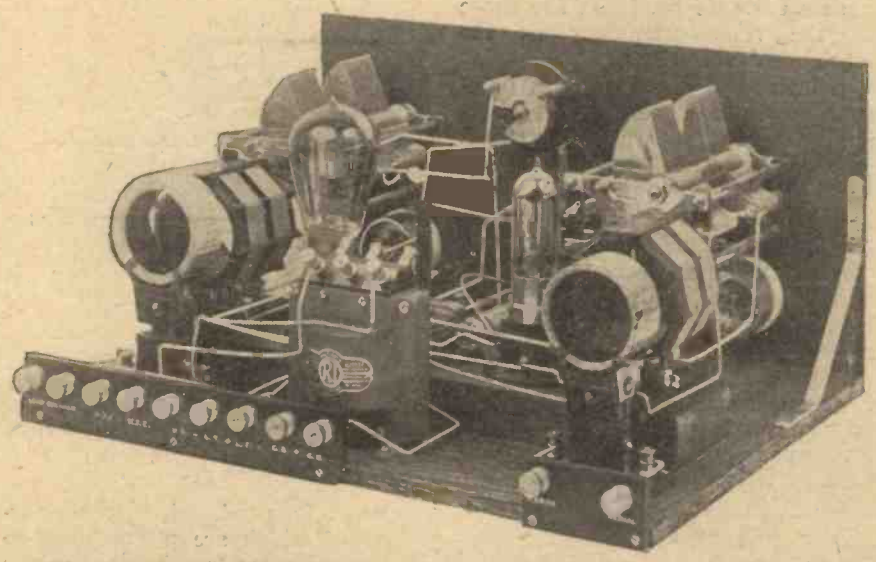
It may also be added here that when searching for stations, once the high-frequency valve has been properly neutralised, no fears need be entertained of re-radiation taking place if the detector valve is made to oscillate. This receiver was among the sets used during a recent Press demonstration of non-radiating receivers at the Radio Press laboratories.

Valves and Voltages

Tested on an aerial about 12 miles north of the London station, some very good results were obtained. A D.E.5 valve in the first position, with 120 volts H.T. and 7½ volts grid bias, and D.E.5.B. in the detector position, with about 60 volts H.T. and 3 volts grid bias, were found to be most suitable. A Lissen No. 30 coil was employed for the aerial coupling, whilst a No. 50 coil of the same manufacture was used for the H.F. coupling.

Some Results

Birmingham, Aberdeen, Madrid, Bournemouth, and one or two Continental stations were received on the loud-speaker, whilst London, of course, was received at full loud-speaker strength, and with good quality. When the telephones are employed it is not exaggerating to say that it is possible to obtain a station at practically every degree of the dials. Using a Gambrell A2 coil in the aerial circuit, it was possible to obtain both Manchester and Cardiff with only a very small background of London on the telephones, while one or two Continental stations working on wavelengths very close to that of the local station were heard. Whilst operating the receiver, the absence of low-frequency howling and the absolute stability was very noticeable, ease of operation and smoothness of reaction also being two very good points.



The centre-tapped coils are raised on a wooden platform in order that they may be co-axial with the standard plug-in coils.

How Modulation Produces Side-Bands

By Capt. H. J. ROUND, M.C., M.I.E.E.

A good deal has been heard lately about side-band telephony, and in this interesting article Capt. Round gives a lucid explanation of the manner in which modulation produces side-bands.

The Marconi-Sykes microphone, with the development of which Capt. Round has been closely connected.

WHEN a direct current is modulated by means of a microphone, the only alternating currents produced are those of the same frequency as the mechanical vibrations.

If instead of direct current, however, we use a very rapid alternating current, superficially it seems as though we shall not be altering frequency but only amplitude when we modulate; but actually any variation of amplitude of alternating current can be analysed into a band of frequencies. This can be shown quite easily algebraically, but it is not easy to see how this is occurring without the algebra. The following explanation may throw a little light on the production of these other frequencies, for those who do not care to follow mathematics.

The Doppler Effect

It is well known that moving relatively towards or away from a

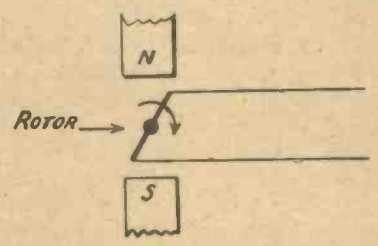


Fig. 1.—In a simple alternator, revolution of the rotor in the magnet field produces an alternating current voltage.

source of sound raises or lowers the note of the sound that is heard. This effect is called the Doppler effect, and is quite a common phenomenon. For instance, engines whistling when rushing through a suburban station apparently whistle with a variable note. The same phenomenon is at work when we consider alternators fed with alternating current fields.

The Simple Alternator

Fig. 1 represents a simple alternator, the stator of which N.S. is constructed of permanent magnets, while the rotor consists of a simple loop of wire. If the rotor be now revolved, an alternating current

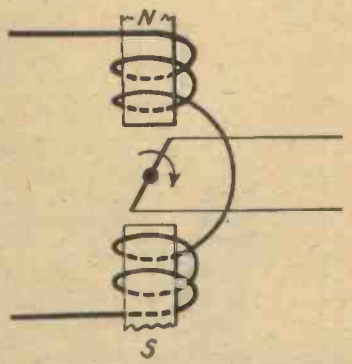


Fig. 2.—The addition of an alternating field to the alternator of Fig. 1 will produce modulations of the current generated.

voltage is produced, the alternations of which are proportional to the number of revolutions of the rotor. Every revolution gives one alternation. If in addition to this permanent field we supply an alternating field, by means of a winding wound on N and S, as in Fig. 2, still leaving the permanent field, we can see that the resulting current from the rotor will be modulated by the alternating part of the field.

In fact, this system constitutes an extremely simple wireless telephone arrangement, for if the rotor is connected to a suitable aerial system, and if the frequency of rotation is high enough, we should be able to get modulated radiation.

Forms of Currents

If the permanent field is zero a peculiar resulting current is produced, shaped as indicated in Fig. 3, the dotted line representing the shape of the alternating current magnetising the field. If a permanent field is now added to this alternating field, we get in two cases the result shown in Figs. 4 and 5. We have here in the two last wave-forms exactly similar results to those given by a wireless telephone transmitter when we have a variation round a steady value of oscillation.

From Another Viewpoint

There is another way to look at these alternator effects. It is quite common to consider an alternating field as made up of two equal and oppositely rotating fields. If we could have two permanent magnet systems, like N.S. in Fig. 6 (*a*) and (*b*), superimposed, revolving in opposite directions at the same speed, it is quite obvious that twice per revolution the fields will add and twice they will oppose one another, and the general result can be seen to be the same as an alternating field produced by an alternating current field system. This result is indicated in Fig. 6 (*c*).

Modulation

If in such an alternating field we revolve a rotor clockwise, this rotor will tend to move relatively slower with one imaginary revolving component of the field [Fig. 6 (*b*)] and

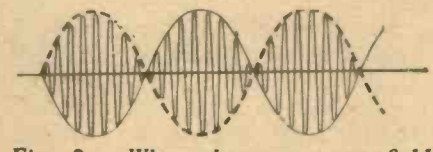


Fig. 3.—When the permanent field (Fig. 2) is zero, the current takes the form shown here.

faster with the other revolving component [Fig. 6 (*a*)]. We get here a similar effect to the Doppler effect. If the rotor with a permanent magnet produces a frequency n,

How Modulation Produces Side-Bands—*continued*

and the two revolving fields, constituting the alternating current field, are revolving at a frequency n2, then we shall get produced currents with a frequency

$$n1 - n2 \text{ and } n1 + n2.$$

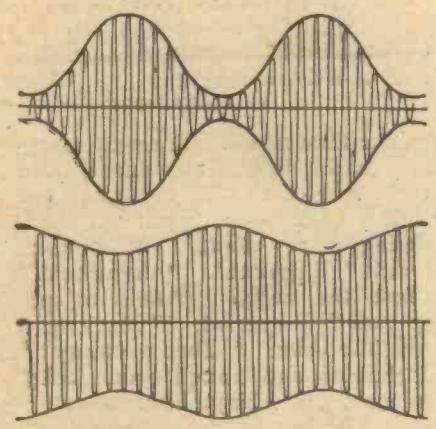
If in addition to these two revolving fields we have a permanent field, we shall get as well the frequency n. In fact, our superimposed direct and alternating field is giving us three waves, and as we had considered this arrangement at first as giving a modulated alternating current, we can say at once modulation in this alternator case is equivalent to three waves.

If we refer back to Fig. 3, where the direct field is absent, we have the case where only $n1 - n2$ and $n1 + n2$ are present. whereas in Figs. 4 and 5 we have all three frequencies, the chief difference being that frequency n1 is preponderating in Fig. 3.

Oscillating Valves

It is now a small step to see the analogy between this alternator case and the case of an oscillator valve supplied with modulated D.C. high tension.

The valve is the alternator, the D.C. supplies the steady field, and the resulting current has a frequency n1 and a constant amplitude. If on top of this D.C. we supply



Figs. 4 and 5.—The addition of the permanent field produces wave-forms of this type, which may be compared with those produced by a telephone transmitter.

modulation, we get our other frequencies $n1 - n2$ and $n1 + n2$.

Reverse Processes

It will be interesting to consider the reverse processes with an alternator.

If we have an alternator with no field excitation at all, and into the armature, revolving at frequency n1, we insert a current of frequency n1 at the correct phase, the armature will give a permanent magnetisation to the field, because each time the armature reverses its direction the current also reverses.

If in addition to n1 we have currents at $n1 - n2$ and $n1 + n2$ in the armature, the two latter waves will each give a modulation of frequency n2 to the permanent magnets.

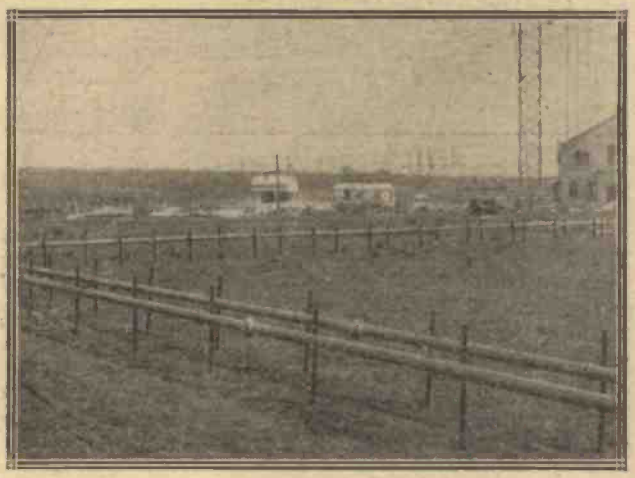
Eliminating the Carrier Wave

Also if we have a winding round N.S. connected to telephones, then we shall hear the modulation; but note this point, that the permanent field produced by n1 gives no effect on the winding, so that we could leave n1 out and still get our speech with only $n1 - n2$ and $n1 + n2$. As long as we could revolve the rotor at n1, we should not need the current.

The analogy with valves is that if we can supply the carrier wave at the receiving end, there is no need to transmit it.

A little careful reasoning will show that $n1 + n2$ and $n1 - n2$ both produce the same effect on the field, so that one of them can be cut out and the modulation still obtained.

An elaborate earth system, consisting mainly of copper piping, is to be used at the nearly completed Marconi beam station at Bodmin, in Cornwall.



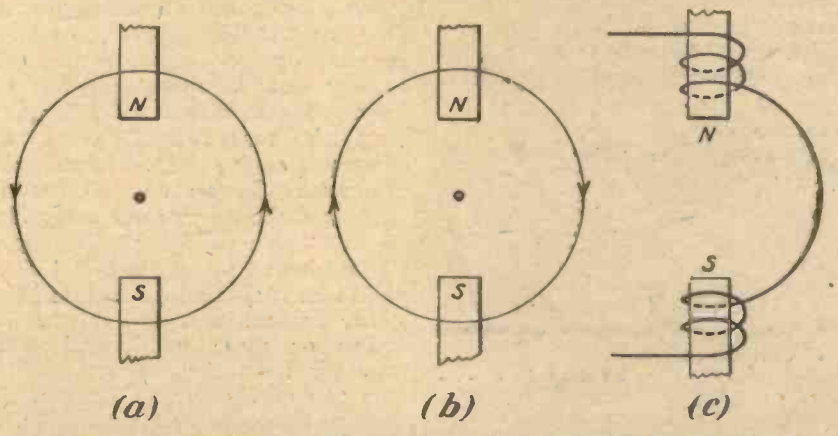


Fig. 6.—(a) represents a field magnet system revolving anti-clockwise, and (b) a similar system revolving clockwise. If the two are imagined superimposed, it can be seen that they give the same effect as the alternating field (c).

Jottings by the way

"GLORIOUS weather," cried the General, bursting into the wireless club. "I tell you what, you fellows, it's about time we had another picnic." His suggestion was received with acclamation. Why, I do not know, for personally I have never been able to understand the curious passion of the inhabitants of our islands for making journeys into the country in order to devour food. I must say that I infinitely prefer a chair to a wasps' nest as a seat and that I do not find the flavour of my tea improved by the addition of spiders and other things that seem to have a superfluity of legs and whiskers. Nevertheless, I am always willing to sacrifice myself, if

. . . a wasps' nest as a seat . . .

by doing so I can add to the pleasures of my fellows. Since all the members seemed determined to have a picnic I merely shrugged my shoulders so expressively that I bust my braces and agreed to share with them the perils and the horrors of open-air feeding. Several of them suggested that it was hardly fair to drag me out if I really felt like that about it, and that fellow Snaggsby actually had the impertinence to say that if I would only stay at home their little fête would probably not be marred by a single untoward incident. This you will agree was hardly fair, since it is nearly always I (you will observe that I do not write "it is me") who extricate them from the difficult situations in which they are so frequently landed by their own lack of common sense.

The Venue

"And now," said the General, taking the chair and thumping the table in order to obtain silence, "We must decide upon the place at which our picnic is to be held. Who's got a bright idea?" "The sewage farm," I suggested. "It is nice and handy and we can shelter in the Gazette's laboratories when it rains, as it always does." Any sensible body of men would have adopted this idea at once. As it was I found myself in a minority of one. They were unanimous in turning my proposal down, but far from unanimous in their suggestions for a suitable spot. Poddleby wanted to go to the deep shady valley near Snailsthorpe, but the rest fell upon him in a body, pointing out that such a place was nearly sure to be a blind spot. Bumpleby Brown was all for the hills and the heights out Buggridge way. "Reception there," he said. "was bound to be good." Others told him flatly that he was an idiot. They assured him that it was five miles or more uphill and cross country from the nearest road to the top of Buggridge Beacon. If *he* wanted to carry *his* portable set up there, he could jolly well do so; but they didn't and what is more they wouldn't.

A Delightful Rendezvous

It looked at one time as though there were going to be twenty-three separate picnics, each consisting of one, but eventually, after a heated and wordy discussion, it was decided that we should make the big wood near Mirebury-in-the-Wallow our rendezvous. Mirebury-in-the-Wallow is a charming little spot, populated chiefly by pigs and oldest inhabitants, some fifteen miles from Little Puddleton as the crow flies and twenty-five or so as the Lizzie rattles. It was agreed that we should journey thither on *The Pride of Puddleton,* a vehicle which after doing its bit in the Great War as a lorry has since become the "up-to-date, commodious and speedy charabanc ideal for pleasure parties," owned by Mr. Spoople, who runs a flourishing garage and incidentally wrecks our accumulators.

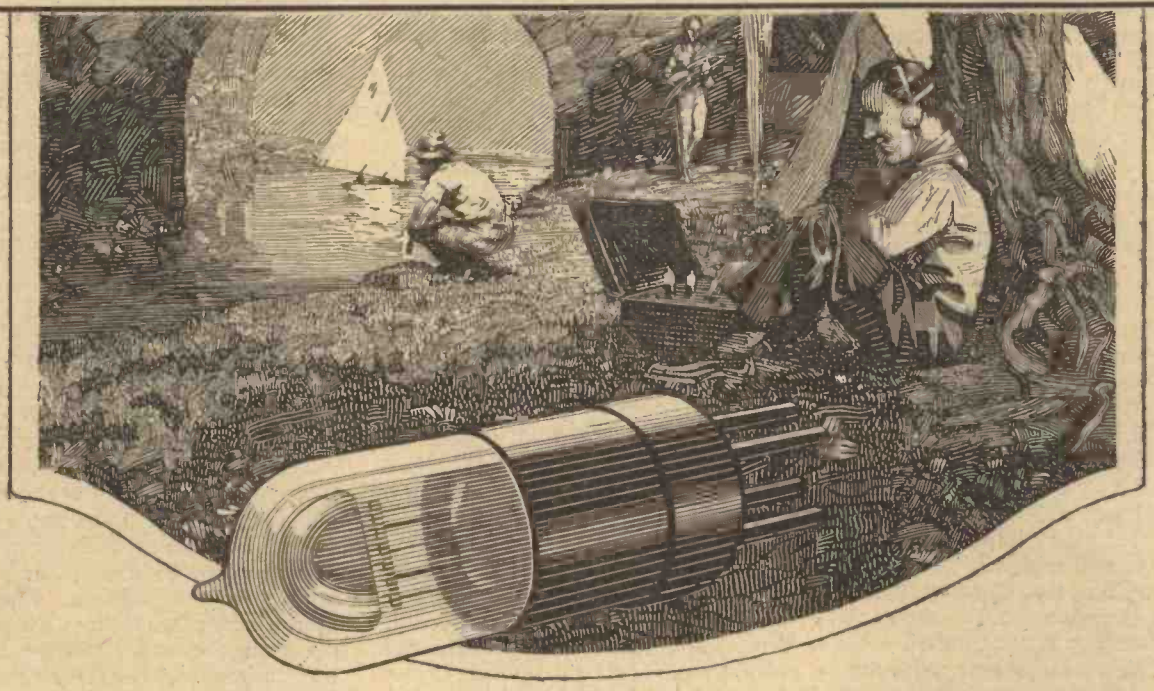
The Start

It was arranged that we should assemble at the Club at ten o'clock so that a start might be made at half-past. I was rather bitter about this, telling them quite plainly that I was not in the habit of setting out on expeditions of this kind before breakfast. However, I was simply shouted down by the rest of them. I left instructions over night that I was to be called two hours

. . . a fellow propping up a lamp-post . .

earlier than usual. The next morning, whilst it was still dark—I am quite sure of this for my eyes were tightly closed—there came a thundering at my door. "What time is it?" I grunted. "Arpastate," came the reply. "Ack or pip emma?" I queried. "Morning," said the voice. "Then go away!" I shouted and turned over. After a most refreshing little snooze I woke up without any extraneous help. Then it suddenly occurred to me that this was the day of the picnic. Rising with the lark was the order of the day. I rose, dressed, descended and proceeded to breakfast. When I had finished I glanced at the clock and noted with astonishment that the hour was 12.30. On walking round to the wireless club I found that *The Pride* had long

The Dull Emitter which popularised Summer Radio



SO long as bright-emitter valves were the only ones available the really portable Receiver was impracticable. No one wanted to carry big 6-volt accumulators out into the country for the pleasure of enjoying a Radio concert in the meadows—it wasn't worth the trouble. And even when the first dull emitters became more popular their extreme fragility rendered them unsuitable for the inevitable rough handling which every Set must get when carried from place to place.

And so the portable Receiver lagged in development. But, with the introduction of the Wuncell, summer Radio becomes a new delight. It is now quite easy to design a three-valve Receiver which can be fitted into an attache case complete with a 2-volt unspillable accumulator. Such a Receiver will give at least 10 to 12 hours' reception on one charge. And, what is more important still, the Wuncell valves will not be harmed by the vibration and rough usage to which such a Receiver must inevitably be subjected.

The reason for this lies in the design of the filament and its method of manufacture. Instead of being a long, straight filament, it is arched and further stayed at its centre with a third support. Instead of obtaining low current consumption by thinning down the filament at the risk of fragility, the Wuncell filament is manufactured under an entirely new process. This permits an exceptionally high electron emission at a temperature of only 800 degrees—when the Wuncell valve is working, its glow is practically invisible in daytime. Even in the dark it is no more apparent than the luminous figures on a watch dial. As a result, therefore, we have every confidence in saying that the Wuncell Valve is quite as robust as even the well-known Cossor Bright Emitter.

Types and Prices:

*W.1. For Detector and L.F. use - 14/-
1·8 Volts. Consumption ·3 amps.
*W.2. (With red top) for H.F. use 14/-
1·8 Volts. Consumption ·3 amps.
W.3 The Loud Speaker Valve - 18/6
1·8 Volts. Consumption ·5 amps.
*Also in special base with resistance to suit 2, 4 or 6-volt accumulator 16/-

Cossor Valves

Issued by A. C. Cossor, Ltd., Highbury Grove, London, N.5.

Gilbert Ad. 5066

JOTTINGS BY THE WAY
(Continued)

since departed. "Was everybody there but me?" I asked a fellow who was earning his dole by propping up a lamp-post. "The 'ole bloomin' menadgery excep' the Perfessor," replied the human buttress.

Stranded

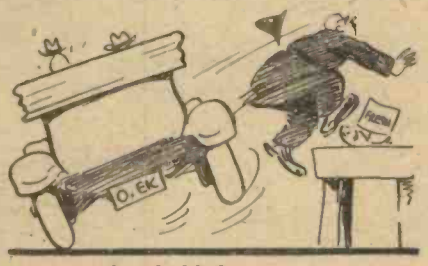
I set out to "The Microfarads," where I found Professor Goop busily engaged in installing his latest invention, the wireless door bell. Pressure upon the knob, he told me, set a buzzer buzzing, whose sounds were picked up by a crystal set with a two-valve note-amplifier installed in the kitchen. "Aren't you going to the picnic?" I cried. "Picnic?" said the Professor, "Picnic? Why, of course I am, but that's in April." "So are we," I said. "Dear me, dear me," murmured my old friend, "I was quite under the impression that March was still with us." When I proved to him that that very day was the one consecrated to the rural orgy he became very agitated. *The Pride of Puddleton* had departed, and here were the two most brilliant members of the club left behind.

"Safety First"

"The day is not yet lost," quoth I. "Place yourself in my hands and I will see that the club is not to be deprived of the presence of its leading lights." Under my guidance he fairly ran down to the Gazette Office, where we borrowed the official car. When I say "borrowed" I mean that no one was looking, and that the car was there simply eating its head off. The next instant we were speeding down the High Street at Heaven alone knows how many miles an hour. At the cross-roads, where the new Goop Boulevard traverses the High Street, that ridiculous creature P.C. Bottlesworth endeavoured to bar our passage with an extended arm. "Safety first" being his motto, he made a leap which landed him on the slab of the fish shop, where he skidded on a plaice and disappeared from view. In a few moments we had left that town behind and were out in the great open spaces, where men are men and small boys fling stones straight from the shoulder.

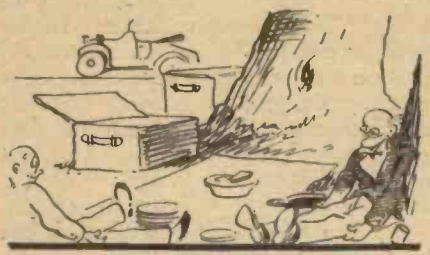
Overtaken

We had covered rather more than a dozen miles, when right in front of us I saw a yellow something upon the road which grew gradually bigger and bigger as we approached. Amidst the yellowness were black marks which presently resolved themselves into the words *The Pride of Puddleton*. There, immobilised by the side of the way, stood that splendid conveyance. Around it were grouped the mem-



. . . *he skidded on a plaice* . . .

bers of the wireless club, whilst beneath it strong men strove and struggled and shouted "Give us that blinkin' spanner, Bill." We pulled up. "Hullo!" I said, "Hullo! Going to picnic here? I thought that Mirebury Woods were to be the scene of the feast." They all started explaining at once that there had been a slight break-down. We sympathised, and I could not refrain from telling them that it just showed how risky it was to expose delicate machinery to the raw airs of early morning, before the day had got properly warmed up to its work. At this juncture Mr. Spoople arose from his resting place in the dust to say that he hoped to be ready to start again in about half an hour, but that he was a little doubtful whether *The Pride* would be able to manage the big hill. If only he had not quite such a load



. . . *I looked lazily across* . . .

on board. . . . . A brilliant idea occurred to me. "We will help," I cried. "Put the luncheon hampers into our car and we will take them on. That should lighten the ship considerably." No sooner said than done. In a minute or two the Professor and I were under way once more, after promising that the others should find the feast prepared for them when they arrived.

The Ideal Picnic

When we came to unpack the hampers we found that Poddleby, its secretary, had certainly done the club jolly well in the matter of lunch. Laid out on fair white cloths beneath the trees it made a most attractive spread. When at half-past two there was no sign of the others, the Professor and I decided that we must have a snack to sustain ourselves. A couple of hours later I looked lazily across at the Professor, who was smiling happily with his back against a tree. "Professor!" I called. "Do you think that we might finish that veal and ham pie?" With the unselfishness for which he is renowned the Professor expostulated that we must really leave something for the others when they turned up. I pointed out that there were still two sandwiches, a hard-boiled egg, and a cold sausage; but the Professor did not think that these would be more than sufficient for the twenty-one club members, to say nothing of Mr. Spoople and his accomplice. We resolved to give them another hour. As they had not turned up at the end of that time we put the pie and the other things out of their misery. Then, after a restoring little nap, we packed up and set out for home.

The Others

Once more we saw in the road a distant splash of yellow that resolved itself as we approached into *The Pride*, which reposed exactly where we had left it. Our arrival was greeted with cheers. "Thank Heaven you have come," said Poddleby. "We are on the verge of starvation." It was a difficult moment. The Professor and I looked at one another out of the corners of our eyes. My unfailing presence of mind came to the rescue. I begged them to remove the hampers from the back of the car; which done, we would drive it at once to Little Puddleton to send help. Before they had time to raise the lids we were beating it down the road like a flash of lightning. We must have been the best part of a mile away when the General's wrathful roars were borne gently to us by the breeze. "Quite the best picnic I have ever had," I said, as we chugged down the High Street. The Professor smiled sleepily.

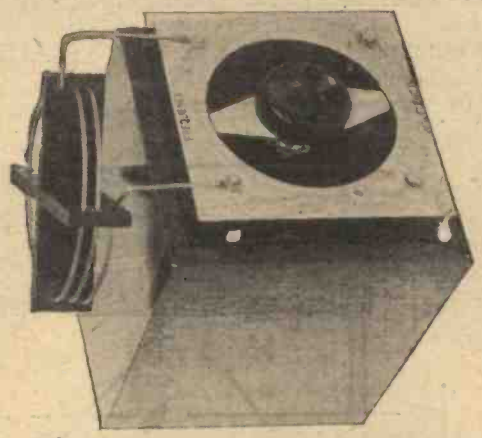
WIRELESS WAYFARER.

(The next instalment of "Jottings" will appear in the issue for May 12.)

A Direct-Reading Absorption Wavemeter

By B. G. R. HOLLOWAY.

Describing the construction of a useful wavemeter, specially suitable for the higher frequencies, which is provided with scales reading direct in metres or kilocycles, thus dispensing with a calibration chart.

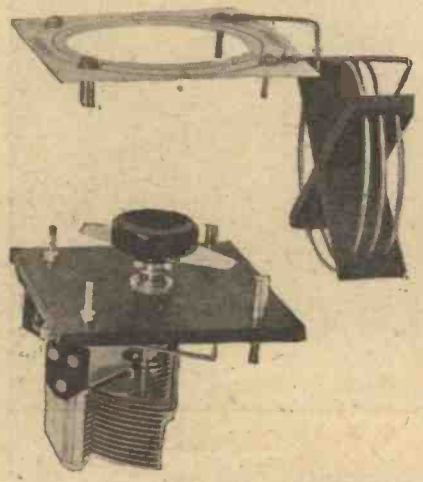


The double pointer gives either wavelength or frequency readings.

ONE does not search far to find the cause of the popularity of the absorption method of measuring the higher frequencies. Buzzer wavemeters of the best design cannot be relied upon above about 3,000 kc., while the valve type, subject as it is to small variations in anode and filament voltages, is for this reason difficult to use accurately with simple apparatus. The chief appeal, however, of the absorption wavemeter is its simplicity, which perhaps goes some way to account for its comparative constancy.

How it Works

The absorption type consists in its simplest form of a single inductance tuned by a variable condenser, the closed circuit so formed being placed somewhere near the receiving set. The coupling between the coils in the set and the one in the wavemeter then causes a transference of energy from one to the other, which may result in stopping the receiver from oscillating, and will certainly cause clicks to be heard as the two circuits come into tune with each other.



The construction of the meter is extremely simple.

An Important Point

If the absorption circuit is placed very close to the receiver it will actually stop the latter from oscillating when in tune with it, and as the wavemeter dial is turned *two* clicks will be heard, one denoting that the set has ceased to oscillate, and the other that the wavemeter dial has been turned beyond the resonance point, and the set has started to oscillate once more.

As the frequency to which the wavemeter is tuned is approximately midway between the clicks, if they are widely separated accurate measurements will be impossible. Hence the set and the meter should be separated as far as possible, and usually before the absorption effect becomes nil the two clicks merge into one and accurate reading becomes easy.

A Secondary Effect

This adjustment is also beneficial in another direction, as it has the effect of reducing the mutual inductance between the coils. In consequence the apparent inductance of the wavemeter coil may be affected, and if extremely accurate measurements are desired it is wise to keep the distance between set and wavemeter constant.

Special Features

The photographs accompanying this article illustrate an interesting absorption wavemeter, which has several unique constructional features. Of these the interchangeable direct-reading scale is the most important. The usual method is to draw a chart showing the relation between dial reading of the wavemeter condenser and the frequency, but the greater convenience resulting from direct reading is well worth the extra constructional trouble entailed.

As the wavemeter may be desired for more than one frequency range the scale (to which is attached its respective coil) is made interchangeable. The scale also gives simultaneously corresponding frequency and wavelength readings, a refinement which will be appreciated by those who are not quite as familiar with frequencies as they are with wavelengths.

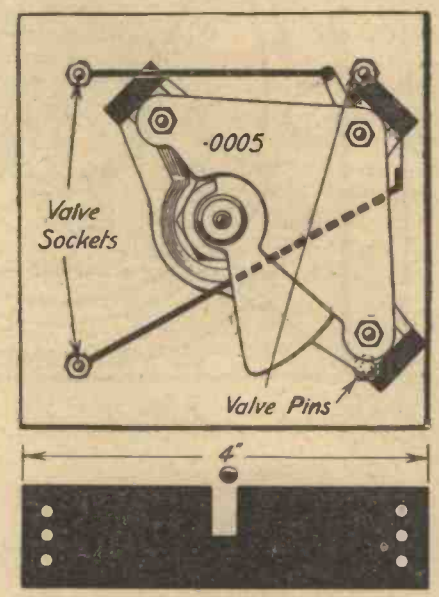


Fig. 1(a).—The layout of the panel carrying the variable condenser will be apparent from this diagram. (b) Two pieces of ebonite of this shape will be required for each coil former.

Materials

The list of components and materials necessary is not a long one and is as follows:—

One "Utility" low-loss condenser, .0005.

One sheet of Ivorine (Hobbies, Ltd.).

Ebonite panel 4 in. × 4 in. (any reliable brand).

Four valve sockets (about ⅝ in. long).

A DIRECT-READING ABSORPTION WAVEMETER

(Continued)

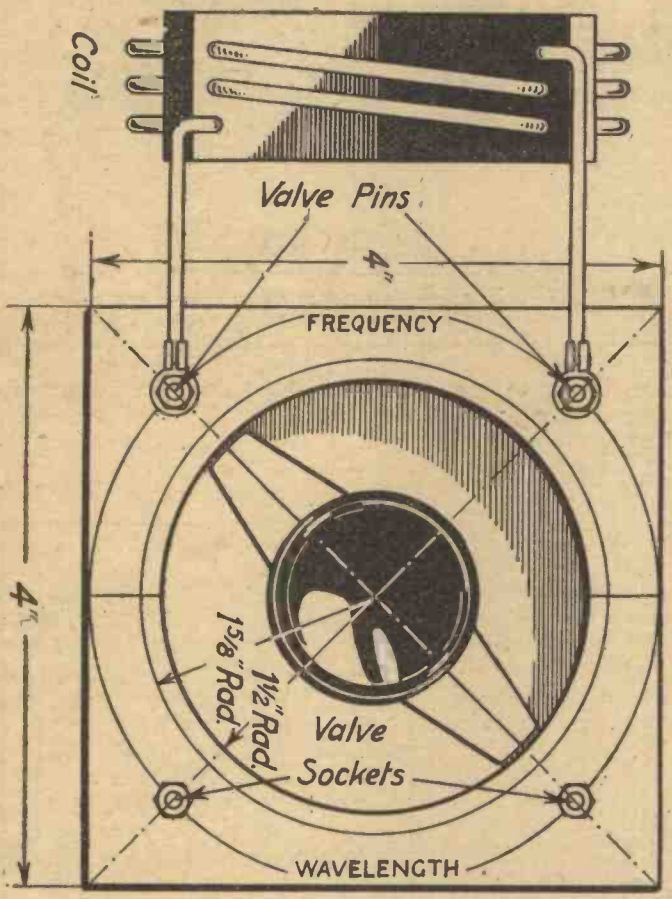


Fig. 2.—The marking of the positions of the valve pins and sockets should be done with care, to ensure that they register with those on the ebonite panel.

Four valve pins (shortened to suit sockets).

A suitable cabinet.

Some scrap ebonite and 14-gauge bare copper wire.

Figs. 1 and 2 preclude the necessity of detailed description of the method of mounting the variable condenser, two valve sockets and two valve pins on the panel.

The centre of the condenser spindle is found by the intersection of the diagonals, while the intersections of a 2-in. radius circle, with the same diagonals, give the pin and socket centres. This way of marking out successfully obviates errors, and a resulting badly fitting scale. The position of the condenser should also be noticed.

The Scales

The ivorine scales are marked similarly to the panel, but before the 3-in. centre is cut away (for this operation use a sharp pair of scissors) the reverse side must be marked ready for calibration. Two concentric circles 4 in. and 3¼ in. in diameter are deeply scratched with a pair of sharp dividers. Two further lines are scratched dividing the circle into two semi-circular scales. The lines are then made to stand out by filling with Indian ink.

For constancy of calibration the coil former and the internal connections must be as rigid as possible.

Scale Indicator

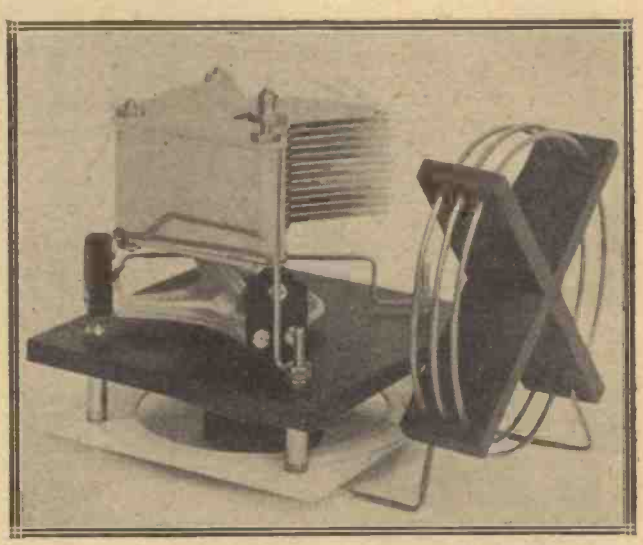
The two scales necessitate a dual indicator, which is cut to the shape shown in Fig. 2, a hole ⅝ in. diameter being cut in the centre. It then fits on the underside of the condenser knob (the original dial having been first removed) and is securely fastened by two 6BA screws tapped into the knob.

The Coil

The coil used is not remarkable for "low-loss" qualities, but, which is more important for the purpose in view, it is rigid and well insulated. The former from which the coil derives its rigidity consists of two pieces of ¼-in. thick ebonite cut as suggested in Fig. 1b. The former shown is designed for a coil of three turns, hence the width is 1 in., allowing a spacing of ¼ in. between the turns. Larger coils can be closer spaced in order to keep the width down. Attention is drawn to the size of the holes, which should fit the wire fairly tightly.

Winding the Coil

The coil is formed on a 2½-in. diameter cylinder, as it will spring to approximately the required diameter. When the coil is threaded on, the two ends are bent as shown and fastened to the valve pins on the scale by means of two soldering tags. The ends should be long enough to hold the coil away from the cabinet so that vibration will not cause trouble.



Calibration

Before calibration is attempted it is advisable to read the article on "Calibrating a Short-Wave Absorption Wavemeter," by D. J. S. Hartt, B.Sc., in Vol. 7, No. 3, of *Wireless Weekly*. This describes the "Lecher Wire" method of calibration. The most convenient

(Continued on page 359.)

Operating the "Twin-Coil" Four-Valve Set

By C. P. ALLINSON, A.M.I.R.E.

The adjustment of the neutralising condensers and the coupling battery in this receiver need careful attention, after which excellent results may be expected, as indicated by the test report.

THE constructional details given in last week's issue will have enabled interested readers to build the twin-coil four-valve set.

On the Aerial

The receiver may now be tried out on the aerial, and it will be necessary to determine three things: (*a*) the correct settings of the neutralising condensers, (*b*) the correct value for the coupling battery between the plate of the detector valve and the grid of the L.F. valve, and (*c*) whether grid bias on the H.F. valves can be used; it is an advantage to do so if its use is not accompanied by any drop in signal strength, since it reduces the total plate current passed.

Connect the set to the aerial and apply the correct voltages to the H.F. and detector valves. With quarter-ampere valves (D.F.A.1, B4, D.E.5, etc.) the correct voltage for the H.F. valves was found to be about 45 volts, with .06 valves 90 volts, while the detector, if of the D.E.5 or D.E.3B type, may be about 100 volts.

Neutralising the Set

Plug the 'phones into jack No. 1 and with the reaction condenser set at zero tune in the local station. Having tuned it in to a maximum, unscrew the resistor controlling V2 (which is the valve preceding the detector) and turn the neutralising condenser spindle (C_4) till the signal is either entirely balanced out or is reduced to a minimum. Switch this valve on again, and repeat the process with the first valve, and its neutralising condenser C2. The receiver will now be perfectly stable on the H.F. side, and reaction may be used to cause the detector valve to oscillate without radiation taking place.

The receiver is not, however, quite in its most sensitive condition, and the necessary adjustment to get it so should be made on a distant station of higher frequency, such as Brussels. This and other operating points will now be dealt with.

ELSTREE TEST REPORT

The set was easy to neutralise and pleasant to handle, searching being easily accomplished.

The reaction adjustment enabled the receiver to be maintained in a sensitive condition without continual alteration, and searching could be conducted without its aid.

The selectivity was good, Manchester being received free from London, while Cardiff was heard at about equal strength.

Operating

The procedure of tuning-in will be found simple: the first two dials read the same within about a degree, the third one will read slightly lower. Having tuned-in the desired station, the value of the reaction condenser required to bring the set to the edge of oscillation should be noted, and this condenser adjusted about three degrees below this point.

The first neutralising condenser is *reduced* in value till the set just comes up to the oscillation point, it is then increased about half a turn. The same is done to the other neutralising condenser. The reaction condenser is now increased again, and the set should go into oscillation at very nearly the same point as it did before. Should it now be found that with the detector oscillating, adjusting either of the first two tuning condensers has a serious effect on any beat note heard, one of the H.F. valves is too much under-neutralised, and a slight readjustment of the appropriate condenser must be made.

Stability

Once these adjustments have been made it will be found that they hold over the whole frequency band covered by the receiver, and as long as the three tuning condensers are kept in step stability should be perfect right down to the lowest readings on the condensers. If they are not all set together it may be found that short-wave oscillation results over the last two or three degrees of their range, but since the highest frequency receivable is above 1,500 kc. (below 200 metres) this will not interfere with broadcast reception.

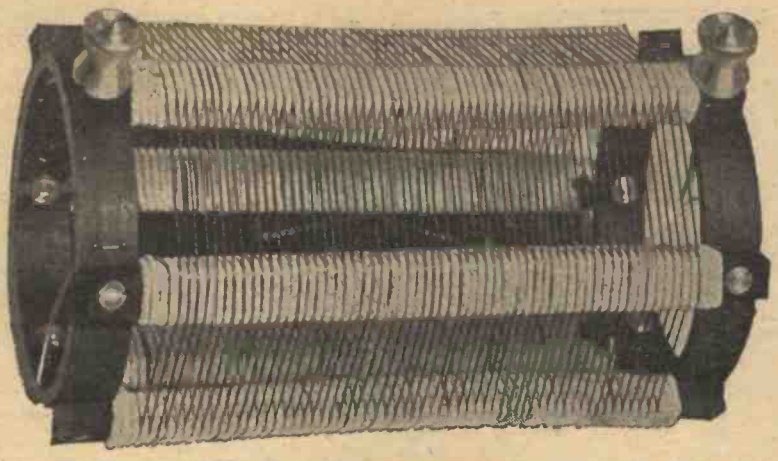
Now tune-in the local station again and plug the loud-speaker into jack No. 2, and with a 100-volt battery connected to terminals G.B. – and G.B. + adjust the value of the tap-

(*Continued on page* 354.)

THE BASIS OF COIL-RESI

By J. H. REYNER, B.Sc. A.M.I

That it is necessary to hav basis of high-frequency resis is evidenced by the conflict Mr. Reyner here gives an which have previously been



The results of Mr. Reyner's measurements on a coil of this type were very similar to those obtained by other authorities. He has, however, been directing his attention to more compact coils.

SOME time ago I discussed at some length the question of the high-frequency resistance of tuning coils, and suggested that the use of a finer gauge of wire than that hitherto employed was preferable. Certain definite figures were given for the resistance of tuning coils at various times, and the interest aroused has been considerable.

Conflicting Opinions

Comparatively recently, however, various results have been published by other journals and by manufacturers, which appear at first sight to be directly contrary to those previously obtained and published by myself. In fact, one writer* has definitely stated that he is unable to agree with several of my conclusions.

R/L Ratios

At first sight it would certainly seem that there was some serious discrepancy somewhere. To take a particular example, I stated in an article some time ago that the best coil I had tested had a decrement of 0.35 at 825 kilocycles. This would correspond to a ratio of R/L of about .057.

As a matter of fact this value has been considerably improved upon, and it is now possible to obtain a coil having a ratio of R/L in the neighbourhood of .03. Even this value, however, would appear at first sight to be distinctly high when compared with some other values which have been given. Details of coils have been published having a ratio of R/L as low as .015 or even less.

Information Lacking

Now this apparent discrepancy is entirely due to an inadequate statement of the basis on which the coils are to be judged. If low-loss is the ultimate requirement, then even a value of R/L as low as .015 is by no means the last word. Large transmitting inductances, where the size can be increased to a considerable extent, have a ratio of R/L considerably below this value. The Rugby inductances, for example, have a ratio of R/L less than .0005.

On the other hand, it is rapidly becoming appreciated that for the satisfactory design of selective receiving equipment, and particularly for multi-valve high-frequency receivers, the elimination of stray coupling is a most desirable feature. This carries in its wake the demand for compact coils and compact receivers as a whole.

Factors Controlling Selectivity

It is a well-known fact that in order to obtain selectivity with adequate quality, a certain minimum resistance is necessary in each tuning circuit. For a receiver employing two tuned circuits the demands of quality and selectivity are incompatible, and some sacrifice of one has to be made. If selectivity is the criterion, a reasonable result may be obtained with a coil having a ratio of R/L equal to .02. This, of course, must include the damping introduced by the valve circuit, but in the majority of receivers this may reasonably be considered as offset by the reaction which is usually provided. Better results are obtainable using three circuits, in which case, with a small sacrifice of quality (probably unnoticeable), it is possible to obtain reasonable selectivity if the ratio of R/L for each of the tuning circuits is in the neighbourhood of .04 to .045.

It has been shown that a simple hank coil of this type may have quite a low value of H.F. resistance.

Some Coils Measured

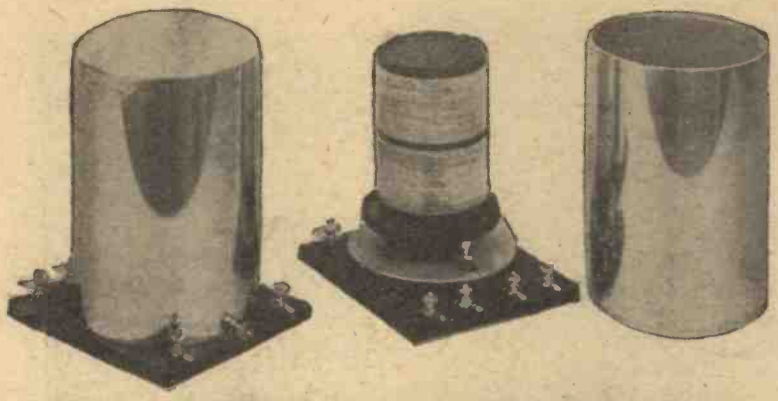
Now such values are within the bounds of possibility even for a small

* Sowerby, *Experimental Wireless*, April, 1926.

ISTANCE MEASUREMENTS

(Hons.), A.C.G.I., D.I.C.,
.E.E.

e... clear statement of the tance measurements of coils ...g opinions on this subject. ...explanation of the results published in these pages.



The screened coils, of the type designed by Mr. Reyner, shown here complete and with the screen removed, were found to have a low R/L ratio.

and compact coil. There is the well-known "Dimic" coil, for example, which has a resistance of slightly less than 6 ohms at 750 kilocycles, so obtaining a ratio of R/L of less than .03. Again, we have the coils which were recently designed by myself for use in the screened containers. These coils, which were wound with No. 30 gauge wire suitably spaced on a 2-in. diameter former, have a ratio of R/L of the order of .03 without the screen and .033 inside their screened containers.

Large diameter relative to winding length is a factor for low H.F. resistance for a given frequency.

Some binocular coils recently designed by Mr. C. P. Allinson, of the Radio Press laboratory staff, had an inductance of 300 microhenries and a resistance of about 13 ohms only, giving a ratio of R/L of .043. This is all the better in view of the high inductance of these coils.

All these coils, therefore, are within the limits required if a really selective receiver is to be designed, and they facilitate the construction of such equipment because of their compactness.

My Own Experiments

Any seeming discrepancy, therefore, which may appear to have existed is due more to the fact that I have been concentrating on smaller and more compact coils, and for this reason the results have of necessity been somewhat higher than had been given in other publications. As a matter of interest, I tested for myself one of the lowest resistance coils given, actually wound with No. 16 gauge wire on a 3¾-in. diameter former, and, as one would expect, I obtained a value in close agreement with that given by other authorities.

From my point of view, however, a coil of this diameter is unsatisfactory, and in fact I compared the coil with one of equal inductance wound with No. 30 gauge wire spaced 40 turns to the inch on a 2-in. diameter solid former, and obtained for the second coil a resistance of 2½ ohms, giving a ratio of R/L equal to .025. For anything except a single circuit this second coil comes within the limits described, and can therefore be considered a satisfactory low-loss coil, which has in addition the merit of compactness.

What Gauge of Wire?

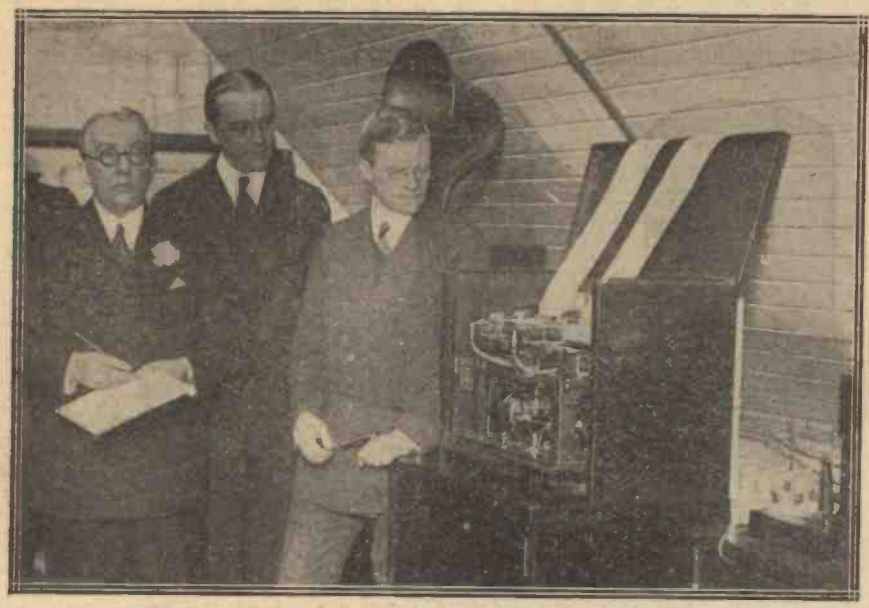
For single circuits there is an advantage in increasing the diameter of the former and using a heavier gauge wire. According to the Bureau of Standards in America, however, there is little to be gained by increasing the size of the wire beyond about No. 24 gauge. Although the use of No. 16 S.W.G. does give a slightly lower resistance for any given inductance, yet the use of this wire is apt to make the coil unwieldy, particularly if a reasonably large inductance is required. In a recent publication ("Radio Frequency Resistance and Inductance of Coils Used in Broadcast Reception"), the Bureau of Standards suggests that little advantage accrues from the use of a thicker gauge of wire than No. 24.

Litzendraht

The use of Litzendraht, comprising 32 strands of No. 38 gauge, was found by the Bureau of Standards to give definitely better results. The use of this wire, however, I have not discussed myself, because unless it is used by an expert the results are often worse than with solid wire. I see, however, that one firm has started to market coils wound with Litz. wire, so that we may be able to obtain even better results from compact coils in the future.

MONEY "VIA ETHER"

It has been prophesied that the next big development in wireless will be the successful transmission of pictures from any point to all parts of the world. A most interesting demonstration of a method of picture transmission which is practically ready for use as a commercial service is described in these pages.



Among those present at the demonstration were (left to right) Mr. A. V. Houghton, the American Ambassador; Mr. Owen D. Young, Chairman of the Radio Corporation of America; and Captain R. H. Ranger, the inventor.

AT Radio House, London, on April 20, the first tests were carried out of a greatly improved system of radio-photography. Although the system is not new (it was explained by Capt. Ranger, the inventor, that the basic idea was almost as old as telegraphy), the system has now reached such a state of perfection that it is intended to inaugurate a commercial service some time this year.

Previous Demonstrations

Some of our readers will remember that as long ago as November, 1924, a demonstration of a similar system was given, but it is claimed that important modifications developed in the last twelve months have meant progress from laboratory instruments into commercial machines of untold future possibilities.

A Distinguished Gathering

A distinguished gathering included Mr. A. V. Houghton, the American Ambassador; General James G. Harbord, President of the Radio Corporation of America; Mr. Owen D. Young, Chairman of the Radio Corporation; and many well-known journalists.

Mr. Houghton despatched a greeting to St. Paul's School, Concord, New Hampshire, couched in the following terms:—"This is the first message reproduced by wireless across the Atlantic. May I send it to you and the school with my best wishes? — HOUGHTON, April 20."

Our Representative attended the demonstration of picture transmission by wireless given by Capt. R. H. Ranger at Radio House on April 20. General James G. Harbord, President of the Radio Corporation of America, wrote a special message for our readers which is reproduced on the next page.

A Cheque Transmitted

Messages of all sorts were then sent, one of them being an autographed manuscript by Robert Browning, taken from the "Grammarian's Funeral," addressed to the St. Lawrence University, Canton, New York.

One of the most interesting tests to which the new system was put was the transmission of a cheque drawn upon the Bankers' Trust Company in New York by General Jas. G. Harbord in favour of the Radio Corporation of America.

The Apparatus

A negative film was prepared of the cheque, placed upon the cylinder of the transmitter, when it immediately began to click, making a noise similar to a typewriter, the film rotating in alternate directions as a traversing beam of light completed its travel.

Almost immediately a checking apparatus began to work. This checking was intensely interesting, being the wireless signals from the Carnarvon Station of the Marconi Co., through whose system the transmission took place, picked up at Radio House and converted back into pictorial form.

While one was watching the beam of light travelling across the film being transmitted, it was possible by just moving the eyes to see the cheque being received.

A Great Achievement

To realise that this had been transmitted to Carnarvon, was going out from Carnarvon all over the world and being immediately picked up by ourselves, stimulated the imagination to realise a few of the possibilities of the latest use to which wireless and the thermionic valve have been put.

We learnt by wireless that after the necessary endorsement had been placed on the cheque, this was duly honoured less than one hour after it was drawn in London.

As Mr. Houghton said, "The demonstration has been marvellous, and the future possibilities cannot be gauged."

A Message for Our Readers

General Harbord said that the Radio Corporation of America were entirely satisfied with the tests, especially as Capt. Ranger has not

Money "Via Ether"—*continued*

been in England more than a fortnight.

As he was talking to the representative of the largest radio publishers in the world, with a public keenly interested in all matters wireless, Gen. Harbord naturally had a few special words for our readers, and a facsimile of his message is reproduced in these pages.

The Apparatus Used

Capt. Ranger then very courteously gave a complete explanation of the whole of the apparatus. First of all, when it is desired to transmit a picture, a negative of this must be prepared on an ordinary photographic film. The film is then placed on the glass cylinder, which forms an integral part of the transmitting apparatus, and it is then ready for transmission.

Powerful Illumination

Outside the glass cylinder there is a powerful electric glow lamp of the projector type. The light from this is allowed to enter the cylinder, where it impinges on a glass prism and is reflected at right angles on to the wall of the cylinder.

This light is sufficiently intense to penetrate the film and produces a ray on the outside.

The glass cylinder is then caused

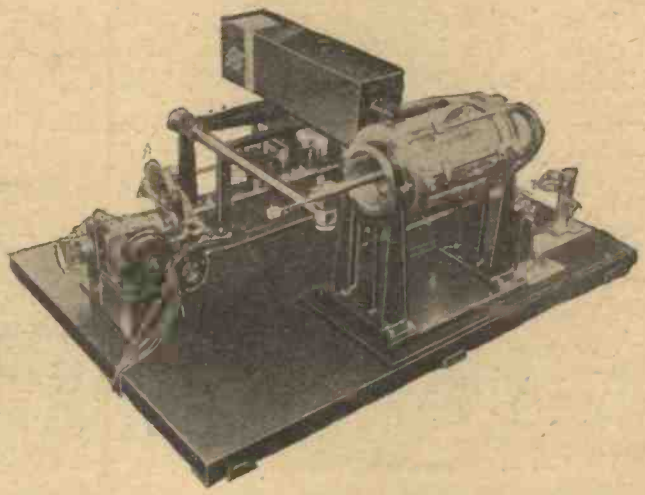
A photograph sent by wireless during previous experiments. The black dots were caused by atmospherics.

to rotate by means of a drive from an electric motor.

During the rotation the reflected beam impinges on lighter and darker portions of the film, varying the amount of light transmitted through the film, which thus becomes a fluctuating beam of varying intensity.

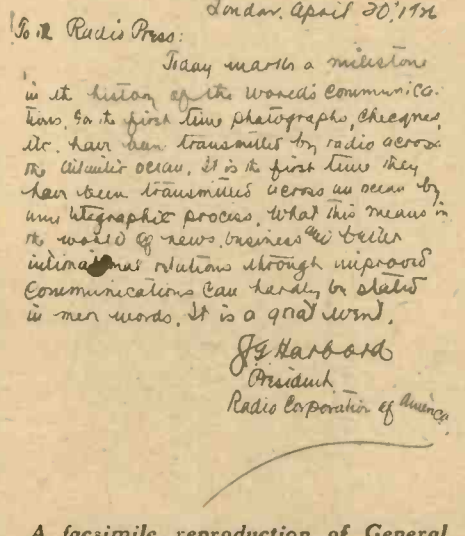
* * *

Part of the apparatus used by the Radio Corporation of America for the transmission of pictures.



* * *

This fluctuating beam is then concentrated by means of prisms and lenses on to a photo-electric cell, which converts the varying


London. April 20, 1926
To the Radio Press:
Today marks a milestone in the history of the world's communications. For the first time photographs, cheques, etc. have been transmitted by radio across the Atlantic ocean. It is the first time they have been transmitted across an ocean by any telegraphic process. What this means in the world of news, business and better international relations through improved communications can hardly be stated in mere words. It is a great work.
J. G. Harbord
President
Radio Corporation of America

A facsimile reproduction of General Harbord's message.

light into a series of equally varying minute electric currents.

The Transmitter's Eye

The photo-electric cell, the invention of which has made wireless pictures and speaking films possible, is popularly called the "eye" of the transmitter, and possesses the peculiar property that its resistance varies according to the intensity of light thrown upon it.

This cell in appearance is like an electric bulb, but it is coated over the inside with potassium hydride, an easily ionised salt. One portion, however, is not coated, a clear circle being left as the aperture through which the fluctuating light enters the cell.

Inside are two electrodes, which are maintained at a potential just below the striking point for ionisation.

Defects in Earlier Cells

Previously, in all similar apparatus, before the discovery of the potassium cell, the element selenium had been used, but this suffered from a serious "time lag," which varied according to the light intensity.

The inertia, or "time lag," of the new cell is inappreciable, the variations of resistance being simultaneous with the light variations.

Transmitting a Picture

To send the whole picture the cylinder rotates backwards and forwards until the whole surface of the film has been exposed to the light. So perfect is the apparatus in its present form that it is possible to cover 96 lines per inch longitudjnally and 60 per inch laterally, enabling half-tone work to be sent.

The cylinder rotates through an angle sufficient to expose the whole length of the film, and with each revolution or part revolution the electric eye is pushed up one step.

Amplification and Reception

The variations in current from the "eye" are then passed to a bank

(*Continued on page* 353.)

AMATEUR TRANSMITTING NOTES

New Call-Sign Allotted

2BPV: T. A. Harwood, Battisford Hall, Needham Market, Suffolk.

QRA's Wanted

X2M, G-5MT, G-5BU, SS-8LBT, UR, K-V8, N-PB7, P-3OR, P-3GB, KEGK, ONM, K-J1, SMVJ, S-2BS, N-oUC, KWS, LFG, PE-6XC, F-8BE, SMYU.

small group of them reproduced on this page. We have received them from eleven countries, and they are addressed to the following stations:—G-6YD, GBM, G-5UQ, G-2IA, G-2ZA, G-2LF, G-5HG, G-2IT, G-5GS, G-2QM, G-6EP, F-8FU, F-8RST, OCNG, B-O8, I-1AF, U-1AI, SMUV, RRP, L-1AG, N-oRP, PCLL, D-PK7, XGB1.

Of the eight cards shown in this photograph of some of those sent in to us for distribution, it will be seen that three are from India. Two lists of Calls Heard, sent in by amateurs in India, appear on these pages, and it is apparently a splendid location for long-distance work.

QRA's Found

G-5IA: G. M. Whiteley, "The Hollins," Sowerby Bridge, Yorks.

K-W1: Funkverein, Halle-a-Salle, Reilstr. 128.

PI-3AA: F. Johnson, Elser, Baquio, Philippine Islands.

ISRA: Poste de l'aeronautique militaire Italienne, Viale Milizia, nr. 5, Roma.

QSL Cards Held

Our collection of QSL cards now forms quite an interesting assortment, as may be gathered from the

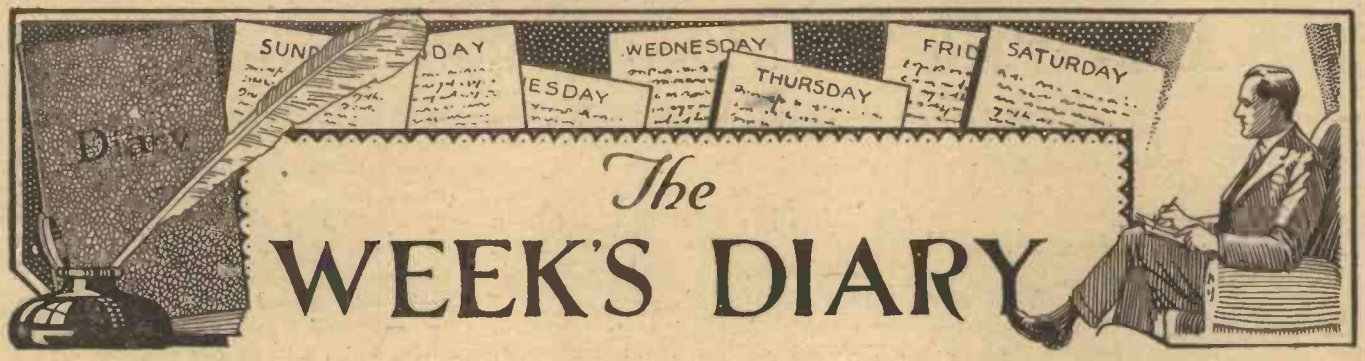
We have received complaints of the misuse of the following call-signs. Most of the offenders are apparently transmitting on telephony in the London area:—2GC, 2ST, 5TB, 5UN, 6MB, 2NT.

* * * *

Below are given two lists of Calls Heard. The first was sent in by Mr. R. J. Drudge-Coates (Y-DCR), of Cambridge Barracks, Rawalpindi, India.

British: 2NM (Fone), 2OD, 2CC, 2LZ, 5LF, 6MA, 5NJ, 2VO, 5DA, 5MA, 2VR, 6AL, 6YD, 2KF, 6EP, 5SZ, 2QB, 2XY, 2QM, 2II, 2VO, 6DO, 2IH, 6WH,

(*Continued on page* 357.)



The WEEK'S DIARY

I AM very sorry to hear that Capt. C. A. Lewis has found it necessary to resign his position with the British Broadcasting Co., in order to devote more time to literary work. "Uncle Caractacus" will long be remembered by the children with affection, and by the many grown-ups who enjoy the Children's Hour.

Capt. Lewis came to the Broadcasting Company in its very early days, at a time when Mr. Arthur Burrows was struggling manfully to do all the programme work himself. I believe one of the first tasks undertaken by the new Uncle was to reorganise the Children's Hour, and there is no question that he had a very considerable influence for the good. So far as Lewis's activities outside of the Children's Hour are concerned, he has made many friends by his excellent delivery of the Philemon talks. He also stood out as one of the few announcers who could read poetry well. I am sure *Wireless Weekly* readers will wish him all success in his future literary work.

* * *

RADIO HOUSE, the City offices of the Marconi Co., and the point to which the land lines from the several Marconi stations are brought, was the scene of a most interesting demonstration the other day of sending photographs by wireless. We were all jostled together in a tiny room high up in the building, and so great was the congestion that the Press photographers had to draw lots as to who should be permitted to take the one photograph allowed! General Harbord, President of the Radio Corporation of America, created an excellent impression among the visitors. He is quite different in appearance from the conventional American business man of fiction (and advertisement), and would easily pass as a retired British Admiral.

A part of the proceedings was the transmission to America of a cheque drawn by General Harbord on the Bankers' Trust Co. In due course it was honoured. Personally I venture to doubt whether, in the present state of the art, banks on this side would be prepared to honour such documents if generally transmitted. After all, the cute bank manager, if he has any doubt, can trace a hundred little individualities in the actual handwriting and penmanship, which would be very difficult to detect in a photograph.

AN AERIAL HINT.

Heavy showers of rain, such as are often experienced at this season of the year, sometimes cause trouble owing to water running down the lead-in wire and possibly injuring the earthing switch or entering the house. A special lead-in insulator will deal with this trouble, but it is possible to cure it in a simpler way. An insulator with a length of cord on it is attached to the lead-in a foot or two from the window and the cord is fixed to a nail in the wall so as to form a downward kink in the lead-in. Water will then run down the lead-in and fall off at the insulator, instead of flowing down on to the earthing switch or into the house.

* * *

CAPT. LEWIS'S place as Chairman of the Programme Committee of the British Broadcasting Company will be taken by Mr. R. H. Eckersley, brother of the Chief Engineer. "R. H." has been associated with the B.B.C. for some time, although one hears far less of his activities than those of his brother. For a time he was connected with outside broadcast work, but for some time he has been Capt. Lewis's Chief Assistant.

* * *

I SEE the new Polish broadcasting station at Warsaw is now open, and the Polish Prime Minister, Count Skrzynski, attended the ceremony and addressed a few remarks to foreign listeners. I wish the new station all success. All the same, I do not envy the position of the B.B.C. announcer if at any future occasion there is to be a re-broadcasting from this station. Think of the agonies of the announcer trying to tell the listening British public that Count Skrzynski (you see I have the advantage over you, I can write it—you must read it) is about to broadcast.

* * *

AMONG the many problems connected with American broadcasting is the difficulty arising owing to the different ownership of various stations. The Zenith Co., in Chicago, have for a long time been "up against" the Radio Corporation of America and other organisations on the wavelength question, and some time ago the Zenith Co. were forbidden to broadcast on a wavelength they had previously been using. The Zenith people refused to take any notice of the ban, and went on broadcasting, challenging the Government to make a test case of it. An action has been fought, and the Government has lost the day, so that at the moment, and until the new legislation has passed, there is likely to be chaos in the transatlantic ether.

* * *

MOST of the daily papers have given space to an account of what is said to be a remarkable "wireless-fitted" house in New York. The house, situated on Staten Island, New York, is wired so that loud-speakers can be switched on in every room of the house; the wiring being concealed everywhere.

Capt. Eckersley, by pressing a key at Radio House, the City offices of the Marconi Company, and by utilising the Transatlantic radio service, was able to switch on the installation from this side.

THE WEEK'S DIARY
(Continued)

I take off my hat to the publicity people who arranged the " stunt " in America. There is no novelty in it so far as I can trace, and the Burndept Co. here have been installing a similar system in this country for some time past. The whole point is, how many people want a loud-speaker in every room? Personally, I have had three rooms wired for loud-speakers for at least a year, and so far have found no need to install loud-speakers in the kitchen or bathroom. So far as the latter is concerned, there is very little broadcasting during the hour of the morning tub, while if the only accompaniment of the hot bath at night is to be the Savoy Havana Bands I would rather do without it.

Capt. C. A. Lewis, perhaps better known to many as "Uncle Caractacus," who has resigned his position with the British Broadcasting Company.

* * *

MR. BARTON-CHAPPLE tells me that he is lecturing in Bradford on Friday, April 30, at the Chapter Hall, Church House, North Parade. Bradford readers will find it well worth while to attend this lecture, as they will have the opportunity of seeing and hearing one of the " hush " sets, developed by Radio Press Laboratories during the last few months. I have heard it, and you can take my word for it that it is a very remarkable instrument.

* * *

A NUMBER of passengers on a liner in the Indian Ocean amused themselves recently by playing skittles by wireless. On March 5 the liner *Herefordshire*, homeward bound from Rangoon, received a wireless message from the *Oxfordshire* of the same line (outward bound) challenging six passengers to a game of skittles, six rounds each. After each round the scores were wirelessed from one steamer to the other. During most of the play the boats were about 200 miles apart, and up to the fifth round the score was level. In the end the *Oxfordshire* won by 9 points.

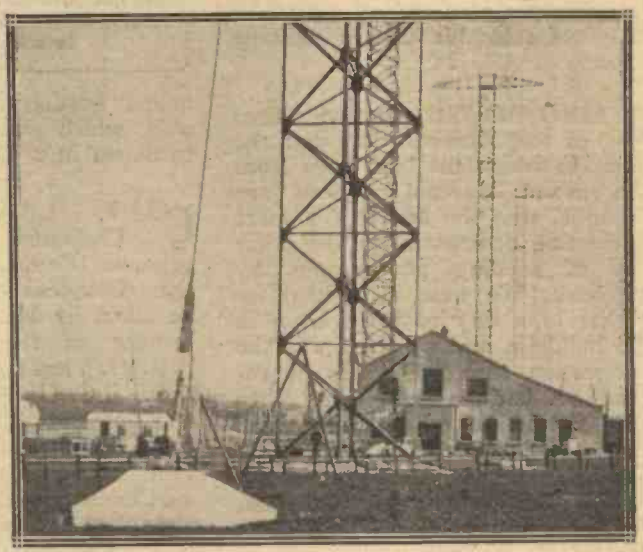
This reminds me of the remarkable popularity achieved by the chess matches organised between the liners travelling to and from South Africa before the war. At that time wireless communication was not so hidebound by rules and regulations as it is at the present time, and the greater freedom allowed to the wireless operators enabled many excellent schemes to be organised. After a time the Marconi Company issued instructions that such matches were only to be conducted on the strictly business basis of each ship sending a formal telegram (to be paid for, of course) to the other ship and receiving a reply in a similar fashion. This rather damped the ardour of chess enthusiasts, who were not willing to pay eightpence a word for such communication!

I remember myself taking part in a limerick competition between ships, organised by the purser of a liner travelling from South Africa to England. The idea was to see which ship of the two could raise the largest number of limericks (good, bad and indifferent). An appalling number—many of dubious quality—were collected in a very short time, and as the ships passed out of range of one another there were still a few more to come.

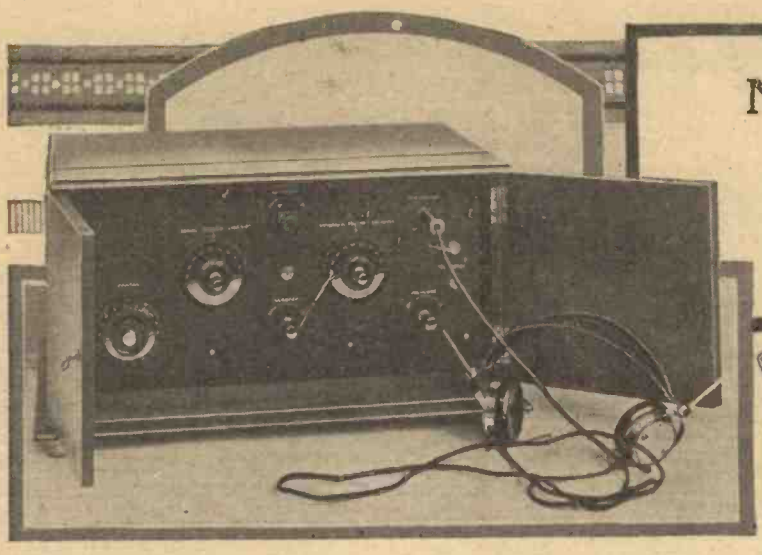
* * *

A RATHER surprising number of breaksdown of the new 2LO station have occurred since it was erected on top of the Oxford Street building. As one of those present at the Press demonstration of the station when it opened, I well remember the emphasis laid by the British Broadcasting Company's engineers on the fact that practically every part of the plant was duplicated, to avoid the possibility of delay in the case of a breakdown. We were told that only a minute or two would elapse at the most for a complete change-over of apparatus to be effected. In spite of this, the station broke down again recently, and, apparently, the breakdown was of so serious a nature that it was necessary to transfer the transmissions to the old plant at Marconi House. As a matter of fact, the total number of breaksdown in all stations throughout the country is remarkably small, in view of their regular working.

WAVE-TRAP.



The beam station at Bodmin, one of those to be used for Imperial communication, is nearing completion. The size of the masts may be gauged from this photograph.



NOTES FOR THE OPERATOR

Heterodyne Wavemeters — Superhet. Troubles.

A HETERODYNE wavemeter, reliably calibrated and of sound construction, is a most useful instrument to possess. It is, however, capable of giving quite a fair amount of trouble, and, sometimes, very misleading results, if it is not properly handled. We will assume that the calibration has been performed quite accurately, and that the valve in use will oscillate over the whole range of the dial, and deal only with the faults that may occur through careless handling.

Battery Voltages

First, heterodyne wavemeters should always be calibrated with definite and known values of high-tension and low-tension, and a valve which should be specially marked and kept for use with the wavemeter only. It is important that the high-tension voltage should be the very lowest value which will keep the valve oscillating over the whole of the calibrated range. The writer seldom uses more than 18 or 20 volts; if more is employed the oscillations emitted by the wavemeter are so powerful that it is impossible to obtain an audible beat note with the receiver.

Adjusting H.T. Voltage

On rotating the wavemeter dial nothing but two clicks will be heard, the general effect being very similar to that obtained with an absorption wavemeter. On reducing the high-tension voltage by steps, however, a position will be found at which a loud heterodyne whistle, capable of being varied right down to the "silent point," which will be sharply defined, is heard. This is, of course, the best point at which to work, and it should therefore be determined *before* the wavemeter is calibrated, and that high-tension voltage should not be altered.

Position of Wavemeter

Another point that should be watched is this: If the wavemeter coil is in the same plane as, and fairly close to, the inductances on the receiver itself, an actual absorption effect may be set up, causing the tuning of the receiver to vary when the wavemeter dial is rotated, even when the valve is not switched on. The remedies for this are obvious, either to turn the wavemeter coil through 90 deg. or to remove it further from the receiver.

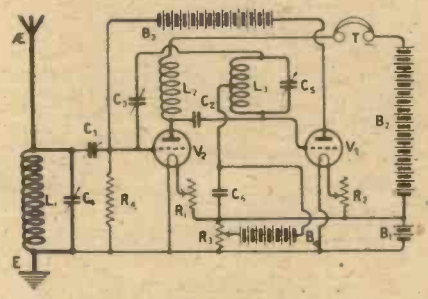
Difficulties with Superhets

The writer has recently investigated various complaints about minor ailments in superheterodyne receivers, and has in practically all cases found the fault to lie, not in the construction, but in the operation of the set. As regards the construction, however, two points that should not be overlooked are the provision of a condenser from one end of the potentiometer winding to the actual tapping, and the connection of a condenser of about .01 capacity from the "H.T. +" side of the intermediate transformers to the L.T. +. These two points are mentioned simply because the operation of a "superhet" can become extremely difficult if they are overlooked, although the set may appear to be functioning correctly.

C.W. Reception

If the set is intended for C.W. reception, and no separate long-wave oscillator is provided (the intermediate frequency amplifying valves being made to oscillate by adjustment of the potentiometer), it will often be found an advantage to connect a 30-ohm filament rheostat between the tapping on the potentiometer and the transformers to which it is connected. This will provide a very fine control of the degree of oscillation. The writer recommends the use of a separate long-wave oscillator for C.W. reception, however, as a much quieter background is obtained, and the set works more efficiently altogether.

"REFLEXING THE PRINCE CIRCUIT"



In the article "Reflexing the Prince Circuit" in last week's issue of "Wireless Weekly," Fig. 4 on page 316 was incorrectly shown, the battery B4 being wrongly connected. This diagram is correctly reproduced herewith.

We are asked by Messrs. Burndept Wireless, Ltd., to state that in their advertisement of the Balkite Trickle Charger in the April 14 issue of *Wireless Weekly* the last sentence of the paragraph should read:—Its current consumption is less than that of the smallest electric lamp made—average cost ½d. *per day.*

Wireless News in Brief.

Licence Prosecutions Proceedings have so far been taken against 135 persons for installing wireless apparatus without taking out a licence, and 134 convictions have been recorded. We understand that steps are being taken by the authorities to locate unlicensed users of wireless sets.

* * *

B.B.C. Mystery Programme On the evening of April 30 the B.B.C. are to broadcast a programme consisting mainly of "mystery" items. For the solution of the puzzles large prizes are to be offered.

* * *

London Station Breakdown Owing, it is stated, to a temporary defect in the transmitting aerial, the London Station programme was interrupted on April 16. After some delay the broadcasting of the opera "La Traviata" was carried out via Marconi House.

* * *

On April 18 a new broadcasting station was opened in Poland by Count Skrzynski, the Polish Prime Minister.

* * *

A Public Lecture At 7.45 p.m. on April 30 a lecture, open to the public, will be given by Mr. H. J. Barton-Chapple, who is well known to our readers. The arrangements are being made by the Bradford Radio Society, and the lecture will be given in The Chapter Hall, Church House, North Parade, Bradford. Mr. Barton-Chapple has chosen as his subject "Some Recent Developments in Broadcast Reception"; the lecture will be illustrated with lantern slides and will be followed by a demonstration.

* * *

Irish Railway Wireless We hear that tests of reception carried out on trains running between Dublin and Cork, on the Great Southern Railways of Ireland, have been quite successful.

* * *

Future Programmes Sunday, May 2.—London, 3.30 p.m.: Choral service from King's College, Cambridge. Glasgow, 9 p.m.: Act I of Wagner's "Parsifal." Bournemouth: Light symphony programme.

Monday, May 3.—Belfast: Chamber music. Manchester: Solos and songs at the harp.

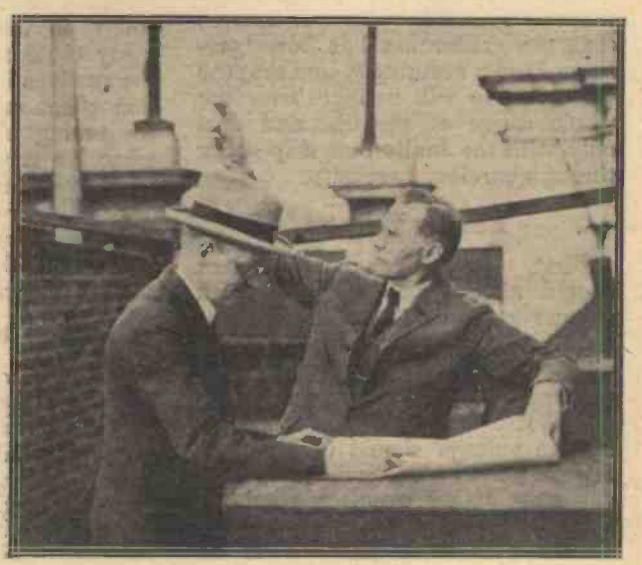
Tuesday, May 4. — London: Popular orchestral concert. Birmingham: Welsh programme. Cardiff: Musical comedy.

Wednesday, May 5: Separate programmes from main and relay stations.

Thursday, May 6.—London, 10 p.m.: Pianoforte recital by Frederic Lamond. Birmingham: Comic opera, "Les Cloches de Corneville." Aberdeen: Symphony concert.

Friday, May 7. — London: Variety and Brahms' Commemoration. Bournemouth: Band of the Royal Tank Corps. Newcastle: Light orchestral and vocal concert.

Saturday, May 8. — London: Final edition of "Listening Time" Revue. Birmingham: Popular programme. Bournemouth: Winter Gardens Night.



Capt. R. H. Ranger discussing the arrangement of an aerial on the roof of Radio House. A full account of his transmission of pictures by wireless appears on another page.

The B.B.C. announce that special staff nights are to be given at intervals from the London station. The programmes will be provided by members of the B.B.C., who possess a good deal of talent not yet fully exploited before the microphone.

* * *

May Day Broadcast On the afternoon of May Day, between 3 and 4.15 p.m., an English Folk Dance Festival will be broadcast. This will include folk songs sung by Mr. Steuart Wilson and a number of folk dance tunes.

Anode Current or Cumulative Grid Rectification?

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

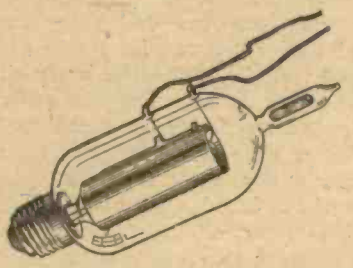
This set, designed for comparative tests of anode current and cumulative grid rectification with different valves, was described in the March issue of "Modern Wireless."

Are you familiar with the anode current method of rectification and its advantages compared with the grid condenser and leak method? Below will be found an interesting discussion of their relative merits.

IT is a curious fact that when the subject of rectification is discussed amongst amateurs their minds immediately conjure up a vision of the grid leak and condenser method (sometimes called cumulative grid or grid current rectification). This method is generally looked upon as simple to operate in practice, while the components required are the usual specified .0003 and 2 megohms. The result of this is that there is often little thought given to any other type of rectification; indeed, it is quite conceivable that many people fail to appreciate the fact that a valve can be employed in any other manner for rectifying signals.

The "Remarkable Five-Valve" Set

A glance at recent issues of Radio Press publications, however, will indicate that certain of the receivers have been designed to operate on the anode current rectification principle,



An early type of soft valve, designed by Capt. H. J. Round, in which provision was made for controlling the pressure and temperature of the residual gas present.

a typical case being the "Remarkable Five-Valve Receiver," designed by the Radio Press Laboratories, and described in the April issue of *Modern Wireless*. In this particular set, which employed three stages of neutralised high-frequency amplification, it was found that an actual increase in signal strength was noticeable with anode current rectification, as compared with the grid leak and condenser method, while it was possible to match up three of the condensers so that they gave the same reading.

Comparative Tests

Again, in the March issue of the same journal, Mr. A. V. D. Hort described a "Set for Valve Rectification Experiments," in which it was possible to employ either of the two methods at will, and the results of qualitative tests with this instrument make interesting reading.

Principles of Rectification

Before further discussion on the subject let us examine briefly the principles of the two methods. Anode current rectification, as its name suggests, takes advantage of the curvature in the anode current / grid voltage characteristic, the bottom bend being usually utilised. For any given voltage variation brought on to the grid there will be a greater increase in anode current than the resultant decrease, provided the adjustment of the valve is such that the working point is at a position such as A in Fig. 1. Thus the average anode current is increased for the particular voltage cycle indicated, and rectification is said to take place owing to the asymmetrical variations in anode current.

Practical Application

The connections for a receiver to work in this manner are quite straightforward, and reference to Fig. 2 will make this plain. The potentiometer and small tapped grid-bias battery are for the purpose of adjusting the voltage on the grid to the correct value, according to the type of valve employed in conjunction with the high-tension and low-tension voltages.

The Cumulative Grid Method

Turning to the study of grid leak and condenser rectification, the characteristic to consider is that showing the relation between grid current and grid voltage, a curve often omitted by the valve makers. The grid is kept, by the grid leak, at such a steady potential that a very minute grid current flows in the

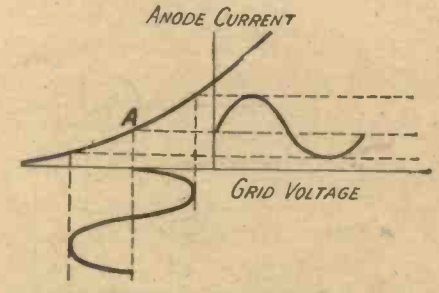


Fig. 1.—With the anode current method rectification takes place owing to asymmetrical variations in the current.

steady condition. On the application of the signal potential to the grid, its voltage falls and rises, the shape of the resultant curve depending upon the type of incoming signal, and this in turn causes a fluctuating anode current, the resultant form of which is of acoustic variation, thus producing the necessary sound in the telephones. The whole subject of cumulative grid rectification is more complex than at first imagined, especially for tele-

Anode Current or Cumulative Grid Rectification?—*continued*

phony considerations, but we will not spend time on discussing its theory.

Causes of Distortion

Now it should be apparent that the shape of the resultant signal curve will depend upon the value of the grid condenser and grid leak. It is in consideration of this fact that distortion is introduced, for although it may be possible to have both the grid leak and grid condenser variable so that the anode current variations show a perfect form for a note, say, of 1,000 cycles per second, these values will be wrong for other notes, and so distortion will be introduced.

A Convenient Compromise

Why, then, is this method so popular, if when judged from the reproduction standpoint of efficiency it is found wanting, inasmuch as a faithful reproduction of the original speech current is not possible? The answer is not hard to find, for comparisons must be made employing all the attendant apparatus necessary for reception of the wireless signals. Exact reproduction is not perfectly possible with the combination of components utilised, and thus the contribution to the distortion through the medium of this particular method of rectification is often not an unduly large proportion, provided adequate precautions are taken. The grid leak in the case of British valves should be connected

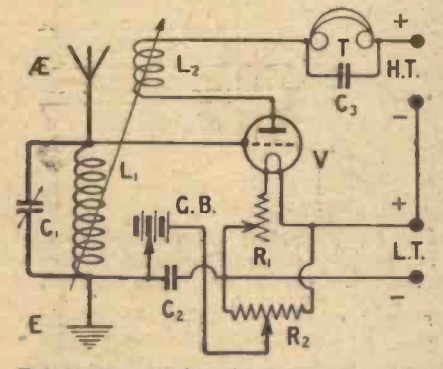


Fig. 2.—A grid-bias battery will usually be needed in addition to the potentiometer to apply a sufficiently negative bias to the grid of the valve.

to the positive leg of the filament, while the grid condenser should possess a high insulation resistance, of the order of 50 megohms or more.

Soft Valves

Returning to the anode current method, what sort of a situation is revealed? We find that unless a special type of rectifying valve is utilised, such as the QX and DEQ, the curvature of the characteristic is not sufficiently steep to give loud signals unless the incoming signal is relatively strong. When utilising the old soft valves, the characteristic is much sharper and steeper, but trouble is encountered here because of the lack of uniformity in operation, consequent upon the susceptibility of the gas present in the valve to changes of temperature and pressure. If, however, signals are comparatively strong, say, from the local station or from distant stations, if a sufficient number of stages of high-frequency amplification are interposed between the aerial and the detector, then greater purity of reproduction is secured by the employment of this method.

Damping

A further advantage is gained here since by working the valve with a sufficiently large negative grid voltage no energy is absorbed from the oscillatory circuit of the input side, and thus no damping is introduced, whereas with the grid leak and condenser method its very action is dependent upon grid current flowing, and thus damping is brought about. The measure of this defect in the latter case, however, can be suitably reduced by resort to many of the methods which have been described in the columns of this journal, and which in consequence will not be duplicated here.

Conclusion

As a result of deliberations on the pros and cons of both methods I am led to the conclusion that for the reproduction of speech and music with the least distortion anode current rectification is the best medium provided the input signals are sufficiently strong to give adequate strength. Perhaps some readers will refute this, however, and the results of experiences with both methods will be welcomed by the writer.

Anode bend rectification is employed in the "Remarkable Five-Valve Receiver," with which loud-speaker results of excellent quality have been obtained from a large number of broadcasting stations.

A DIRECT-READING ABSORPTION WAVEMETER

(Continued from page 338)

procedure is to use this method to calibrate an oscillating valve receiver, and from the resulting curve the oscillator can be set at any desired frequency or wavelength and the wavemeter marked at the point of absorption.

Marking the Scales

With the wavelength range given by the three-turn coil every metre and half-metre can be marked with short radial lines to the inner circle and every five to the outer circle. The "fives" can be numbered by sticking on small pieces of gummed paper with the corresponding wavelengths printed upon them.

The frequency scale can be conveniently marked for every hundred kilocycles, numbers being given to the "thousand kilocycle" marks.

Other scales will be sub-divided in a similar way, the range having been first found in order to ascertain the most suitable "units." Having completed it, no amateur will begrudge the time and labour spent on the construction of this instrument, as it will become a valuable guide to him when exploring the higher frequencies.

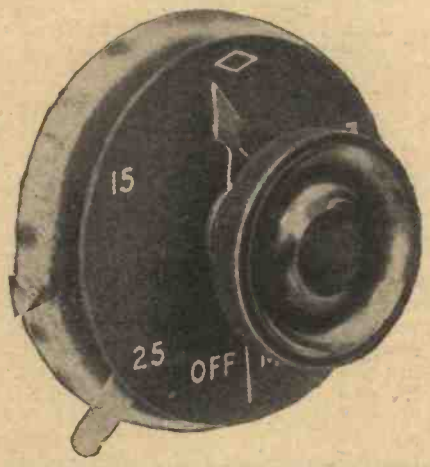
APPARATUS WE HAVE TESTED

Conducted by the Radio Press Laboratories, Elstree.

Universal Rheostat

We have received a Universal rheostat from Messrs. The General Electric Co. for test and report.

The resistance element of this rheostat is wound on a square insulating rod bent in a circle and mounted in a metal casing, being insulated from it by fibre sheet. The metal container consists of two parts, one of which has a flange, which is bent up at one end to lift the slider off the resistance wire.



The Universal rheostat submitted for test by Messrs. The General Electric Co.

There are two portions to this element, one being suitable for the control of dull-emitter valves and the other for bright, and at the junction of the two windings a projection on this metal flange is provided for lifting the slider across the junction. A small hole is drilled in the slider, so that if desired this projection affords an auxiliary off position, the projection fitting into this hole, and so giving a second positive stop.

Connections are made to this rheostat by means of soldering lugs, and a dial is provided giving the resistance of the rheostat at 4 points, while the position at which the slider passes over the projection as it moves from the high to the low resistance element is also marked.

When placed on test, the high-resistance portion of the winding was found to have a resistance of 23 ohms, the bright-emitter resistance part having a resistance of 7 ohms, making a total of 30 ohms. The contact was very quiet in action, and the bright-emitter part of the resistance passed .8 amperes without overheating.

This component is exceedingly robustly constructed, and should be able to stand up to a great deal of rough usage. Its finish is satisfactory, and the component may be mounted on the panel by means of one hole only.

Anti-Capacity Sockets

Messrs. Wates Bros., Ltd., have submitted to us for test some of their "Tuscon" anti-capacity sockets.

It is claimed that as these sockets are made of a single piece of metal they are mechanically and electrically sound, there being no losses due to joints, loose nuts, etc. A minimum of metal is used, and a maximum of space allowed between the sockets, thus reducing self-capacity and leakage. They are very easy to fit, and cannot become loose. They can be used either for valve sockets or for anti-capacity switching.

The socket is composed of a strip of plated brass 1½ in. long by ⅛ in. wide. It is slightly cylindrical in form, and at one end is completely tubular for a length of ⅜ in. The diameter is such that this end will fit tightly into a hole drilled in the panel with a No. 16 drill. The thickness of the metal at the extreme end is increased somewhat, so as to form a boss to prevent the socket being pushed right through the panel in the act of pressing it home. The fact that the socket is split enables it to be gripped tightly in the hole into which it is fitted. At the other end of the socket the strip is bent into a semi-circular form so as to facilitate soldering the connection. Underneath the panel the shanks of the sockets can be

bent away from each other, so as to reduce the self-capacity.

The sockets were mounted, and found to fit easily and firmly. As valve sockets they provided a good fit for the valve. It was found impossible to dislodge the sockets in the act of withdrawing the valve as long as the former had been pressed fully home. As the sockets project above the panel it is possible to burn out the valve by attempting to insert it the wrong way. This is a common feature with anti-capacity sockets.

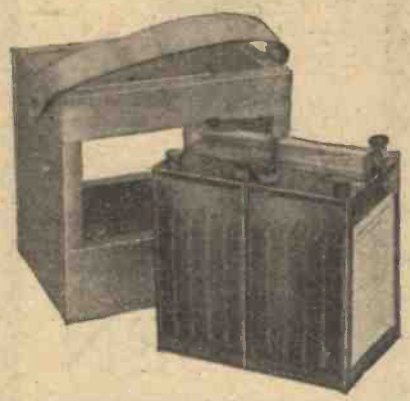
These sockets have several advantages over the more orthodox type. It is desirable to make connections with stiff wire, as otherwise there is a danger of the shanks moving round and touching beneath the panel.

A Non-Spillable Accumulator

We have received a new-type non-spillable accumulator from Messrs. Rowland, Edwards & Co. The container of this accumulator is constructed with an ingenious trap arrangement to prevent any acid being spilt in the event of the accumulator being upset. A vent is provided for allowing the egress of any gas liberated while in use, while a screw to the stopper is provided for filling the accumulator with acid.

Showing how the upper portion of the Rowland Edwards accumulator is constructed.

When turned violently on its side this accumulator showed not the slightest sign of allowing any of the acid to escape, and could be turned upside down and held thus for some considerable period without a drop of the acid coming out. Before any of the acid could be got out of this accumulator it had to be held upside down and shaken violently, a form of treatment to which it would not be normally subject.



The Rowland Edwards non-spillable accumulator.

Rated at 50 ampere-hours, on a continuous discharge on test it was found to give an actual maximum of 53 ampere-hours, after which the accumulator was completely run down.

This accumulator should prove of great use where it is necessary to keep the battery in a living-room and where it is desired to obviate all risk of damage to carpets, etc., through acid being spilt.

Variable Grid-Leak

We have received a variable grid-leak for test and report from Messrs. Igranic Electric Co., Ltd. This is constructed on similar lines to the high-resistance potentiometer made by the same firm, except for the fact that the carbon track on which a brass brush slides is specially prepared to have a high resistance.

When placed on test this grid-leak was found to have a resistance variation between 10,000 ohms and 9 megohms, while the form of construction is such that the reading on the dial will be approximately proportional to its resistance. When tried in a set it was found to give a satisfactorily silent control.

This component, which is of the one-hole-fixing type, is well constructed and nicely finished. It can be recommended as being entirely suitable for its purpose.

"Six Sixty" Valves

Messrs. The Electron Co., Ltd., have submitted to us for test and report two of their "Six Sixty" dull-emitter valves.

This valve works with a filament voltage of 1.5 to 2 volts, consuming a filament current of .3 amps., whilst an anode voltage of 40 to 120 volts may be applied. One of the special claims made for this valve is that the thorium-coated filament, based on a molybdenite core, gives it great mechanical strength.

When tested at the makers' rating both valves were found to be satisfactorily uniform. The filament current taken at 2 volts potential was .34 amps. The valve was found to have an impedance of 40,000 ohms, with an amplification factor of 14. When thrown on the bench with sufficient force to make the valve bounce it was found that the filament remained intact, notwithstanding a repetition of the treatment.

When tested in a three-valve set consisting of one stage of H.F. amplification, detector and one stage of L.F. amplification, they both functioned satisfactorily as H.F. and detector.

For L.F. amplification it was found that these valves would not stand a very great load, and though on medium-strength signals the quality was certainly very good, they were slightly overloaded on the local station. It was found that two to three volts negative was the maximum value that could be applied to the grid, which is confirmed by the grid-volts anode-current characteristic curve published by Messrs. Electron Co., Ltd.

This type of valve has now given place to a new and improved model, on which a test report will be published in an early issue.

Short-Wave Low-Loss Coils

We have received from Messrs. A. B. Callingham & Co. some samples of their Allan short-wave low-loss coils for test and report.

These are wound with 16 S.W.G. enamelled copper wire, in one continuous length in slots on ebonite blocks which serve to hold the wire rigidly in position. These blocks are placed at the top and bottom of the coil, and are separated by means of two ebonite rods, the whole forming quite a robust inductance. The plug and socket, which are of the standard type, are mounted on an ebonite base cut from ¾in. sheet, and a hole is drilled through this between the two in order to reduce the capacity.

The 10-turn coil approximately covers the waveband between 35 and 102 metres when tuned with a .00025 variable condenser in parallel in a closed circuit. Other sizes of coils are obtainable, covering a waveband up to 250 metres. The figures will vary, of course, somewhat, according to the self-capacity present in the circuit.

The high-frequency resistance of these coils was found to be satisfactorily low, and the self-capacity was negligible.

These coils can certainly be recommended for short-wave work.

"Cosmos" Anti-Vibration Valve-Holder

Messrs. Metro-Vick Supplies, Ltd., have sent to us for test and report one of their "Cosmos" anti-vibration valve-holders. The valve-holder proper is carried on a base, 2¼ in. in diameter, of moulded black insulating material, the socket in which the valve is inserted being sprung to it on spiral springs. Means are provided for limiting the movement of this portion for insertion or removal of the valve, while connections are made to four screws and washers which are set at equal distances round the circular base.

On test its insulating resistance was found to be infinity, and when put in use with a dull-emitter valve it was found to afford a satisfactory degree of protection from shock and vibration.

This component, which is of the baseboard-mounting type, is well finished and of robust construction, and can certainly be recommended when an anti-vibration valve-holder is required.

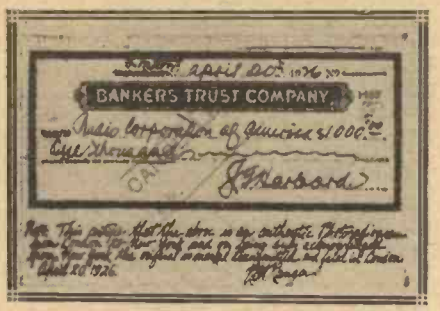
Griffco Permanent Detector

In the issue of *Wireless Weekly*, dated April 14, the manufacturers of the Griffco Permanent Detector were stated to be Messrs. A. W. Gibson & Co. This should have read Messrs. A. W. Griffin & Co.

Money "Via Ether"

(Continued from page 343)

of amplifiers, the output from the latter being used to modulate the ordinary transmitter. The incoming modulated wave is then rectified,



A reproduction of the cheque transmitted from London to New York, in the form in which it was received.

again amplified, and by special apparatus caused to vary the light from a powerful lamp. The light from this lamp is directed by lenses on to a film.

The method seen at Radio House was, however, that by which the amplified rectified incoming current was employed in operating a very sensitive pencil bearing on a white sheet of paper.

Synchronisation

When it is desired to obtain a photographic reproduction, the light from the lamp previously mentioned is permitted to fall on a sensitive film placed on a similar cylinder to the transmitting cylinder. If this then commences to rotate in perfect synchronism with the transmitter a perfect duplicate will be obtained.

This synchronisation presents certain difficulties, and various attempts at solving these problems has resulted in motors being used controlled by tuning forks.

H.F. RESISTANCE OF COILS

In our issue for March 10 we published a letter from Mr. C. S. Endersby on the subject of the high-frequency resistances of coils. Later, Mr. S. Butterworth very kindly drew our attention to the fact that the figures given by Mr. Endersby, as well as details of the coils themselves, were to all intents and purposes identical with those published in an article in our contemporary *The Wireless World*.

In view of the remarkable coincidence, we communicated with Mr. Endersby, and we now publish a letter received from Mr. S. J. Endersby, addressed by him at our request to the Editor of *The Wireless World*:

"My attention has been called by the Radio Press, Ltd., to an article written to them by my son, C. S. Endersby, in February last, and published in *Wireless Weekly*, regarding various tests of low loss coils. In the interests of both your readers and theirs I feel obliged to give you the facts.

"My son has for a long time been experimenting in low loss coils for the purpose of improving results on DX work, and has constructed and tested coils with various gauges of wire wound in various ways with excellent results. Reading your article on test results of various coils which in some cases correspond with his own figures, he conceived the idea of sending your figures to *Wireless Weekly* with the object of obtaining their criticisms of same, and very wrongfully stating that they were his own results. He had no idea that his letter would be published, otherwise he assures me that he would not have written in the manner stated.

"Personally, I regret that he should have allowed his enthusiasm to have exceeded his veracity in the matter (he is 17 years of age), and shall be glad if you will publish this letter in order to correct any wrong impression given to the readers of *Wireless Weekly* or *The Wireless World*."

OPERATING THE "TWIN-COIL" FOUR-VALVE SET

(Continued from page 339)

ping till the maximum signal strength and purity of reproduction are obtained. This will vary, of course, with different valves, but it will not be found exceedingly critical, and the best value is easily found.

Obtaining Reaction

With this receiver the H.F. side may be made to oscillate either by under- or over-neutralising, and it has been found in practice, not only in this but other neutralised sets, that if it is desired to obtain any natural reaction on the H.F. side by upsetting the neutralising condenser settings, the best results are obtained by under-neutralising. In this case the neutralising condensers are set to a value lower than that required to give stability. This would appear to be due to the fact that when energy is fed back by the inter-electrode capacity of the valve it will be in phase with the signal energy, while if over-neutralising is resorted to, notwithstanding the fact that sufficient energy is being fed back through the neutralising condenser to bring the associated circuit or circuits into oscillation, this being 180 degrees out of phase with the signal will not give the same improvement in signal strength. An improvement will, of course, result, since effective reaction (*i.e.*, reaction that will produce oscillation) however applied is bound to result in a decrease in the H.F. resistance of the circuit to which it is applied.

Effects of Over-Neutralising

An effect that is observed in most cases where over-neutralising has occurred is that when the H.F. circuit or circuits are brought into resonance with the detector circuit, an increase of reaction is required to bring the detector valve just on the oscillation point, or else that if the detector is oscillating it will go out with a slight plonk as the H.F. tuning condenser is adjusted. In extreme cases what I call "frequency overlap" may occur, *i.e.*, the receiver goes out of oscillation at a certain frequency as the H.F. condenser is turned; there is then the narrow band where it is non-oscillating, and then when it goes into oscillation once more it appears to do so at a frequency far removed from that at which one would expect it. Thus before going out of oscillation the local oscillations beating with a carrier may produce a very high beat note, and, since the silent point appears to be at the centre of the "plonk," it would be expected that when the receiver again went into oscillation a high beat note would again be heard. This does not, however, happen, as the circuit now appears to be oscillating at a frequency somewhat removed from that of the station one is trying to receive.

No Risk of Re-radiation

The tuning of this receiver is not exceedingly critical for each stage, but, unless all three condensers are correctly set, distant stations will not be received. Since the receiver is neutralised, the detector valve may be made to oscillate without fear of radiating, and this will be found of great help in searching. Once the station has been found, adjusting the three condensers will be found to result in less reaction being required, and on the set described it has very seldom been found necessary to employ more than about 40 degrees of the reaction condenser when all circuits are correctly tuned. (N.B.—This is with the Polar Cam Vernier Condenser, which starts at 26 degrees.)

The sharpest dial to adjust is the third, which tunes the detector grid circuit, and a little practice and patience will be required before the maximum results are obtained.

Those who are interested in listening to amateur telephony will find that those transmissions which are not below about 190 metres can be received, many of them coming in at great strength. Reaction control has not presented any difficulties even at this low wavelength.

The Coupling Battery

Finding the correct value of the coupling battery B1 is soon done, since it is not critical within a matter of ten or twelve volts. Signals will be heard distorted and at reduced strength if the voltage employed is not correct (provided it is not much too high), and though the actual potential to apply varies with different valves it will generally be in the neighbourhood of the H.T. voltage on the plate of the detector valve, plus about 6 to 10 volts. This is merely intended as a guide to the size of battery to use, and a fair degree of latitude should be allowed.

(Continued on page 358.)

READERS' COMMENTS

"Local Conditions"

The following letter has been received in reply to Mr. Kendall's letter asking for experiences of local conditions published in the March 24 issue of *Wireless Weekly*:—

SIR,—I can endorse every word of your interesting letter on local conditions. Here we rarely hear a howl, and the water from East by South to West brings in all telephony from those directions at very much greater volume than I can ever get over land. A 2-v-1 neutrodyne used with a 10ft. twin indoor aerial gives me such stations as Cassel, Kiel, Dortmund, Gleiwitz, etc., at really comfortable strength on the Amplion. Brussels is much too loud for comfort. Similarly Rome, Vienna, Zurich, Ecole and all the Spanish stations are quite adequate, even on this very small collector. Stoke, Notts and Swansea come in well at night at times, but I find all transmissions from the North uncertain, although there is an unimpeded stretch of Spithead immediately between them and me.

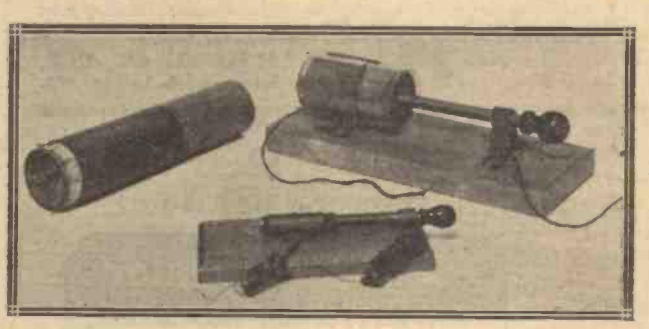
All this, however, is subject to the nearly incessant Morse. Literally dozens of spark transmissions are always present, and we also have such cheerful diversions as the wireless control of experimental warships from Portsmouth which fairly beat the band for "mush." There is also a curious effect when a ship operates close at hand. The volume of reception falls to about half and then within from ten to twenty seconds or so Morse begins near at hand. It is as though the ship liberates a kind of carrier wave before keying on it. 2LO is very susceptible to this owing to the 350-metre Morse, but I often notice sharply-tuned spark practically on top of 2LO and 5WA. It is easy to draw a parallel between this "deadening" of reception by ships and the similar effects when one is surrounded by dozens of howlers.

I have compressed my neutrodyne receiver to small dimensions for use on a small cruiser. Also I often take my receivers on my car, and on such portable work I have come to the conclusion that a frame is really very much less "portable" than a short length of wire thrown over trees, etc. Under picnic conditions some sort of support is nearly always available, and even on the downs where trees are scarce one can usually find gorse or similar low supports. The small coil of wire is then much less in the way than even the most "portable" frame. Also in the immediate neighbourhood of ships and shore stations I find the frame has practically no directional effect in cutting out spark. On a few degrees of orientation the shock is certainly diminished, but unfortunately that orientation hardly ever gives the required transmission. On the downs I have had most wonderful reception with kite aerials.

I notice a very great difference between the sensitivity of a receiver when used indoors and out in the open, particularly with a frame.—Yours faithfully,

DONALD STRAKER.

Bembridge, I.O.W.



It is interesting to compare these early types of Marconi condensers with the modern instruments in everyday use.

Broadcast Talks

SIR,—There has been a great deal of discussion recently regarding the number of talks broadcast by the B.B.C., and I personally fail to see the reason for this.

Almost every talk which has been broadcast has had some educational value, and I feel sure that thousands of listeners must have greatly benefited from them. The excuse of many in downcrying the talks is a pitiful "We do not want to be educated during the evening," and this alone, if I may be permitted to say so without offence, shows the characters of the individuals in question.—Yours faithfully,

A. R. HEADSTRONG.

Derbyshire.

Tandem Condensers in a Super

"With a view to simplifying the controls of my supersonic heterodyne receiver to an absolute minimum I am considering the employment of a tandem straight line frequency condenser simultaneously to tune the frame and oscillator circuits. Before, however, seriously altering my receiver I should be glad to receive your observations on the practicability of the scheme."

Although the scheme sounds very attractive there are, in practice, a number of serious difficulties which may, and some which cannot, be overcome, which detract seriously from what is otherwise a roseate proposition.

In order that satisfactory functioning may be obtained over the whole of the frequency range covered by the two condensers and the frame and oscillator coils, it is essential that the inductance of the frame and that of the oscillator grid coil be exactly matched, and it is advisable that the self-capacities of the coils also be matched. Generally, a balancing condenser is provided to balance up differences in self-capacity of the two coils, but the "snag" here is in the difficulty of separating the inductance from the self-capacity of a coil, that is, by adjusting the balancing condenser we may be compensating both for a slight difference in self-capacity and also slight differences in inductance. In such a case, of course, the balance would not be maintained over the whole frequency range covered by the frame and the oscillator coils.

Since there is always a given frequency difference between the frame and oscillator circuits it follows that only one of the two normal tuning points on the oscillator dial can be employed to receive a given station, and therefore, "second channel" interference, if present, cannot be obviated by utilising the other tuning point of the oscillator. Providing, however, the tuning of the frame circuit is exceedingly sharp, which may be somewhat difficult to realise in practice, second channel interference may not be particularly serious.

"I have constructed a 2-H.F. set somewhat on the lines of Mr. Reyner's "Neutrophase-four," described in the March, 1926, issue of "MODERN WIRELESS," and am exceedingly satisfied with its behaviour on the upper broadcasting frequencies, but am experiencing a certain amount of trouble, due to instability, when listening to 5XX and Radio-Paris, on which range the neutrodyne condensers need to be readjusted and the H.T. voltage has to be reduced before the set may be stabilised."

The neutrodyne condensers needing readjustment when changing from the lower broadcasting wavelengths to 5XX indicates that the trouble is due to couplings external to the valves. We would therefore suggest that you further experiment with the positions of the coils coupling the H.F. valves, and the distance of the screens from the coils.

Amateur Transmitting Notes

(*Continued from page 344*)

6NF, 5GS, 5GE, 2FM, 2WW, 6RM, 5LB, 5HS, 6OG, 6QM, 2DX, 5XY, 5WQ, 5PZ, 5NN, 2FU, 5LD, 5KZ.

French: 8YOR, 8DK, 8CS, 8HM, 8TK, 8RZ, 8XP, 8HSF, 8JM, 8MAR, 8GI, 8JC, 8JPS, 8EV, 8ILY, 8ER, 8EE (Fone), 8EN, 8NN, 8VX.

German: K-1o, K-Y_4, KPL, K-Y_5, K-W_3, K-W_7, K-A8, K-I8, K-A_3.

Spanish: EAR23, EAR10, EAR24, EAC9.

Swedish: SMUV, SMTN, SMUK, SDK, SMWU, SMSR, SMVJ.

Norwegian: LA-4X.

Danish: 7BX.

Philippines: 1HR, 1HR2, 3AA, 1CW, 1AR, 1AU.

Italian: 1AS, 1BW, 1AY, 1CH, 1AX.

Dutch: STB, oWC, oCK, oFT, oFP, PC_2.

Belgian: B_2, O_2, Y_2, D_4, P_7, P_2, S_2, 4YZ.

Finnish: 2CO, 2BS, 2ND, 2NM, 2SE, 2NN, 2NL, 2NC, 5NF.

Porto Rican: 4SA, 4JE, 4UR.

Miscellaneous: GEFT, GFUP, GFT, GFD, 6YX, NEQQ, RRP, RCRL, $B8_2$, GB, GHA, GB_2, GHB, DA, DJ, FL, SP, C_9M, ANDIR.

(February 11-March 18 on O-V-I.)

* * * *

The second list comes from Chas. W. Randall, Singapore, Strait Settlements (Receiver O-V-I).

England: BYC, GFD, 2CC, 2OD, 2LZ, 5NN.

France: FBZ, 8HU, FTG, FC8FLO, 8JN.

Denmark: 7PK.

Holland: PCLL, PCMM, PCJJ.

Germany: KBM, POW, AGA

Norway: LCH.

Iceland: TFC.

Italy: ICH, INO.

Russia: RWK.

America: 6AJM, 6AWT, 6ALT, 6AKX, 6BPG, 6BQ, 6BJD, 6CCL, 6CAE, 6DAH, 6DAG, 6HM, 6JS, 6KB, 6OI, 6XI, KET, KDKA ('Phone), NGO, NGY, NEQT, N1PM, NISV, NUPN, NPL, NPE, NNB, NUQG, NAJP, NAJQ, 7TM, 7ADM.

S. America: LRT.

Australia: 2BK, 2CM, 2CS, 2AW, 2YI, 2CG, 2CM, 3HL, 3SW, 3HR, 3CG, 3BD, 3XO, 3RB, 4KB, 5AH, 5KN, 5RG, 5BG, 6WA, 6CJ, 6AG ('Phone), 6BO, 6BCL, 6BTM.

Indo China: HVN, HVA, 8QQ, 8TK.

Japan: 1AA.

Honolulu: KLO.

Java: ANDIR ('Phone), PKX, ANF, PKZ.

Hawaii: NPM.

China: NPP, GFUP, GEFT.

Palestine: 6ZK.

S. Africa: 3BX, A6N, A_3B, A_3E, A_4Z.

Malta: GHA, BYZ.

India: 2BG, 2CQ.

Philippines: NPO, 1AR, 1HR, 1AU, CD8, 1AR, 3AR, 1AT, KW, 1AW, 3L, NNB, NEQQ.

Miscellaneous: KGK, FW, 3XAM, TUK, DX_2CO, 7OF, CHG, ZKN, RPP, BJ, GHB, OCDJ.

Is Your Problem Here?—Continued

A Problem in L.F. Switching

"I am considering building a 2-valve amplifier, using in the first stage transformer coupling, and in the second choke coupling, one H.T. tapping serving for both valves, with a D.E. 5B in the first valve socket and a D.E.5 in the second. In my position I do not always need two note magnifiers, and therefore wish to incorporate some switching device so that one valve can be cut out of circuit automatically. The problem on which I should like your advice is whether I can use a 3-pole 2-way switch, or whether I must obtain jacks, which also switch the filaments, since I do not wish to have to turn one valve out, on its filament rheostat, when not required."

In practice, with your arrangement, there are a number of reasons which make the employment of a 3-way 2-pole switch preferable to jack switching. The circuit which we would advise you to adopt is shown in Fig. 1. The D.E. 5B valve will be inserted into the V1 valve socket and the D.E.5 power valve into the V2 holder. If plug and jack switching is used, when it is required to receive the local station, V2 would be cut out of circuit and the loud-speaker would be inserted into the plate circuit of V1 in place of the present choke coil Z. The D.E. 5B valve, which is essentially designed for resistance or choke coupling, would then function as the last valve in the receiver, in which position it would probably have to deal with heavy volume, for which purpose its permissible grid voltage swing, without introducing distortion, is not sufficiently large. It would be necessary, therefore, to change over the positions of the two valves.

If, however, a 3-pole 2-way switch is wired as shown, the power valve will be used as the last valve whether one or both are in circuit. In the "off" position the OS terminal of the L.F. transformer is automatically joined to the grid of V2, whilst the filament circuit of V1 is broken. This arrangement, therefore, has much to recommend it. It should be noted that it may be necessary to readjust the grid-bias tapping after switching over.

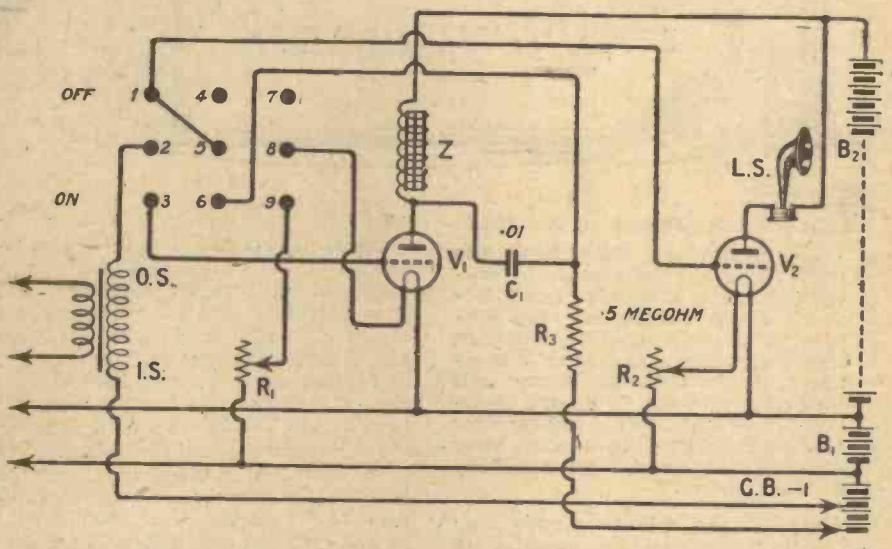


Fig. 1.— This arrangement allows of the valve V2 being in circuit whether one or two stages of L.F. amplification are used.

OPERATING THE "TWIN-COIL" FOUR-VALVE SET

(Continued from page 354)

Valves

In the matter of valves the quarter ampere type (filament potential 5 to 6 volts) are deservedly very popular for H.F. amplification, but in many cases their high H.T. current consumption and first cost present a decided drawback. Various types of valve have therefore been tried out in this receiver, so as to determine, as far as possible from the valves at my disposal, which will give satisfactory results.

The most economical valve—namely, the ·06-ampere type—has been tried, and for best results it was found that the H.T. voltage needed to be in the region of 90 volts, while a small value of grid bias (connected across condenser C8) could be used without drop in signal strength. Bright emitter valves were also tried, and quite good results were obtained. With the 5-volt ¼-amp. valves the D.E.5 type were found to function satisfactorily both as H.F. and L.F., while a D.E.5 B or C.T.25 B worked well as detector. The D.E.8 H.F. valves were also tried, but only for the two stages of H.F.

Adaptation to Aerials

The effect of connecting the aerial either to A1 or A2 should be tried, since it has been found that different aerials give different results, and though the best distant reception was obtained on my aerial using the A1 connection, another aerial on which it was tested gave the best result when connected to A2. It was found that the size of the aerial did not greatly affect the setting of the first tuning condenser, and this and the second read the same within about a degree of each other, while the third one was a few degrees less.

Stations Heard

When the set was tested on an aerial of average size 13 miles north of the London station, the following stations were received:—Elberfeld, Brussels, Hanover, San Sebastian, Bournemouth, Newcastle, Glasgow, Radio Toulouse, Birmingham, Madrid EAJ6, Cardiff, and Union Radio Madrid (with a faint background of 2LO) and Manchester (quite clear of 2LO).

The selectivity obtainable with the set is indicated by the fact that on an aerial about 1½ miles north of the London station Manchester could be received without any interference from 2LO.

Tested at Elstree

When the set was tested at Elstree the list of stations heard included Stoke-on-Trent, Nottingham, Cardiff, London, Manchester, Bournemouth, Newcastle, Hamburg, Birmingham, and various German relay stations.

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