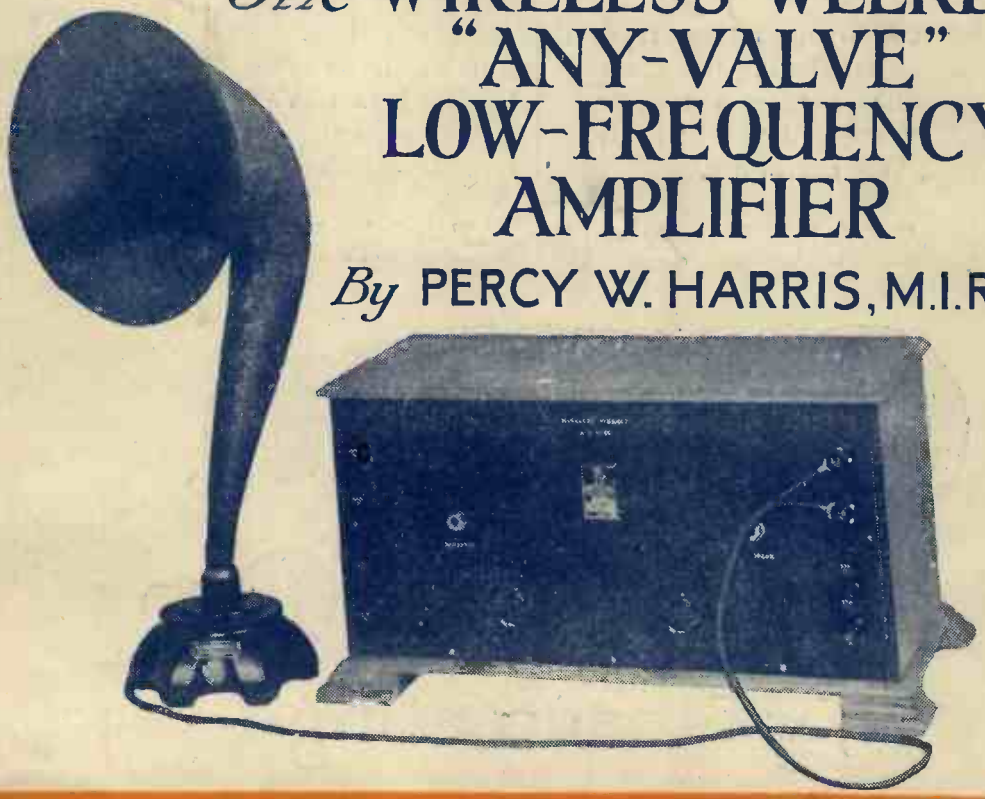
Wireless Weekly. March 3rd, 1926. 3d.

Wireless Weekly

Vol. 8. No. 3.

The WIRELESS WEEKLY "ANY-VALVE" LOW-FREQUENCY AMPLIFIER

By PERCY W. HARRIS, M.I.R.E.



YES! THE INFINITELY VARIABLE ALL WIRE TUNER HAS ARRIVED

Patents applied for in principal countries

NO CONDENSERS NO VERNIERS NO VARIOMETERS

JUST THINK WHAT IT MEANS!

The greatest advance yet made in Inductive Tuners, adaptable to Electro-Magnetic Coupling. A Tuning Unit in itself, which, in conjunction with the ordinary standard Coils for loading, will allow the B.B.C. waveband, 250-600 metres, to be tuned entirely in wire, giving maximum inductance for each wave-length. (Instructions with coils for tuning high-power station.) Astonishing results can be achieved when used in the ordinary straight through circuit.

Infinitely Variable in Bare Wire. (PLATED 18 GAUGE COPPER)

High Variable Figure of Inductance.

Great Increase of Grid Voltage Variation.

Acknowledged the most Efficient and most Accurate Method of Tuning Possible.

If any difficulty is experienced in obtaining these Tuners, write direct to the manufacturers.

EXCELLENT FINISH. ALL FITTINGS NICKEL PLATED.

NICK-O-TIME TUNOMETER INDUCTANCE (*Regd. Trade Mark*) **25/-**

NICK-O-TIME TUNOMETER REACTION - **25/-**

Patentee and Manufacturers:

TUNOMETER WORKS

GOSFORD ROAD,
BECCLES, SUFFOLK, ENG.

Telegrams: TUNOMETER'S, BECCLES.

Wireless Weekly

Phone: City 9911

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

RADIO PRESS, LIMITED, Bush House, Strand, London, W.C.2

Choose your components from the BURNDEPT RANGE

Type HL 512
Price
22/6

Type HL 310
Price
16/6

THE Burndept range of components and accessories covers every requirement for radio reception. They are designed with the greatest care and skill under expert supervision, and Burndept Quality is maintained by the rigorous tests imposed upon the finished product.

The new Burndept Catalogue of Wireless Components will be sent post free on request, together with a copy of the technical catalogue of Burndept Super Valves. Ask any Burndept Dealer to show you the range of Burndept Components, any of which will add to the pleasure of "listening in."

Ethovox Standard Loud Speaker, 120 or 2,000 ohms resistance.
£4 10s.

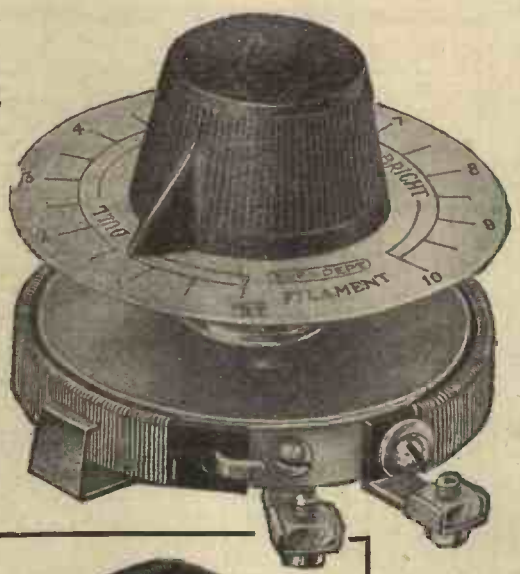
Use

BURNDEPT SUPER VALVES

they're guaranteed

Sectional view showing construction

Anti Phonic Valve Holder, Price
5/-



Back view of Dual Rheostat (5-30 ohms)
Price
6/-

BURNDEPT
WIRELESS LIMITED

Aldine House, Bedford St., Strand, London, W.C.2

Telephone: Gerrard 9072 (4 lines). Telegrams: Burndept Westrand, London.

Branches and Agents throughout the World.

C.F.H.

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 New Departure in Coil Design

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

As a result of the research conducted by Mr. Reyner upon the problems of interaction and coil screening he has now developed a practical plug-in coil of the screened type possessing many valuable features. Full constructional details are given this week, and in future issues Mr. Reyner will explain the many uses of the new coil.

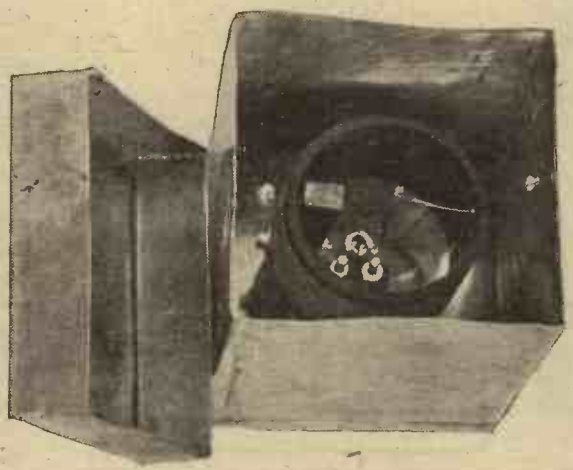
ONE of the principal sources of trouble in valve amplifiers is the presence of stray magnetic and electrostatic fields, which cause interaction between the various component parts of the receiver. These unwanted coupling effects usually manifest themselves, either by creating a tendency to self-oscillation, or by producing an increased damping according to the relative directions of the reactions.

Stray Coupling Effects

Stray-capacity coupling may be generally considered as additional to the inter-electrode capacity of the various valves employed, and may be neutralised by any of the methods usually resorted to in such cases. The stray magnetic couplings may be eliminated either by a definite counter magnetic coupling produced between the various coils of the receiver, or by increasing the negative feed-back utilised to reduce the effects of the capacity coupling. The latter method, of course, is the one usually employed, as there are certain complications in the actual adjustment of reversed magnetic coupling.

A Complication

The effect of the stray coupling, however, is not really quite as simple as one would imagine at first sight. It will be obvious that any diversion of the energy which is passing through the receiver in the process of amplification must result in a loss of efficiency, and such circulation of energy results in a definite loss which cannot be made up by the ordinary methods. It is a well-known fact that the amplification obtained at high frequencies is not as great as is theoretically possible when more than one stage is employed. In a perfect amplifier, if the amplification of the first and second stages are both equal to N, then the amplification of the first two stages in series will be N^2. This is known as the cascade effect.



A view of the completed coil in its copper case, showing the method of fitting the lid.

Actual Amplification

In practice this true cascading is not obtained, the amplification being usually less than the theoretical value. It has been shown by experiment that this loss of efficiency is entirely due to stray coupling, and if all such sources of loss can be eliminated then a true cascade effect is obtained, and a very much more efficient amplifier results. Without the elimination of these stray fields no amount of stabilising will make up for the deficiency. Reaction may, of course, be employed, but the overall effect obtainable is not anything near approaching that which can be obtained if the

A New Departure in Coil Design—*continued*

fields are considerably eliminated, apart from the difficulties of reaction adjustment.

Special Coils

Various types of coils have been devised from time to time, in which the external magnetic field is negligible. Such coils as these are the toroid and the twin coil, and various other forms of astatic winding.

These coils are wound in such a manner that the magnetic field is almost entirely confined to the coil itself, and this subject was dealt with by Mr. Percy W. Harris in a recent issue of this journal (*Wireless Weekly*, Vol. 7, No. 17).

Importance of Static Screening

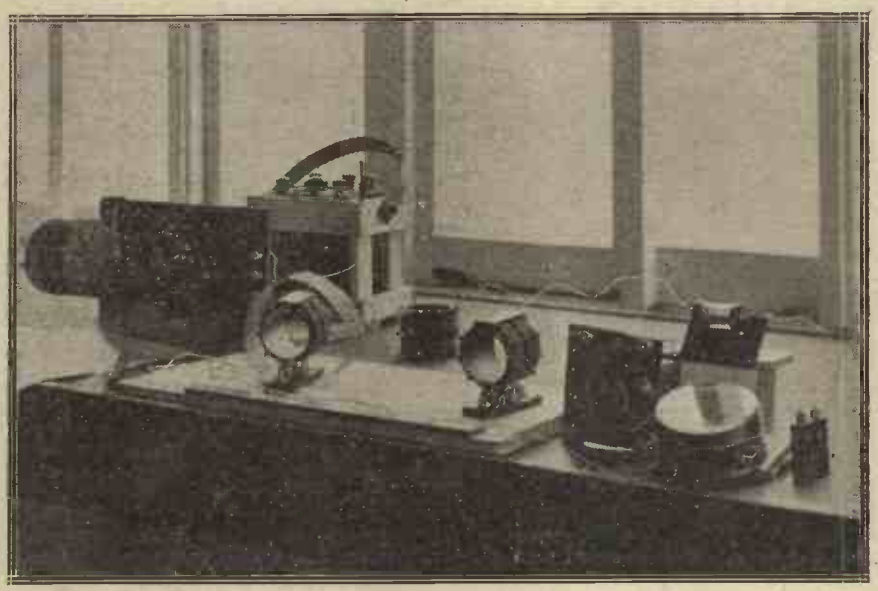
Such arrangements suffer from a few disadvantages. In the first place, although the magnetic field is the worse offender of the two, the electrostatic field is not negligible, particularly if the magnetic field has been reduced to a very small value, when the two fields become of the same order. The use of an astatic winding does not, of course, eliminate this effect. Experience, moreover, shows that astatic windings are not as efficient as straightforward windings. That is to say, if we require a certain inductance, then the high-frequency resistance of a coil wound in an astatic manner to give this necessary inductance will be greater than that of a coil wound in the normal fashion.

Function of a Screen

This leads one to investigate the possibilities of other methods of neutralising the coil fields. The only other method which would appear to be practicable is that of screening the coils. Screening, as was shown recently in this journal, consists in enclosing the coil in a suitable metal framework so constructed that the eddy currents produced in the screen set up counter-magnetic fields in opposition to those produced by the coil. Obviously then the total magnetic field outside the screen will be the resultant of the field of the coil and the opposing field due to the eddy currents within the screen. If these two fields are equal and opposite, then the total external magnetic field is zero.

Screen Losses Not Serious

It would appear at first sight that since the effect depends essentially upon production in the screen of circulating eddy currents, that energy absorbed by the screen would be too great to render the arrangement of any practical value. Some investigations made recently, however (*Wireless Weekly*, Vol. 7, No. 20), showed that the effect of eddy currents was quite small if the screen was kept a reasonable distance away.



This view shows some of the apparatus used by Mr. Reyner at Elstree. The coils under test are "Dimics."

The effects produced are a *slight* increase in the high-frequency resistance of the coil, due to the absorption of energy by the screen, and a slight reduction in the inductance. The experiments referred to indicated that if the screen was kept more than 1½ inches from the coil along the axis, and not closer than half an inch from the coil in a radial direction, then the increase in resistance was comparatively small.

Further Tests

It would appear, therefore, that a reasonably efficient screen could be produced, so that the only question remaining to be settled is the completeness of the screen necessary to produce a reasonably negligible external field. Some further experiments were carried out, therefore, with the object of investigating this matter.

For this experiment two coils were employed, one of which was connected in circuit with a valve oscillator. The other coil was tuned to the same frequency, and a

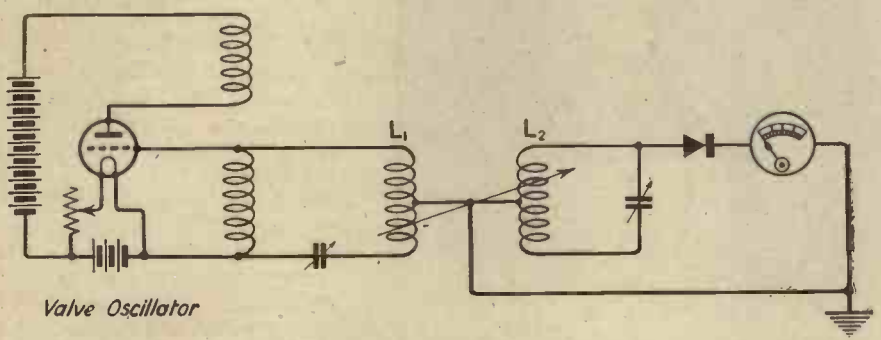


Fig. 1.—The circuit used for the quantitative tests was of a very simple nature.

A New Departure in Coil Design—*continued*

crystal detector was connected across a portion of this coil. The actual arrangement is illustrated in Fig. 1.

The coils employed were inductances of an average pattern, having a reasonable external field (actually two " Dimic " coils). The centre points of these coils were connected together and to earth, the object of this being the elimination of any capacity coupling between the two coils. The currents produced in the second circuit, therefore, as indicated by the reading of the microammeter, could reasonably be assumed to be due principally to the magnetic coupling between the two coils.

Screens Tried

Various forms of partial screen were tried first of all. For the majority of these experiments perforated zinc sheet was employed for the screen. This material was employed because it is cheap, and can be readily obtained from any ironmonger, while the perforation served for the leading of wires through the screen where necessary with the minimum of trouble. Previous experiments have indicated that the additional losses due to the substitution of zinc for copper were practically negligible.

Partial Screening

The first experiment consisted in introducing between the two coils a simple screen, as indicated in Fig. 2. The coils were placed side by side, and in that position it was

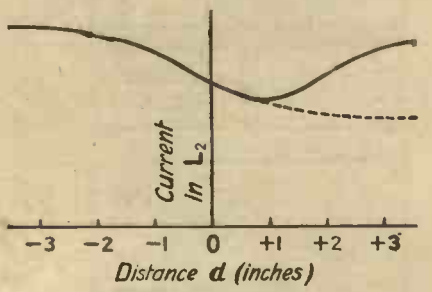


Fig. 3.—The introduction of a single screen between the coils was not found adequate.

found that an appreciable amount of coupling was still employed.

Fig. 3 illustrates the type of curve which was obtained with this form of screen. It will be seen that until the edge of the screen is within one inch of the dotted line very little effect is noticeable. As the screen is then moved between the coils, the coupling between them is reduced to about 70 per cent. of the maximum value, after which it commences to rise again. This subsequent rise was probably due to the fact that the screen was comparatively short, and further experiments showed that this was the case, and if the screen was very long then a progressive reduction resulted as the screen was moved between the two coils, as indicated by the dotted line.

Further Reductions

Such an arrangement, however, is not practicable, and, moreover, it will be seen that the reduction in current is by no means complete. Further experiments were, therefore, tried with a piece of metal in various positions. The effect of

In one of the experiments a coil was enclosed in a screen with a variable opening.

placing a screen immediately underneath and at the back of both coils was found again to produce a partial reduction in the coupling, while a combination of these three types of screens, as indicated in Fig. 4, gave a reduction of over 60 per cent. in the coupling. In all cases the screen was kept at least 1½ inches from the coils, as previously mentioned, and every alteration of the screen was accompanied by a re-tuning to allow for any variation in inductance.

More Complete Screening Needed

None of these screens, however, could be considered really satisfactory. There are cases where a certain partial screening is beneficial, and, in fact, I have actually employed such screens myself in stabilising high-frequency amplifiers where the small amount of stray magnetic field was found to be troublesome. In the case in question, however, the coils used were all placed in a position of approximately zero coupling, and the effect of a screen merely reduced what stray field was left to a

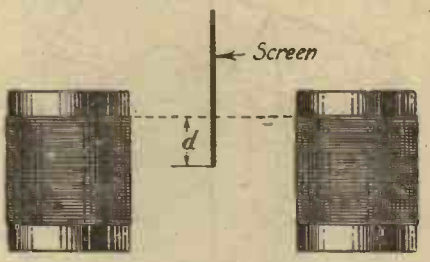


Fig. 2.—The effect of introducing a single shield between the coils to a distance " d " was investigated, and the result is expressed in Fig. 3.

negligible value. If these coils were moved from their position, however, this small amount of screening was practically negligible, so that this arrangement could by no means be considered satisfactory where we are attempting to eliminate *all* the magnetic fields.

Complete Enclosure

Exhaustive experiments showed that the only reasonably complete form of screen was that in which the coil was completely enclosed. Such a screen, therefore, was made up, bearing in mind the principle previously enunciated, with reference to the safe distance of the screen from the coil in order not to increase the high-frequency resistance unduly.

This arrangement was immediately found to give satisfaction. A screen was made up from the same zinc sheeting, all the various joints being soldered. A small cover plate was left to the last, and the coil put in circuit, after which this cover plate was placed over and soldered in position. It was found that with a screen of this pattern, even when the coils were in the position of maximum possible coupling, the amount of current registered on the microammeter was very small.

Effect of Incompleteness

There was a small amount of coupling even with the screen in place, because the metal plate was not complete. There were several

A New Departure in Coil Design—*continued*

gaps in the construction of the box, and, of course, in addition, the sheet itself was perforated. With the coils in the normal position, however, no appreciable coupling

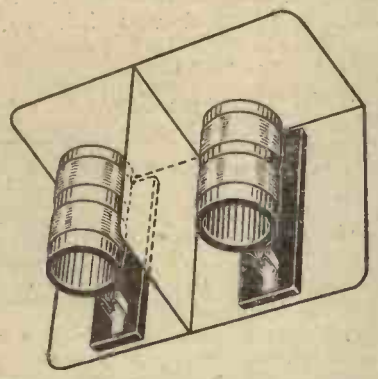


Fig. 4.—This method of partial screening gave a reduction of 60 per cent. in the amount of energy transferred.

resulted, and this arrangement was considered to be satisfactory.

Dimensions

The size of this screened coil, however, was considered too unwieldy for general use. The coil itself was 2 inches long and $2\frac{3}{4}$ inches in diameter, which meant that the screen had to be 5 inches long and $3\frac{3}{4}$ inches wide and high. Attempts were made, therefore, to ascertain whether a compact screened coil could not be produced giving a reasonable efficiency. In order to do this, a somewhat smaller coil had to be employed, but practical experience indicates that the effect of the diameter of the coil is by no means as serious as one would suppose, and no great loss in efficiency resulted from this cause.

Coil Details

In making up a complete unit in this manner, the coil, of course, must be inserted before the screen is finished, and two leads brought outside. There is thus no advantage in using perforated sheet, and, in fact, perforated copper sheet is more expensive than solid. After some experiments, therefore, a screened coil was made up as indicated in Fig. 5. This coil had a diameter of 2 inches, and was wound with 55 turns of 30-gauge d.s.c. wire spaced 40 turns to the inch. This coil was completely enclosed in a copper box, with the exception of a small hole in the base, where a plug and socket were inserted to enable the connections to be made to the coil.

Inductance and Resistance

When tested the coil was found to have an inductance of 200 microhenries and a high-frequency resistance of 10 ohms only. It was then removed from its screen to ascertain what the effect of the screen was, and the resistance was found to be reduced to $8\frac{1}{2}$ ohms, a decrease of 15 per cent. In view of the compactness of the coil, this is not an unreasonable additional loss, and, in fact, if the loss is to be reduced much more, then the screen must be increased in size very con-

One of the experimental models of the coil in its case.

siderably, and it was not considered that such a step would be justified.

Uses

Various uses for such completely screened coils will present themselves to readers. One advantage is that a circuit employing two or three stages of high-frequency amplification may be made up in a very compact space, because these screened units may be placed next to each other if desired without any ill effects. There are also many circuits of a simpler character in which the absence of interaction between the various coils will be a distinct advantage. To quote only one of these, trouble is often experienced in circuits using wavetraps owing to stray couplings existing between the trap coils and the other coils in the receiver.

Commercial Production

Various manufacturers are making up a type of screened coil similar to that described. Such coils can be made in all the various forms which are taken by ordinary plug-in coils, and a new era in the design of receiving sets will be opened up by their introduction. I hope to describe in future issues various circuits and receivers incorporating these units, which I hope will assist readers in their quest for the ideal receiver.

It should, perhaps, be pointed out that in practically every case the screen should be earthed; if this precaution is omitted some very peculiar results may be obtained.

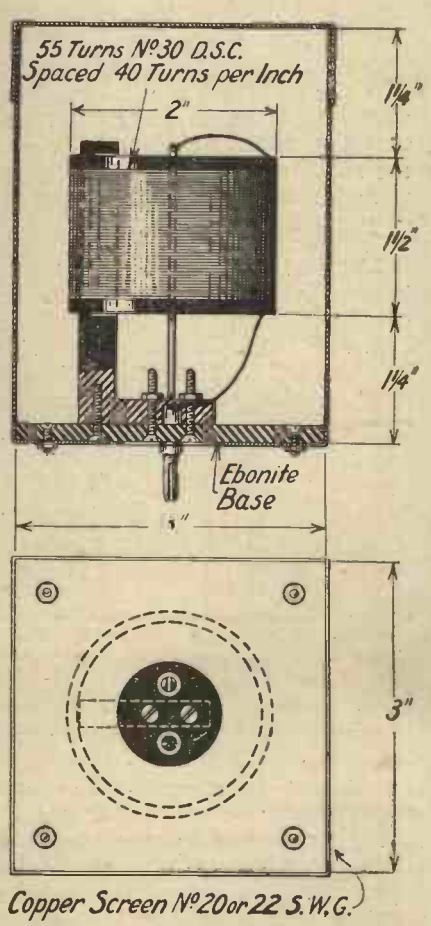
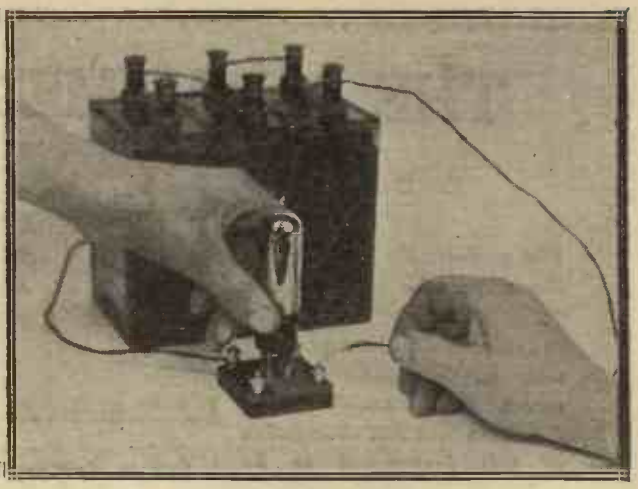


Fig. 5.—Constructional details of the new coil.

Rejuvenating Dull Emitters

By JOHN UNDERDOWN.

Dull-emitter valves are easily damaged by "over-running," lost emission being the usual result. In some cases, however, very simple treatment will restore them to a useful condition.



MANY experimenters who have graduated in the bright-emitter school do not fully realise that although the filament of a dull-emitter valve may be continuous and appear to light correctly, the valve may nevertheless have lost its emission and be practically useless whilst in that condition.

A Danger

The filament voltage specified by the makers for dull-emitter valves is one which will allow of ample emission being obtained and will give long life. Where there is no "factor of safety" with a given set, that is, it has to be run "all out" to obtain the required results, there is always a tendency to brighten slightly the valve filaments, which practice may give considerably stronger signals, but will very materially reduce the life of the valves. Some dull emitters may be run at double their specified filament voltage for a considerable time without burning out, but if maximum life is to be obtained care should be taken in seeing that the specified filament voltage is not exceeded, for which purpose a high-resistance low-reading voltmeter will justify its purchase.

The Real Cause

In practice, suspicion often falls upon the high- or low-tension batteries or the aerial and earth system before it is suspected that the valves may be responsible for lack of volume, through having lost their emission by being worked with too high a value of high tension or at too great a filament brilliancy. Now, valves having "that tired feeling" often may be restored and considerable further useful life obtained therefrom.

Valve Types

There are two main types of dull-emitter valves, *i.e.*, the coated filament class, of which the filament proper consists of a platinum wire coated with oxides of calcium, barium and strontium, and the more common dull emitters with thoriated tungsten filaments. It is the latter class with which we wish to deal, since these may often be rejuvenated by comparatively simple methods when over-run.

Rejuvenating Your Valves

Some idea as to the treatment thoriated tungsten filament valves receive during manufacture will be of interest, since it will throw considerable light on the method of rejuvenation. Originally, valve filaments were made of tungsten, and it was found that if thoria (oxide of thorium) was mixed with the tungsten, the emission could be made much larger by suitable heat treatment than could be obtained with a plain tungsten filament.

Special Treatment

After treatment the filaments gave the same emission as tungsten, but at a much lower filament temperature. The heat treatment to which these valves are subjected consists in running the filaments for about a minute at 2,900 degrees ("absolute") and then at somewhat above 2,000 degrees for three or four minutes, after which it is found that the emission remains steady at the normal filament working temperature of 1,700 degrees.

If run at a higher filament temperature than this, or with too high a value of high-tension voltage, the emission rapidly falls off until the valves may be practically useless. The high emission obtained with a thoriated tungsten filament is due to the fact that the thorium diffuses to the outside of the filament and forms a coating which emits electrons much more freely at a low temperature than does tungsten.

The Remedy

It being clearly understood that the heat treatment is responsible for forming a coating of thorium on the filaments of certain types of dull-emitter valves, the remedy to restore their emission when over-run becomes obvious. The first step to take is to disconnect the high-tension supply and the valves should then be run for some hours at the filament voltage specified by the makers. This will generally have the effect of causing a new thorium coating to form and the emission of the valve will be completely restored.

A Drastic Treatment

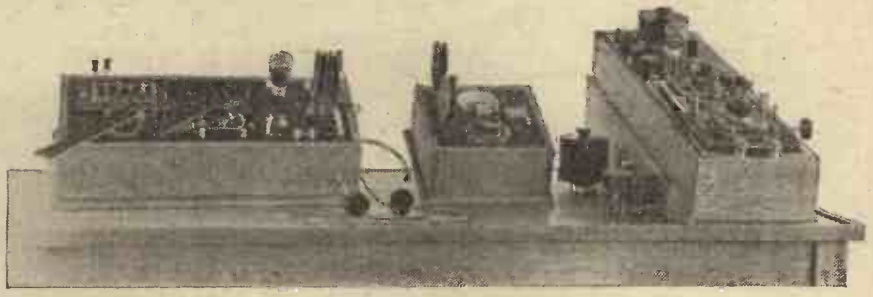
Where the valves have been more harshly treated and this remedy does not prove effective, the more drastic step of "flashing" the filaments should be tried. This consists, with the high-tension removed, of applying a filament voltage to the valves of 3 to 3½ times the normal for a few seconds only. After "flashing" the valves should then be run at slightly above the normal filament voltage with no high-tension supply connected, when generally their emission will be completely restored. There is, of course, a risk of burning out the filaments by the "flashing" process, but this is immaterial, since the valves would have, anyhow, been useless.

The treatment outlined above may be applied to the 3 volt .06 ampere, the 3 volt .12 ampere, the 5 volt .25 ampere, and other classes of thoriated filament dull emitters.

THE WAVEMETER AT ELSTREE

□ □ □

The remarkable accuracy of the wavemeter used at the "Wireless Weekly" laboratories in the recent "silent period" tests has aroused much interest. In this article will be found the first full description of this instrument to be published.



Left to right are the subsidiary oscillator, the quartz control unit, and the wavemeter itself.

THE value of accurate measurements of the frequencies of various broadcast stations has been amply demonstrated by the recent periodical checks which have been taken at our Elstree Laboratories. The instrument which is employed for these measurements is one of the most accurate in the country, and is capable of reading to one part in 3,000.

The Main Circuit

The circuit of the wavemeter itself is comparatively straightforward. The main oscillating circuit is placed in the anode circuit of a valve, while a suitable reaction coil in the grid circuit is coupled to it. The actual circuit arrangements are shown in Fig. 1. Fixed condensers are placed in parallel with the variable condenser in order to obtain an open scale.

The grid circuit is also worthy of attention, the "earth" side of this coil being connected to a suitable point on a potentiometer connected across the filament. By a suitable adjustment of this point, which actually occurs slightly negative of the middle point, a setting is obtained for which the circuit will oscillate even with the minimum condenser reading.

Filament Circuit Precautions

A voltmeter is placed across the filament of the valve, and the voltage is adjusted to a given value before any readings are taken. Even so, however, minor variations take place until the valve has become thoroughly steady, and the result is that the wavemeter valve is

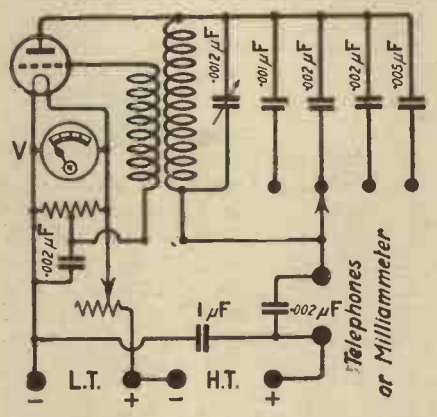


Fig. 1.—The main oscillating circuit.

switched on, and left on for three or four hours, before the actual measurements required are to be taken.

There are two valves in use with the wavemeter, each of which is, of course, definitely marked and reserved for that purpose alone. Any change in the valve employed normally alters the calibration, but in this particular case the second valve was chosen out of a whole range of similar valves, until one was found which gave an identical calibration.

Re-Checking

It will be seen later that the wavemeter is subject to periodical recheck, so that any possible error due to "creeping" or other defects occasioned by variation in external influences such as the valve may be eliminated. Practical experience over some months has indicated that the wavemeter remains remarkably constant in practice.

The Crystal Control

So much for the wavemeter proper. There are, however, two accessories which are equally as important as the actual oscillating wavemeter circuit, if not even more so. These are the Quartz crystal control circuit and the subsidiary oscillator. The latter is a simple oscillating circuit maintained by a valve in the usual way, but provided with a very fine vernier adjustment and capable of oscillating at frequencies as low as 15 kc. (20,000 metres).

How the Crystal Works

The Quartz crystal is the pivot upon which the whole of the apparatus turns. It is well known that certain specimens of Quartz crystal under certain conditions will exhibit a very marked preference for one particular frequency only. If a current is passed through from face to face, the impedance of the arrangement is very high except at one definite frequency which is dependent upon the actual dimensions of the crystal.

The control unit therefore consists of a simple tuned circuit comprising an inductance tuned with a condenser, and an ordinary crystal is

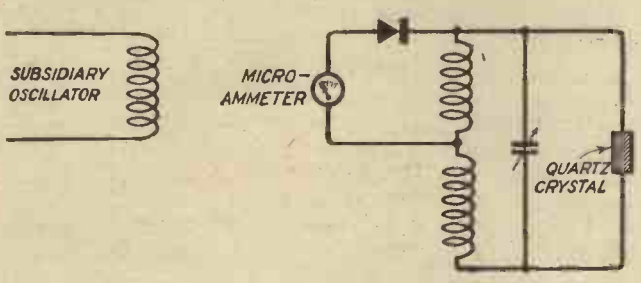


Fig. 2.—The frequency of the subsidiary oscillator is checked by means of a crystal control circuit.

tapped across a small portion of the inductance. Actually the inductance is split up into two parts so that two plug-in coils may be used in series, and the crystal circuit is tapped across the smaller of the two coils. The damping due to the detecting crystal is thus comparatively small.

Use of the Control

Connected across the whole circuit, however, is the Quartz crystal, which in this particular instance is tuned to respond to a frequency of 180.7 kc. (1661 metres). The subsidiary oscillator is set in operation and the control circuit is tuned approximately to the same frequency as that of the crystal. As the subsidiary oscillator is therefore brought into tune with this circuit, so the current through the micro-ammeter rises to a maximum and falls away again, giving the usual resonance curve.

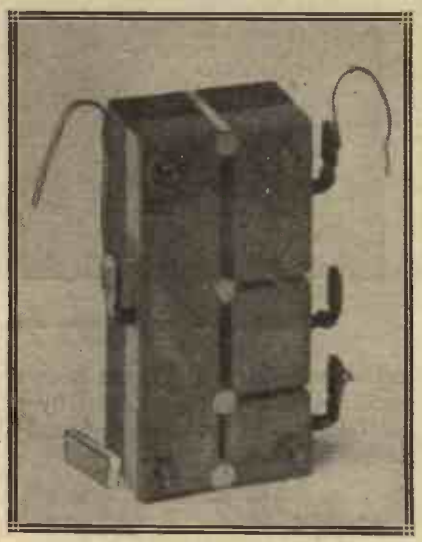
At one particular point, however, corresponding exactly to the frequency of the Quartz crystal, this latter device suddenly offers a very low impedance which is, of course, shunted across the tuned circuit. The result is that the current drops almost to zero as the frequency of the subsidiary oscillator passes through this point.

Effect at Resonance

The effect, therefore, is to give a sudden dip in the resonance curve. It will be seen, of course, providing that the detecting circuit is approximately in tune, this effect will be noticeable, and an exact tune is not essential. The dip obtained in the current is extraordinarily sharp,

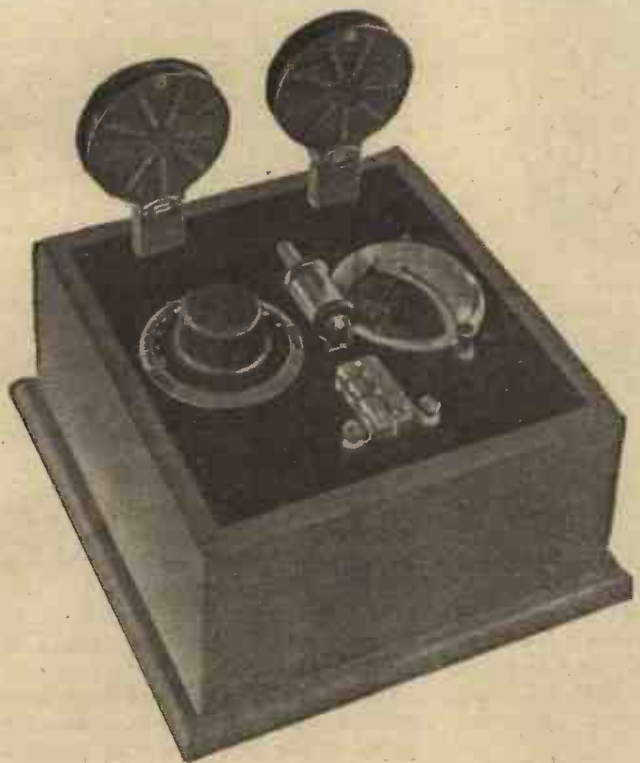
THE WAVEMETER AT ELSTREE

(Continued)



The quartz crystal is of strikingly small dimensions. It is seen removed from its mounting.

and enables the frequency to be determined with extreme accuracy. The result of this operation has been that the frequency of the subsidiary oscillator has been adjusted to 180.7 kc. exactly.



A closer view of the crystal control unit.

* * *

Use of Harmonics

Now this subsidiary oscillator produces a large number of harmonics, and the wavemeter proper is so adjusted as to heterodyne with a suitable harmonic of this subsidiary oscillator. These harmonics are detected by listening-in on a pair of telephones in the anode circuit of the subsidiary oscillator, and one or more harmonics can be obtained on each range of the main wavemeter calibration. These check points, therefore, can readily be obtained as often as required, so that it may be ascertained that the calibration of the wavemeter is remaining constant and that no "creeping" is taking place.

The First Calibration

For the initial calibration of the wavemeter a slightly more complicated method has to be adopted. Where the frequency of the subsidiary oscillator is only one-half or one-third that of the wavemeter itself, the number of harmonics produced in any given range is perhaps only one or two. This is obviously insufficient for a calibration.

It is thus necessary to adjust the frequency of the subsidiary oscillator to perhaps one-tenth that of the Quartz crystal, that is to say, 18.1 kc., corresponding to 16610 metres, when there will be a large number of harmonics produced in any particular range. The actual methods adopted to accomplish this calibration are of somewhat limited interest, but were dealt with by Captain Crowther in an article in *Wireless Weekly* some time ago (*Wireless Weekly*, Vol. 7, No. 10).

Point Checking

It will be seen from the foregoing, therefore, that once the calibration has been effected, a matter which involves considerable time and trouble, check points may be taken on various ranges with considerable ease and rapidity, and, as has been previously stated, the calibration has so far remained remarkably constant.

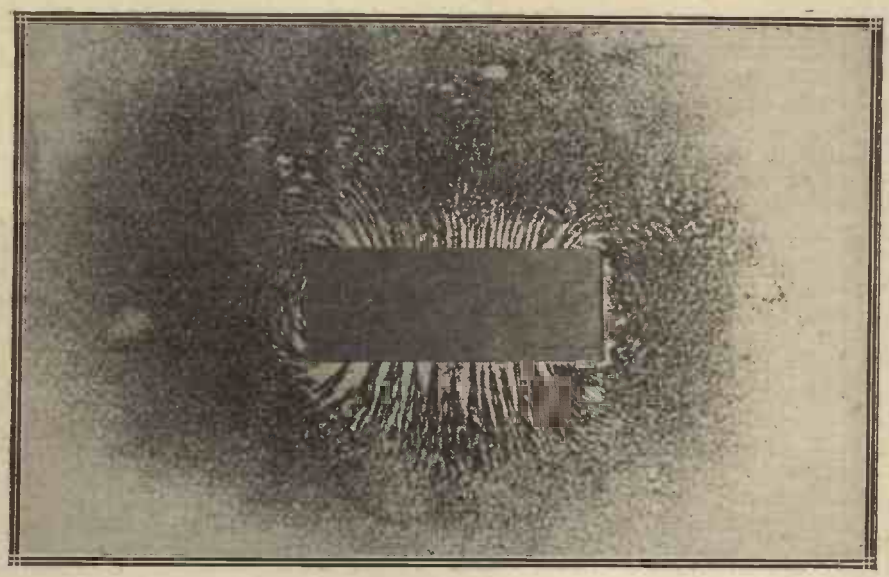
The calibration charts employed are drawn up on a very large scale, the actual size being something like 4 ft. by 2 ft. 6 in. These charts are being hung on the wall of the Laboratory, and it is a striking tribute to the designer, Capt. H. L. Crowther, that even on a large scale like this all the points obtained in the course of calibration lie absolutely on a smooth curve with hardly a perceptible deviation on either side.

* * *

Tracing Out Coil Fields

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

In this article Mr. Barton-Chapple presents some further interesting results of his investigations, with details of another method of determining the shape and extent of a magnetic field.



The field of coil B was determined by the iron filings method.

IN my last article we saw how it was possible to directly obtain a map of the magnetic field of a coil by employing iron filings. When this method was not satisfactory, resort could be made to a compass needle for the somewhat lengthier process of plotting the resultant field. Before describing a further method for deriving these interesting results, the magnetic field for one more coil will be shown.

"D" Type of Astatic Coil

A particular style of coil (coil D) which consists of two single-layer windings on the same tube wound in opposite directions and separated by a small distance, as shown in the photograph, was employed. The field plotted by the compass-needle method is indicated in Fig. 1, and it seems to be somewhat similar in shape to the case of coil C. Although a current of 5 amps. was flowing, however, it was found that the field influence only extended to a distance of 4 in. from the coil centre, thus demonstrating that this type of astatic coil has advantages where stray fields are of importance.

Results

The complete results of these simple experiments are drawn up in a convenient tabular form, the inductance of two of the coils in micro-henries (μH) being stated for comparison purposes.

The seven coils chosen for these experiments are typical of those which are generally met with in an ordinary wireless receiving set, and information of an equally useful nature will be obtained if other coils are employed. In addition the modifications brought about by the introduction of iron can be found by these methods.

Conclusions

Since the above results are drawn up on a qualitative basis, definite quantitative conclusions cannot be drawn from them. The differences

Coil D was of the astatic type wound on a special former.

in the shape and extent of the coil fields are interesting, however, and clearly demonstrate that the question of "stray" fields is of extreme importance.

In addition, the advantages derived through the adoption of special types of winding, designed with a view to reducing the external influence of a coil, are borne out. Where considerations of space in the lay-out of a receiver are of importance the necessity for employing special coils with limited magnetic fields cannot be over-emphasised.

Another Method for Plotting Fields

After completing these tests another ingenious method for securing a permanent record of the magnetic field of a coil was brought to the notice of the writer. In view of its relative simplicity it will be described here so that readers can then make a choice from the three possible methods according to circumstances.

By the means about to be elaborated a definite photograph can be secured without having to fix the iron filings in position by spraying on the liquid fixative.

Details

Procure a piece of ordinary "gas-light" photographic paper of adequate size, and cut it so that it will fit over the coil, the necessary supports being adjusted to hold the coil and paper in order to ensure that the photographic paper forms a mid-section plane as indicated previously.

To prevent the paper from being spoilt by exposure to strong light this work must be carried out in a yellow light, or, failing that, a dim light can be situated in a remote corner of the room so that no direct rays fall upon the sensitised paper.

The Iron Filings

The iron filings should now be carefully sprinkled over the paper by allowing them to sift through the fine mesh of a muslin bag. This allows an even distribution to be secured which otherwise would be difficult to obtain.

When sufficient filings have been spread over the surface of the paper pass the required current

Tracing Out Coil Fields—*continued*

through the coil and very gently tap the paper. The filings will now form themselves into the paths representing the lines of the force.

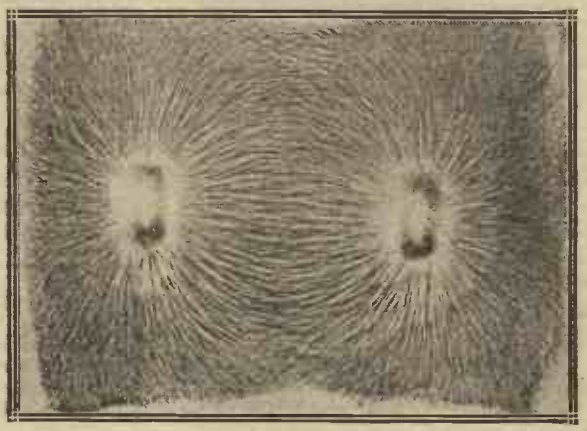
Obtaining the Negative

Having obtained the desired field, disconnect the battery supplying current and switch on a strong light a foot or so above the surface of the photographic paper and "expose" for a period of 5 to 10 seconds. The exact length of time for the exposure can be found by trial if small pieces of the paper are experimented with under the influence of the strong light. The minimum time for obtaining an intense black surface after the ordinary developing processes have been gone through will be the necessary exposure period.

Now develop this paper, taking care to have an ample supply of developer and a fresh fixing bath. The result of this work will give a "negative" showing "white filings" on a black background. The necessary contact prints can be made from this negative, it being found preferable to use bromide paper for this purpose.

Results

The final results obtained from this process are very effective, as will be seen from the accompanying photograph, which indicates the field of a permanent magnet secured in this way. A comparison of the methods is made possible by referring to the other photograph shown, which indicates the resultant field from a coil mentioned in my last article.



An example of a magnetic field plotted by the special method described this week. (This is actually the field of a large permanent magnet).

Table of Results.

Coil Symbol Reference.	Type of Coil.	Current through Coil in amps.	Extent of Coil Field Influence from Coil Centre.	Coil Inductance in μH.
A	Large Multi-Layer Coil.	0.5	8 ins.	—
B	Small Multi-Layer Coil.	2.0	4 ins.	—
C	Special Plug-in Coil.	2.0	3 ins.	—
D	"D" Astatic Coil	5.0	4 ins.	—
E	Bodine Twin-Eight R.F. Transformer.	5.0	4 ins.	—
F	No. 40 Lissen	4.0	5 ins.	130
G	B.1 Gambrell	4.0	6 ins.	156

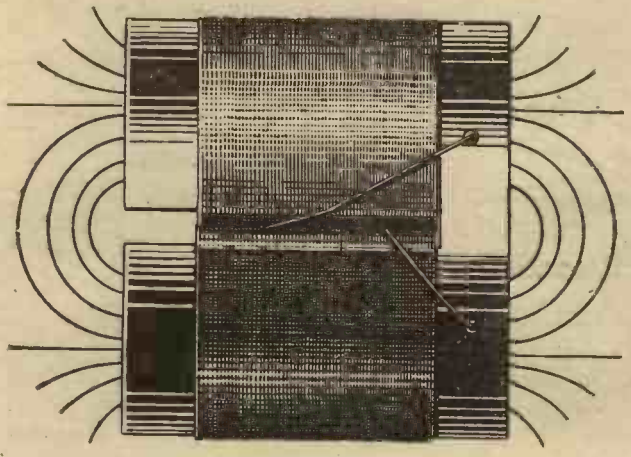


Fig. 1.—The field of coil D was plotted by the compass needle method.

SAMPLE RECEIVED

WE have received a sample of the R.A.C. accumulator from the Royal Accumulator Co., of 30, Wood Street, Deansgate, Manchester.

We understand that this firm is not new to the manufacture of accumulators, this work having been in progress for about twenty years. Recently, however, alterations and improvements have been made, and the sample submitted to us represents their latest design.

Special Features

On inspection of the 2-volt cell sent to us several special features are noteworthy. A celluloid container is used, with reinforcing strips at intervals. The terminals are provided with grease cups at the base, in order to prevent the acid from creeping on to the brass parts. Both the grease cups and the terminal heads are coloured red and black for positive and negative respectively, so that there is no chance of confusion here.

Easy Filling

Round the vent plug is a celluloid cup, which makes for easy filling with water or acid without spilling, and which also should prevent any acid sprayed out during the charge from spreading over the top surface of the cell.

JOTTINGS BY THE WAY

By Wireless Wayfarer

SOMETHING will really have to be done about these newspapers. Like heaps of other devoted wireless men, I am always having my hopes raised by a headline that seems to promise something profoundly interesting in the shape of a wireless article, only to find, after wading through half a column or so, that the thing is really dealing with some other subject of infinitely less importance.

Just the other day my eye was caught by a heading which fairly shouted "B.B.C. Must Act." The first paragraph was really thrilling, for in it the B.B.C. was called upon to put down with a firm hand such nefarious practices as making losing hazards with the butt end of your cue or potting your opponent's ball more than six times running. A splendid idea, was it not? Pal-

. . . "They're wireless telegraph posts, aren't they?" . . .

pitating with expectation of more good things to come, I read on.

Sold!

And then I found that the B.B.C. was the Board of Billiards Control. On yet another day my nerves were frayed to rags owing to my having been deceived by a B.B.C. headline. This time it was the Board of Boxing Control. And only last night when I picked up my evening paper the first thing that struck my eye was the glorious headline, "Towards Aerial Perfection!"

Could anything be more promising than that? I ask you. Would you not have settled down to read what followed, brimming over with expectation? You would? I thank you. You would have been had on —possibly you were—just as I was, for the ensuing two columns dealt merely with improvements in aeroplane design. That sort of thing is altogether too bad.

That Ass Poddleby

And matters become worse when idiots like Poddleby try to work off

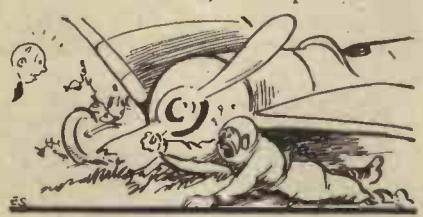
In view of the fact that the new "Wireless Weekly" has gained a very large number of new readers, it is thought that some introduction of the various characters appearing in this feature will be desired. It is believed that the likenesses to be seen above, with the following key to the diagram, will serve to make known the peculiarities of the chief characters.

LIST OF COMPONENTS.

C_1 Breadsnapp	C_2 Admiral
R_1 Snaggsby	L_2 Bumpleby Brown
L_1 Dippleswade	B_1 Professor Goop
D Gubbsworthy	R_2 Poddleby
V_1 Wayfarer	L_3 General

silly jokes on you. Last week the fellow came rushing into my den and said, "I say, Wayfarer, have you heard the news?" Seeing that he was bursting with something, I answered "No," so as to give him a chance of getting it off his chest. "The Government is rigging up wireless telegraph masts just outside the town," he cried. "Come and see."

Naturally I went. About half a mile along the Bilgewater Magna road we came upon a squad of Post Office workmen, complete with



. . . Aeroplanes became a positive nuisance . . .

handcarts and little brown tents. They were engaged in erecting telegraph poles. "There you are!" giggled Poddleby. "They're wireless telegraph posts, aren't they? They have not got the wires up yet? See? He, he, he." "Ha, ha," I grunted. "Oh, yes, ha, ha." Luckily the 'bus bound for Little Puddleton passed at that moment, and I leapt aboard, leaving Poddleby to walk home alone.

Revenge!

A couple of nights later I strolled round to see Poddleby. "Are you much bothered with mice?" I inquired casually. "I should think we jolly well are," cried Poddleby. "The whole house is over-run with them. They eat my coils and make nests in my boots." "You have only yourself to thank," I said; "you simply have not taken a proper step to get rid of them. Now I have not a mouse in the place!" "How on earth did you manage that?" asked Poddleby, his eyes bright

. . . sat scratching his left ear while he concentrated . . .

with expectation. "Oh," I said, "I just used my brain. A little ingenuity is all that is needed, and my wireless mousetrap does the trick." "Some kind of death ray, I suppose," cried Poddleby, all agog. "What a splendid idea. Tell me all about it, and I will rig one up at once. How does one make a wireless mousetrap?" "One uses perforated zinc," I replied, rising and making rapidly for the door. "Go and sit on top of one of your wireless telegraph poles and think it over."

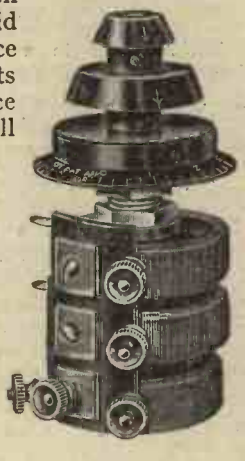
It's an Ill Wind . . . .

But to come back to those deceptive newspaper headings. There is an old saying that out of evil cometh good, and the one about aerial perfection set me thinking.

3 controls in 1

THE MULTISTAT will do all the work of two or three filament controls by itself, and do it easier and better. It saves panel space, simplifies internal wiring, improves the appearance of the set, and costs less than the usual separate controls.

Three independent knobs fixed to separate concentric spindles control the action of the contact arms. These arms engage on the resistance windings which are wound on a solid casting. Each resistance is thus controlled by its respective knob. A glance at the illustration will make this clear.



SPECIFICATION:

Heavily nickel-plated brass metal work. Resistances of best Eureka wire. Solid Ebonite knobs engraved and highly polished. Terminals for necessary connections. One-hole fixing. Highest class workmanship.

The MULTISTAT is made in the following standard units:—

Type A Double Filament 7/6
Type B Treble Filament 11/6
each

The resistance elements may be of 6, 8, 10, 25, or 30 ohms.

The perfect filament control the—

MULTISTAT

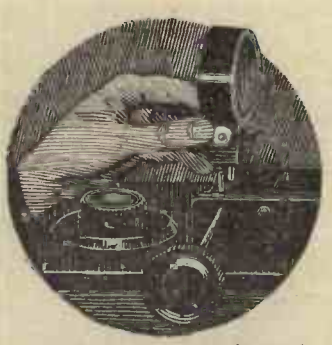
Patent No: 239,277 A Rayol Product

ENGINEERING WORKS LTD.
(Electrical and General)

Regd. Offices: 7 & 8, Gt. Winchester Street, E.C.2.

All applications to:
17-21, Thurlow Park Road, West Dulwich, LONDON. *'Phone: Streatham 2606.*

Send also for particulars of the 'Radiopal'—the four valve portable receiver described by the 'Wireless Times' as far and away the most interesting instrument at the Horticultural Hall Show.



About a book you'll want.

In the new Radion Book you will find complete working instructions for building the unique portable and self-contained Loud Speaker Set illustrated below. Clearly and concisely written and containing many illustrations, in the Radion Book are also particulars for building three other high grade sets. Every enthusiast will want this book. From your dealer, or send 6d. in stamps to

AMERICAN HARD RUBBER CO. (Britain), LTD. 13A Fore St., London, E.C.2

6d.

RADION
DISTINCTIVE PANELS

Gilbert Ad. 4720

FOR TRUTH IN MUSIC USE

FERRANTI

INTERVALVE
TRANSFORMERS

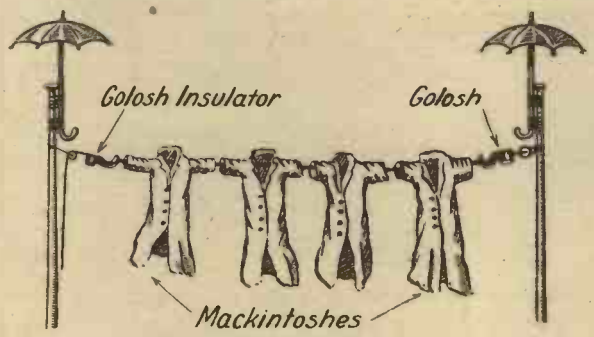
TYPE AF3 25/-

TYPE AF4 17/6

FERRANTI LIMITED HOLLINWOOD LANCASHIRE

Jottings by the Way—*continued*

Whenever this happens I go round to the Microfarads to see Professor Goop. I give him the idea, and he begins to think too. By putting our heads together in this way—



. . . A drawing of the Goop - Wayfarer undamped aerial . . .

tight-coupled if you like—we obtain a kind of telepathic reaction which causes the brain waves to build up to such an extent that damping, in the form of large draughts of barley water, has to be introduced in order to preserve stability. This telepathic reactive effect is easily understood when it is remembered that the capacity of both the Professor's brain and my own is enormous.

Diplomacy

As I entered his den the Professor rose from the only really comfortable chair in the room to greet me. Seizing his extended hand I kept on shaking it and talking hard whilst I backed round the table, drawing him after me. Then when I had got him far enough away from his starting-point I dropped the hand and made a successful dash for the chair.

It is a curious thing, but I can never think properly unless I am really comfortable. The Professor rather gloomily settled down into another chair, whereupon I cried, "I say, isn't this your favourite chair? How thoughtless of me. I could not think of depriving you of it." The Professor was just going to say something when I hastily asked if he had ever considered the aerial question, and this sufficed to make him forget at once all about the chair problem.

Happy Oblivion

Unlike myself, the Professor can think anywhere, for once his brain has been set in motion he becomes completely unconscious of his surroundings. I remember that on a similar occasion not long ago he sank into little Fido's basket, and sat scratching his left ear with the toe of his boot whilst he concentrated.

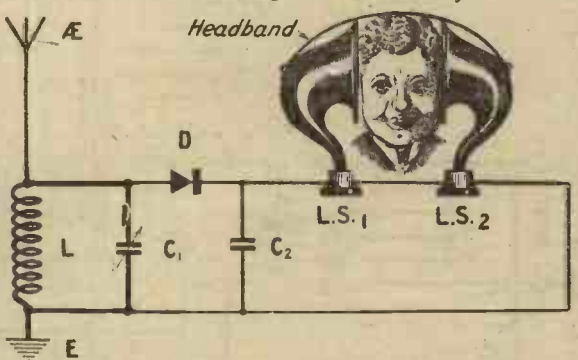
The Aerial Problem

With our brains reacting like anything we sat and discussed the great aerial problem. There is obviously something very much wrong with the aerial as we know it to-day. Apart from its unpleasant habit of falling through the greenhouse when breathed upon by spring's gentle blasts, the aerial has a terrible effect upon the performances of our receiving sets. The

. . . place the head between the loud-speakers . . .

damping which it introduces causes their selectivity to go all to pot. Hoping to increase your signal strength, you rig up a nice large aerial, but when you tune in you find that you cannot separate Brussels from Birmingham. To improve selectivity you reduce the size of the aerial until it is hardly there at all, after which you can get neither Brussels nor Birmingham.

. . . The circuit is a perfectly straightforward one . . .



Wireless Fireplaces

Baffled by the outside wire, you build a frame, whose directional properties should make it splendidly selective. Wishing to hear 2LO, you set your frame on the correct compass bearing. You hear a faint voice, which becomes louder as you turn the frame a little, and is at its loudest when it is pointing directly towards the fireplace. Curiously enough, all the other stations come in best with the frame in the same position. In order to obtain full advantage of the directional effects you scrap the fireplace and install instead a portable tortoise stove. The whole position is very obscure.

A Great Thought

Several ideas for the elimination of damping occurred to us, the most promising of which was to keep the aerial always perfectly dry. A drawing of the Goop-Wayfarer Undamped Aerial is reproduced herewith. It will be seen that goloshes take the place of porcelain insulators, and that the suspended wire is protected by means of mackintoshes. So far we have not had an opportunity of putting the idea to a practical test owing to a certain reluctance on the part of the members of the Little Puddleton wireless club to part with their mackintoshes for experimental purposes. We feel sure, however, that we are on the right lines, and if the mackintoshes are really storm-proof it is most likely that they will help not a little towards the elimination of atmospherics as well as of damping.

The Crystal Loud-Speaker

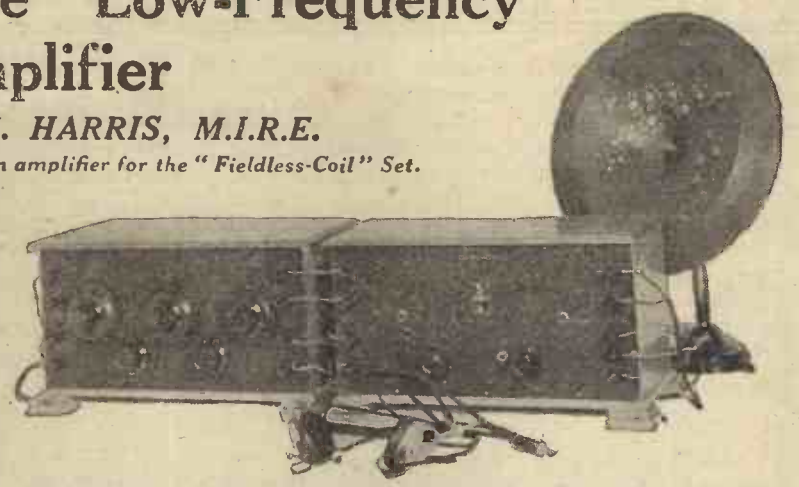
The discussion of the aerial question brought us naturally to the topic of loud-speaking crystal sets. The only satisfactory type so far designed makes use, as you know, of a gigantic aerial which more or

(*Continued on page* 104.)

The "Any-Valve" Low-Frequency Amplifier

By PERCY W. HARRIS, M.I.R.E.

Full practical details of the companion amplifier for the "Fieldless-Coil" Set.



The amplifier has been designed to harmonise in appearance with the "Fieldless-Coil" three-valve receiver.

ALTHOUGH primarily designed as a companion amplifier for the three-valve "Fieldless-Coil" receiver described in *Wireless Weekly* recently, the instrument to be described can be used with any receiver needing a further stage of note magnification, whether crystal or valve. Its special feature is the inclusion of a new type of low-frequency transformer, enabling the user to get good results with practically any type of valve, bright or dull emitter, general or power. It can thus be regarded also as a power amplifier, for separate high tension and grid bias are provided for each valve.

Transformer Requirements

While there are numerous well-made and well-designed low-frequency transformers available to the British purchaser, to get the very best results with a particular valve the impedance of the primary winding of the transformer used in its anode circuit should be suitable for that particular valve.

Some transformer makers sell two or three ratios and specify the particular types of valves for which they are designed. Others design their transformer to suit the average bright emitter, the impedance of the primary being such that reasonably good results will be obtained with most of the valves in common use.

Suiting the Valve

Now, if you examine a valve maker's catalogue in which impedances of various types are stated, you will see that these vary considerably. At the moment I have in front of me one catalogue, in which three different types are recommended for low-frequency amplifying with a 6-volt accumulator. The first is a bright emitter, the impedance of which is given as 30,000 ohms, the second is a dull emitter power valve using a quarter of an ampere filament current, the impedance being 8,000 ohms, and the third is a low-frequency valve using .12 of an ampere with an impedance of 8,000 ohms.

The problem of the design of an amplifier to suit the wide range of the numerous valves now available is not easy of solution. In this instrument Mr. Harris has employed two new intervalve transformers which make it possible to meet the requirements of a great variety of valves and circuits.

In the same catalogue there are a number of other low-frequency valves working on 2- or 4-volt accumulators, the impedances being 32,000, 22,000, 40,000, 10,000, and even 4,000 ohms. How can any one amplifier be equally suited to all these types? Manifestly it is impossible to design a transformer to suit all of these equally well.

A New Transformer

A new transformer has just been placed on the market by Radio Instruments, Ltd., with tappings on both primary and secondary windings, so that different impedances and ratios may be obtained at will. The primary winding has three terminals, the total impedance between the outside terminals being 60,000 ohms, that between one pair being 7,000 ohms and that between the other 28,000 ohms. It is thus possible to choose by means of a tapping an impedance of primary winding much closer to the impedance of the valve than is usually the case.

Occasionally a variation of the ratio may be found of value, but I do not attach to this the same importance as to the tapping of the primary. By utilising the tappings

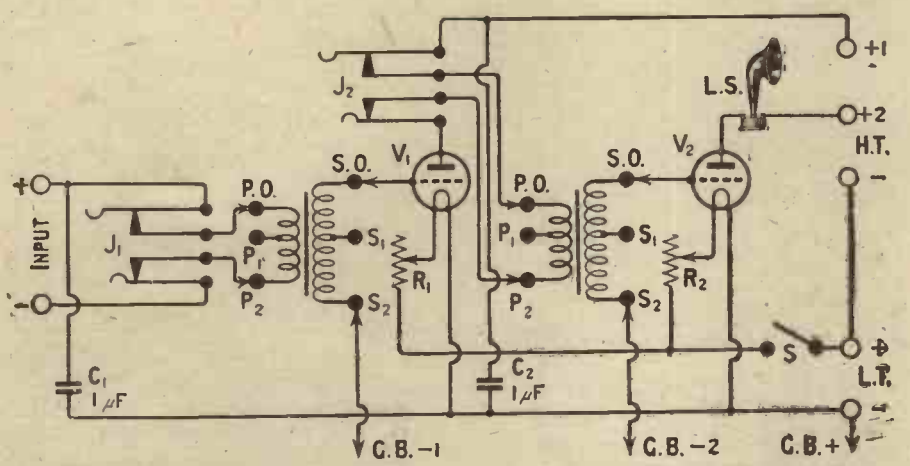


Fig. 1.—Plugs and jacks are provided to permit telephones to be used with one note-magnifying valve and to enable them to be connected directly to the input.

The "Any-Valve" Low-Frequency Amplifier—*continued*

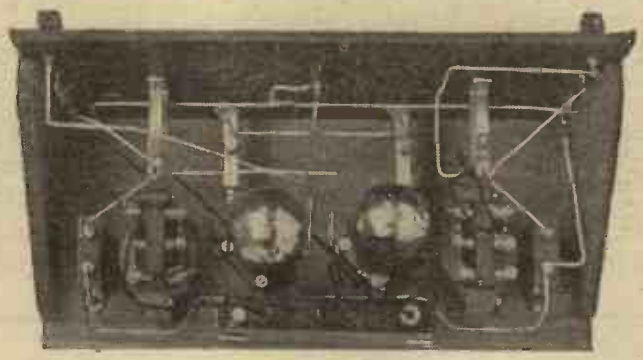
on both primary and secondary nine different arrangements are possible and seven ratios obtainable. An advantage of the transformer that will not be overlooked by the home constructor with an economical turn of mind is that should by any chance and for any reason the windings break down, the broken down section can be cut out by the use of the terminals, and the transformer still used.

Switching Arrangements

The "Any-valve" amplifier has been designed to make full use of the flexibility of this transformer. The transformers themselves are placed immediately behind a pair of jacks, flexible leads with spade terminals being soldered to the two inner lugs of the jacks so that reversals of windings and changes of ratio can be effected in a moment. Short flexible leads are also provided for the secondary windings, and the transformers are spaced adequately to reduce the possibility of interaction. If, for example, the amplifier should tend to howl, reversal of the direction of windings or alteration of ratio in one of the transformers will invariably effect a cure.

Function of Jacks

In order that the user may listen on the detector alone, on one stage of note magnification, or on two, jacks are provided to plug in the telephones when required. The first jack (on the left) places the telephones in the anode circuit of the detector valve connected to the amplifier, without either note magnifier being used. The second jack on the right inserts the telephones in the anode circuit of the first low-frequency valve, while immediately the plug is withdrawn from this jack a loud-speaker connected to the L.S. terminals will be put into action in the anode circuit of the second low-frequency valve.



This view of the base-board shows how simple is the wiring of the amplifier.

A grid-bias battery is included in clips inside the cabinet and separate terminals are provided for high tension of first and second valves. The advantage of the jack switching method is that the correct anode voltage can be applied to each valve, a matter very difficult of arrangement with switches. Furthermore, the wiring with jacks can be made considerably simpler than is generally the case with switches.

List of Components

The following components are those used in the set being described. Other makes of low-frequency transformer can be substituted, but if this is done the same flexibility in the use of valves will not be possible. At the same time, just as good results may be obtained with other good brands of transformers, provided suitable valves are used with them.

One cabinet to take panel 16 × 8 × ¼ in. (Caxton Wood Turnery Co.).

One panel of above dimensions ("Pilot," Peto Scott Co., Ltd.).

Indicating terminals for input +, input −, L.T. +, L.T. −, H.T. −, H.T. 1, H.T. 2, L.S. −, L.S. + (Belling Lee, Ltd.).

Two double circuit jacks (Igranic Electric Co., Ltd.).

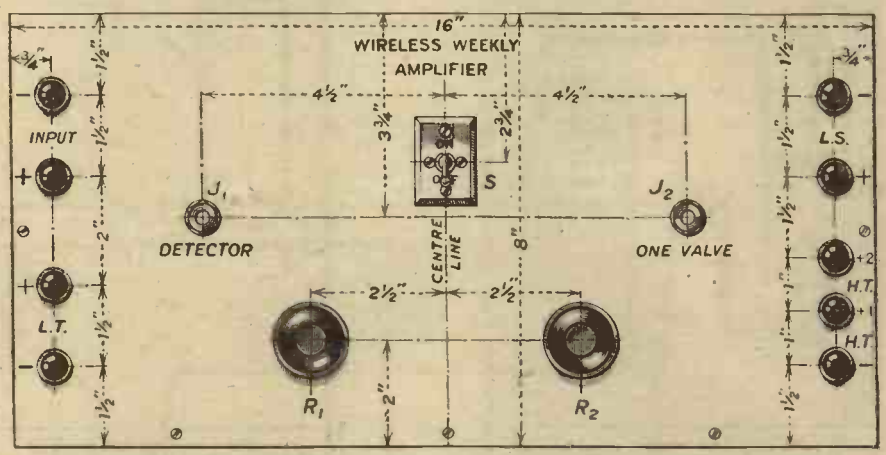
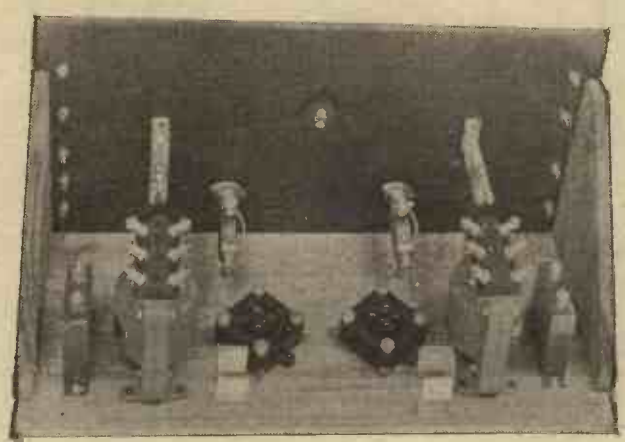


Fig. 2.—The lettering of the jacks corresponds to that in the circuit diagram.



This photograph was taken before the wiring was done, and gives a good idea of the layout of the parts.

The "Any-Valve" Low-Frequency Amplifier—*continued*

Plugs for same (Igranic Electric Co., Ltd.).

One on-and-off switch (R. A. Rothermel, Ltd.).

Two filament resistances (C. A. V. & Co., Ltd.). These resistances have interchangeable bobbins so that bright or dull emitter valves can be used.

Two multi-ratio L.F. transformers (Radio Instruments, Ltd.).

Two Mansbridge condensers, 1 μF (Telegraph Condenser Co., Ltd.).

Two valve holders (Benjamin Electric, Ltd.).

Two clips for grid-bias battery (A. G. Brine).

Eight spade terminals.

Eight short lengths of electric lighting flex, insulated.

One tapped grid-bias battery of suitable size and three wander plugs.

Glazite wire for wiring up.

Radio Press panel transfers.

Constructional Work

The cabinet, if obtained from the Caxton Wood Turnery Co., will be provided with a baseboard and wooden brackets to which the front panel is screwed. You start work by marking out the front panel at the back with a scriber and drilling the $\frac{3}{8}$-in. holes to take the filament resistances and the jacks. The holes for these latter will need to be opened out a little more than $\frac{3}{8}$ in. This can be done with a round file if no other tool is available. The hole for the barrel of the on-and-off switch will need to be larger. This

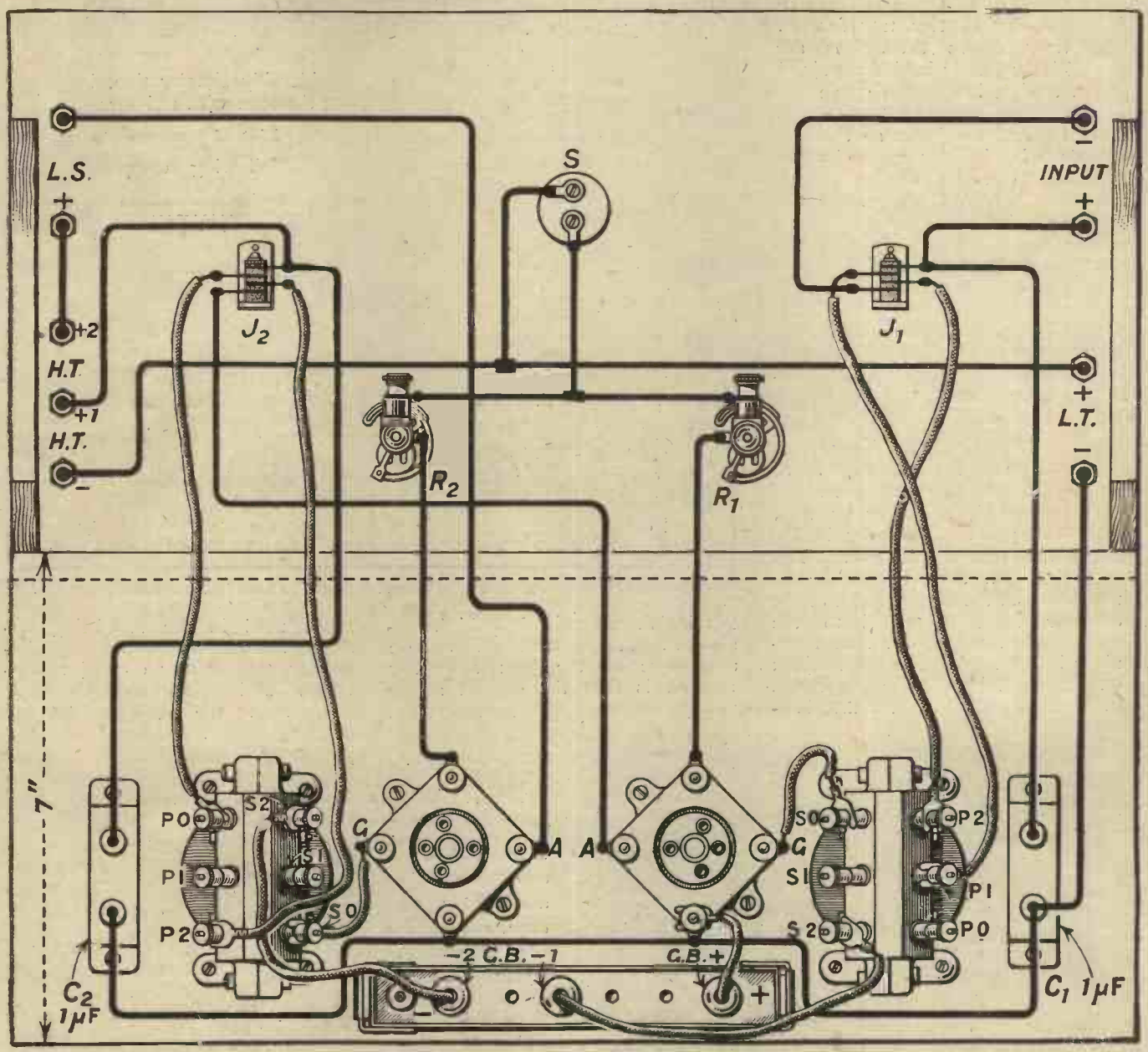
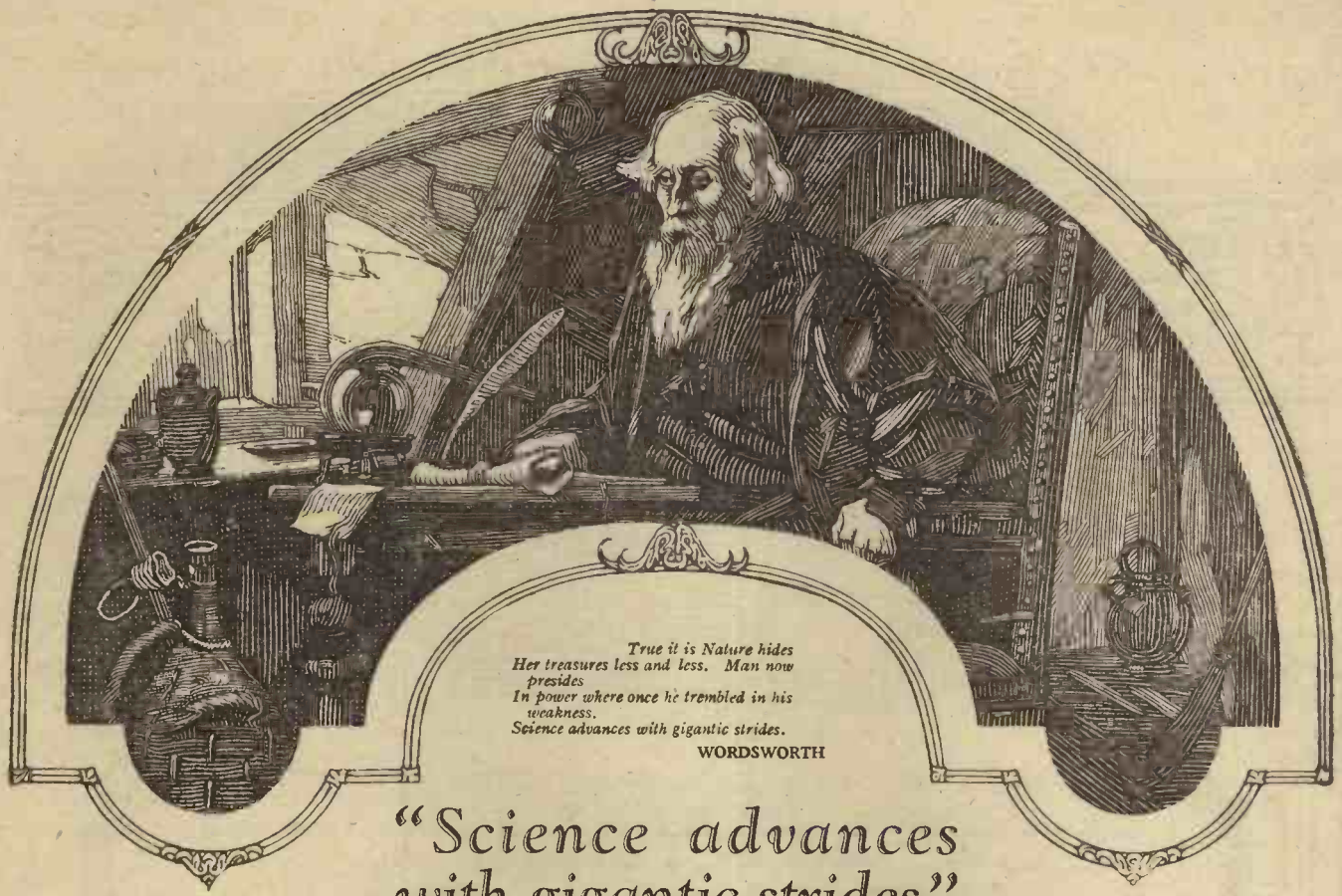


Fig. 3.—Note the placing of the two valve-sockets. A considerable simplification of wiring resulted from this arrangement. It should also be observed that certain of the connections are made with flexible leads.



True it is Nature hides
Her treasures less and less. Man now presides
In power where once he trembled in his weakness.
Science advances with gigantic strides.
WORDSWORTH

"Science advances with gigantic strides"

THE Middle Ages present us with few more romantic figures than the Alchemist. Feared for his magic, more than one suffered the penalty of the stake as a grim reward for his reputed dealings with the Evil One. And yet to these pioneers — these persistent searchers for the Philosopher's Stone — civilization owes much. They were the world's first scientists.

But now, after slumbering for so many centuries, Science "advances with gigantic strides." The fallacy of Alchemy is exposed — sensible men no longer seek the magic formula for the transmutation of base metals into gold. The Alchemist has become the Chemist.

Wireless owes much to the Chemist. It was a Chemist who reasoned that as the whole object of a heated filament is to produce electrons, why not so treat the filament that it gives off a more prolific stream at a lower temperature? And so the idea of the dull emitter valve was born.

To the wizardry of the Chemist we owe the Wuncell—the wonderful Cossor Valve which functions with a filament glow almost invisible. It was his skill which rendered possible its triple-coated filament. Just as the first Dull Emitter was a mile-stone in the progress of Radio, so the Wuncell to-day represents the high-water mark in the evolution of the Valve.

With its electron-retaining hood-shaped Grid and Anode—made famous by Cossor—it sets a new and higher standard of performance. For sensitivity, rare mellowness of tone and lack of microphonic noises, the Wuncell is unsurpassed. Whilst, freed from the destructive influence of excessive heat, its sturdy and robust filament ensures an exceptionally long life. Couple with these facts its low maintenance costs and you'll understand the secret of the great wave of popularity now being enjoyed by this remarkable Valve

Types and Prices:

*W.1. For Detector and L.F. use - Consumption: ·3 amps.	14/-
*W.2. (With red top) for H.F. use Consumption ·3 amps.	14/-
W.3. The Loud Speaker Valve . - Consumption ·5 amps.	18/6
*Also in special base with resistance to suit 2,-4- or 6-volt Accumulator	16/-

Cossor Valves

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

Gilbert Ad. 4701

The "Any-Valve" Low-Frequency Amplifier—*continued*

can be cut out either with a fretsaw or by marking out a circle the size of the barrel and drilling a number of small holes in the ebonite round the circle until the middle piece drops out.

The finished instrument removed from its cabinet. The panel lay-out is very symmetrical.

It does not matter if the edges of this hole are slightly rough, as the front plate of the on-and-off switch will cover this up. Once the central hole for the barrel has been drilled, the switch itself can be used as a drilling template to drill the two holes to take the securing screws. If the holes are drilled slightly smaller than the wood screws provided with the box, the wood screws can be driven into the ebonite without tapped holes being made. The holes can then be drilled to take the terminals and one or two small holes round the edge of the panel to take the wood screws which will secure the panel itself to the uprights.

Mounting the Parts

The transformers, valve sockets, Mansbridge condensers and clips for grid-bias batteries can now be screwed to their places on the wooden baseboard, and, before wiring up, the front panel should be screwed to the upright as shown. It will be found quite simple to carry out all wiring after the panel has been screwed to the upright, as there is plenty of space behind.

Flexible Leads

The flexible leads are soldered, as will be seen, to the two inner lugs of each of the jacks and to the grid terminal of each of the valve sockets. The remaining two flexible leads are joined to two wander plugs of the grid-bias battery.

Note particularly the arrangement of the valve sockets. Looking from the front of the instrument, the valve socket on the left is so arranged that its anode socket is on the right-hand side, while the right-hand socket has the anode on the left-hand side. The Mansbridge condensers are joined between the positive side of each of the jacks and the negative filament lead, thus following logically the line laid down in a recent article in *Wireless Weekly* in which I gave my reason for altering the position of the shunting condensers.

Testing the Amplifier

On completion this amplifier was given extensive tests with all kinds of low-frequency valves of varying filament voltages and impedances. Bright emitters, dull emitter power valves and .06 ampere low-frequency valves were all tested out, and good results were obtained in each case when the correct tapping of the primary was found. The best results of all were with power valves, since these are the only types of valves enabling undistorted reproduction of really loud signals to be given. The variation of secondary winding was not found to be of any advantage, but the variation of primary impedance often effected a vast improvement.

The same size of cabinet is used for the amplifier as for the receiver proper.

Primary Impedances

If it is noted that the impedance between Po and P1 is 7,000 ohms and between P1 and P2 28,000 ohms, and between Po and P2 60,000 ohms, at an average frequency, the best impedance with each particular valve can soon be found.

Reversing the direction of windings of both secondary and primary should also be tried. Adjustment should be made first of all by listening in the anode circuit of the first valve and adjusting this to give the best results.

When this has been done a loudspeaker should be connected to the L.S. terminals and adjustments of primary winding of the second transformer made to secure the best results obtainable. When using this amplifier with a crystal set it will probably be found best to use the lowest impedance primary immediately following the crystal.

(Much valuable data on valves and impedances of all the leading makes will be found in the Radio Press Year Book, now on sale, price 1s. 6d.).

NEXT WEEK

Continuing his series of articles, Mr. Scott-Taggart will deal next week with the subject of "Mysterious Oscillations which Spoil Reception." This contribution will throw light upon many of those problems of eccentric behaviour on the part of receiving circuits which prove so puzzling to the experimenter.

THIS WEEK'S INTERVIEW

No. 3.—Captain H. L. CROWTHER, M.Sc.

In this interview, which is reported verbatim, it will be found that the series of questions has been carefully framed to elicit information of a character to interest everyone and to exclude all irrelevant matter.

SUPERHETERODYNES AND THEIR WAYS.

Q.—One often hears it stated that a "Superhet" is much more noisy and brings in more "mush" than an ordinary straight circuit. Do you think this is so?

A.—There is little to choose in this respect between a superheterodyne and a straight circuit of the same sensitiveness. If all outside disturbances were eliminated, one set would be as quiet as the other, assuming, of course, proper design and adjustment in each case. The idea probably originated owing to comparisons being made between superheterodyne receivers and straight circuits which were far less sensitive.

Q.—But a receiver operating on an outside aerial need not be as sensitive as one working on a frame for the same range of reception. Under these circumstances would you expect the disturbances to be the same?

A.—Up to a point, yes, as although the outside aerial receives more energy, from the desired station, it also picks up considerably more extraneous or parasitic noises such as "mush" or atmospherics. The relative strength of signals to "mush" probably remains approximately the same in the two cases.

Q.—So from this point of view you consider there is nothing to be gained by using an outside aerial and a less sensitive receiver?

A.—I would not go as far as that, as in many cases a great deal of disturbance might be due to quite local sources, such as electric light mains, telephones, electric generators and motors, and lifts in the same building. Disturbances of this type might easily be picked up on a frame aerial to a greater relative extent than on an outside aerial, and thus give a greater ratio of extraneous noise to the signal strength.

Q.—Can a straight set operating on an outside aerial receive as much as a superheterodyne?

A.—Yes, there is little doubt that this is so, except possibly in a special case of two stations operating on nearly the same frequency, in which case the directional properties of the frame aerial might come in useful, if the two stations concerned are not in the same direction from the point at which it is required to receive.

Q.—It would appear, then, that there is little advantage in using a superheterodyne except in cases where a reasonable aerial is impossible?

A.—This is hardly a fair statement, as a superheterodyne has another important advantage over any present design of straight circuit, and this is its simplicity of control. Although the superheterodyne is possibly more complicated in design, it certainly combines simplicity of control with a high degree of selectivity and at the same time is probably more sensitive than any other circuit of the same number of valves. With a superheterodyne two tuning controls only are necessary, whereas an ordinary high-frequency circuit requires at least four controls to effect the same selectivity with good reproduction.

Q.—Exactly how is this simplicity of control possible with the superheterodyne?

A.—With the ordinary H.F. circuit it is necessary to tune very accurately each circuit to the frequency which is to be received. With a superheterodyne, on the other hand, only one circuit need be tuned to the incoming signal. All incoming signals are converted to the same intermediate frequency by adjustment of the oscillator control, so that any desired degree of selectivity can be obtained by means of a multi-stage selective long-wave amplifier, the tuning of which can be definitely fixed once and for all.

Q.—It is often stated that two stations which are very close in frequency cannot be separated owing to the heterodyning of the carrier waves. Could two such stations, say, only two or three metres apart, be separated by means of a superheterodyne?

A.—At first sight this might appear to be possible, as when both stations are converted to the intermediate frequency by means of the oscillator, their wavelength might differ by something like 50 metres. If, however, we consider it from a frequency point of view, it can easily be seen that two stations differing by, say, 3 kilocycles, will still differ by 3 kilocycles after conversion, so that stations only differing by a frequency less than the upper limit of audibility cannot possibly be received independently.

Q.—I am not quite clear on the point. If the wavelengths of both of the stations are stepped up in the same ratio, their frequencies would be reduced in the same ratio, and the actual frequency difference

would be less on the intermediate wavelength than on the short wavelength.

A.—If the superheterodyne depended for its operation on the stepping up of different wavelengths in an equal ratio it would be quite useless for broadcast purposes, because each individual transmission comprises a series of different frequencies, so that hopeless distortion would result. The intermediate frequency is the difference between the frequency of the incoming signal and that of the local oscillator.

Let us consider an example of two stations whose frequencies are 1,000 kc. and 1,005 kc. If the local oscillator is adjusted to 950 kc., the intermediate frequencies will correspond to 50 kc. (1,000-950 kc.) and 55 kc. (1,005-950 kc.), so that the actual frequency difference remains the same in each case, namely, 5 kc.

Q.—Then a straight set can, with care, be made just as selective as a superheterodyne?

A.—That is so, the chief advantage of the superheterodyne being its simplicity.

Q.—I noticed just now that you took about 50 kc. as the intermediate frequency. Is this the most suitable frequency to use?

A.—Not necessarily so, as the choice of the intermediate frequency depends to a certain extent on the requirements of the set. For instance, if the set is only required to cover the normal broadcast range of frequencies from 1,500 to 600 kc. (200 to 500 metres), I should be inclined to use a much higher intermediate frequency, of between, say, 100 and 125 kc., which would enable the intermediate-frequency transformers to be made smaller and probably of lower resistance. Such an intermediate frequency, of course, would not be suitable for frequencies such as that of Daventry, and it would be necessary to use one much lower.

Q.—Is there any limit to the frequency that can be received by means of the superheterodyne?

A.—The intermediate frequency must always be several times less than that of the frequency which it is desired to receive. The intermediate frequency obviously cannot be reduced too far, otherwise it would come within the audible range of frequencies and good reproduction could not be obtained. The lower limit is probably something like 20

This Week's Interview
(Continued)

to 25 kc., so that the lowest frequency that can be received is probably between 100 and 75 kc. (3,000 and 4,000 metres). This, however, is sufficient to cover all the broadcast stations.

Q.—There is one point not quite clear with regard to conversion of the incoming signal to the intermediate frequency, and that is the necessity for rectification in the first valve. Can this be explained in a few words?

A.—A concise explanation is not very easy, but it will probably help matters if we try to define exactly what is meant by a "beat." A

A view of the R.A.F. main direction finding laboratory at Farnborough, where Captain Crowther was stationed before he joined the Radio Press staff.

beat, of course, is produced by the combination of two oscillations which are fairly close together as regards frequency, and can be considered as being a variation in amplitude of the more powerful of these oscillations. The period of this variation in amplitude is equal to the difference of the two frequencies. A beat, therefore, is not a true oscillation at a frequency corresponding to the difference of frequency of the two oscillations producing it, and cannot directly influence circuits tuned to the beat frequency. By rectification, however, the "beat" can be converted into a true oscillation at the beat frequency, and as such can influence circuits tuned to that frequency.

Q.—But the beat between two tuning forks can be heard by the ear and there is no need for rectification. Is not this similar to a beat between two electrical oscillations?

A.—The ear is responsive to the frequencies of the tuning forks, and the beat produced is simply a variation in amplitude due to the combined effect of the two forks. If the ear could only respond to frequencies lower than that of the tuning fork, then the beat would not be heard. For instance, if two tuning forks had frequencies of 10,000 and 10,100 respectively, the beat of 100 frequency would only be heard by persons who could hear frequencies up to at least 10,000. If, however, some form of rectification could be used, the beat frequency of 100 would easily be audible. It is thus only after rectification that a "beat" can be treated as an ordinary oscillation which will influence circuits tuned to its frequency.

Q.—Does not this preliminary rectification cause loss of sensitiveness on weak signals, as compared with a circuit in which the signal is amplified prior to rectification?

A.—With ordinary rectification the resultant signal strength is approximately proportional to the square of the amplitude of the incoming signal. That is, if the amplitude of the initial signal is halved, the resultant signal strength is reduced to approximately one quarter. If, however, the incoming signal is heterodyned by a fairly strong local oscillator, as in the case with the superheterodyne, the strength of the resultant intermediate frequency oscillation is directly proportional to the first power of the amplitude of the incoming signal, so that there is no loss in sensitiveness on weak signals as compared with a straight high-frequency circuit.

Wireless News in Brief.

Wireless Dispute. In connection with the strike of wireless operators, which terminated recently, when a provisional agreement was reached between employers and men, a number of points raised by the union are now being discussed. We understand that if no agreement is reached on any question at issue by March 31, the matter will be referred for settlement to the Industrial Court.

* * *

On a voyage from Liverpool to West Africa recently, a wireless enthusiast kept a continuous log of his reception. He was able to hear the transmissions from Daventry on most days, but atmospherics became increasingly troublesome as the ship moved south. The short-wave transmissions from KDKA, East Pittsburgh, were received with greater consistency.

* * *

Listeners in Germany. In spite of the fact that a wireless receiving licence costs in Germany 24s. a year, the number of listeners in that country is steadily increasing. The statistics for last month show that there were then over 1,108,800 listeners, more than half a million of these residing in or around Berlin.

* * *

Radio in Iceland. Following on the establishment of a broadcasting station at Reykjavik in Iceland, we now hear that Mr. A. Gook, a missionary of Akureiri, Iceland, is intending to instal a transmitting station there. Mr. Gook's primary intention is to use the installation for communication with all parts of the island at times when bad weather hinders travelling. It is also hoped that it may be possible to relay both English and American programmes from Akureiri. A frequency of 1,500 kilocycles (200 metres) will be used.

B.B.C. News. We learn that on March 5, instead of the usual talk at 7.40 p.m., listeners to the London programme will hear scenes from the making of a film play. The film is to be "The Whirlpool," which is being produced in Messrs. Gaumont's studios at Shepherd's Bush. In the cast are Miss Fay Compton and Mr. John Stuart.

It is reported that a member of the staff of the University of Pennsylvania has produced a valve which has no filament and can be supplied with H.T. from A.C. mains.

From the Programmes Sunday, March 7.—London, 9.15 p.m. : Band of H.M. Royal Air Force.

Monday, March 8.—Aberdeen : Chamber Music. Birmingham : A Light Musical Evening.

Tuesday, March 9.—London : An Unannounced Orchestral Concert. Belfast : "What's Wrong With This?" A Musical Competition.

Wednesday, March 10.—Birmingham : Variety Concert. Glasgow : Symphony Concert. Manchester : Popular Orchestral Night.

Thursday, March 11.—Cardiff : In Cap and Bells. John Henry and Blossom. Birmingham : Opera, "Cavalleria Rusticana."

Friday, March 12.—London, 9.50 p.m. : "No No Nanette," from the Palace Theatre.

Saturday, March 13.—London, 4.15 to 7.0 p.m. : Programme relayed from the Ideal Home Exhibition. Bournemouth : "Listening Time," the new Radio Revue (also from Belfast and Manchester). Birmingham : Popular evening.

* * *

Opera in Broadcast Studio. The broadcasting of an opera to be performed actually in the London studio is proposed for next month. Hitherto such items have, of course, been relayed by land-line from one of the theatres. It is hoped that it will be possible to secure Russian artistes to give from 2LO Rimsky-Korsakov's opera, "Kitesh," which has not yet been heard in this country.

* * *

The B.B.C. and Authors. In an agreement reached between the B.B.C. and the Society of Authors it is stipulated that no alteration in the author's original manuscript shall be made for broadcasting purposes without permission from the author. The B.B.C. have also agreed to pay certain minimum fees for broadcasting literary and dramatic items.

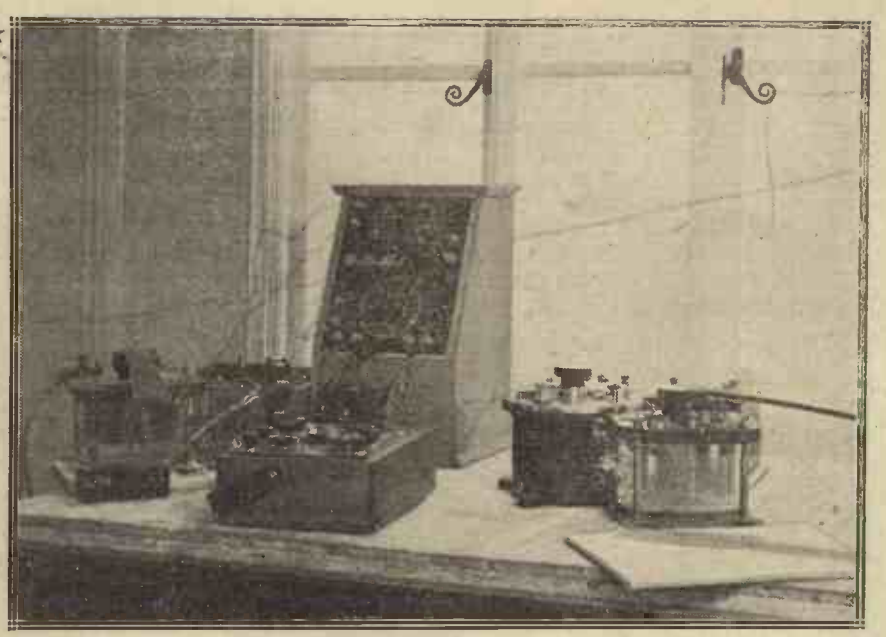
* * *

Curious Interference. Listeners in St. John's Wood, N.W., have been troubled for some time by a noise like that of a pneumatic drill, which is heard at certain times during broadcasting hours. The source of this noise has until recently been obscure, but it has now believed to have been traced to a machine in a Post Office sorting office which is used for the automatic stamping of letters.

A Simple Method of Measuring H.F. Resistance

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

One of the most important measurements in wireless work is that of resistance at the working frequencies, and special interest attaches to accurate methods of carrying out such work. The simple method described here is one which has been used very successfully at our Elstree laboratories.



A view of the actual apparatus used at Elstree for measuring H.F. resistance.

READERS of *Wireless Weekly* will have gathered from the interesting series of articles by Mr. Reyner the great importance of the measurement of high-frequency resistance in wireless work. For some time experiments have been conducted at the Elstree Laboratories with a view to finding the best and simplest method of measuring high-frequency resistance. Several well-known methods were tried out, but for one reason or another it was decided that they were unsatisfactory.

A Novel Method

Finally it was decided to try out rather a novel method which overcomes many of the difficulties in the more conventional methods of measuring high-frequency resistance. It is claimed that the method employed has the merit of comparative simplicity, and if care is taken gives very accurate results. The method is based on the well-known fact that if a tuned circuit is brought into the neighbourhood of an oscillating receiver the anode current in the latter will change. If the tuned circuit is brought too close the oscillator will cease oscillating. For the method employed it was, however, found necessary to use very loose coupling so that the drop or rise in anode current did not exceed more than about 100 microamperes.

The Measuring Circuit

The circuit employed is illustrated in Fig. 1, and it will be seen that the voltage across the L.T. battery is employed for balancing out the steady anode current through the measuring instrument. By this means it is possible to employ a microammeter to read the change in anode current and so obtain the utmost sensitivity. The resistance R2 is variable, and is of about 2,000 ohms resistance. It is preferably variable in steps, with a fine adjustment to cover intermediate values. Apart from this, the oscillator is of a conventional type employing a tuned grid.

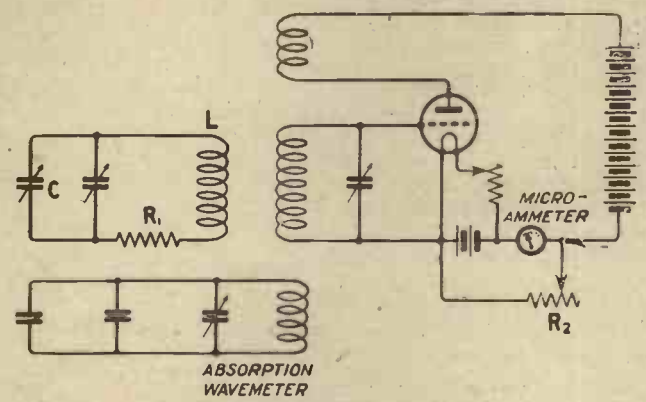


Fig. 1.—The complete circuit arrangement indicates that very little apparatus is needed.

The coil tested is shown as L in the figure, and it will be seen that this is tuned by means of two condensers, one of which is a vernier in order to obtain fine adjustment. The coil tested is coupled to the oscillator so as to produce a drop in anode current giving a full scale deflection, this corresponding approximately to 100 microamperes.

Experimental Method

The procedure in taking a reading is as follows. The oscillator having been previously adjusted to the frequency at which measurements are to be taken, the circuit L C is brought into tune, and the drop in anode current noted. A known high-frequency resistance is then inserted in series with the coil as shown at R1, and the decrease in anode current again read. A series of these readings are taken with different values of added resistance. A curve is then plotted of the added resistance R1 in ohms, and the reciprocal of the drop in anode current in any convenient arbitrary units.

Determining the Coil Resistance

It is found that the curve obtained is invariably a straight line, as was to be expected from theoretical considerations. This

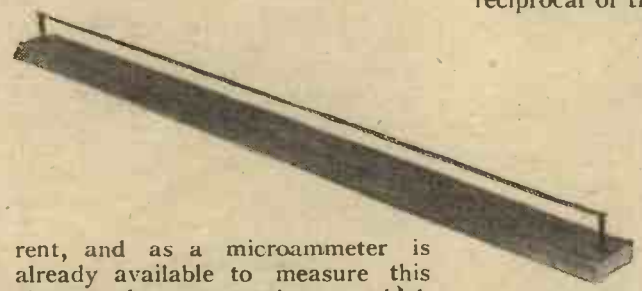
A Simple Method of Measuring H.F. Resistance—*continued*

straight line is then produced backwards. as shown in the graph in Fig. 2, until it cuts the axis along which the resistance is plotted. This intercept then gives the value of the resistance of the coil.

Measuring the Frequency

As the resistance of a coil changes rapidly with the frequency, it is essential to have some means of accurately checking the frequency at which readings are being made. For this purpose an absorption wavemeter is coupled to the oscillator in the same way as, but on the opposite side to, the tuned coil. This absorption wavemeter consists, in the apparatus at Elstree, of rather a small coil together with several fixed and one variable condenser in parallel. This variable condenser then acts as a vernier across the small wavemeter coil, and enables it to be tuned accurately to the frequency required.

When this absorption wavemeter is brought into tune it naturally causes a decrease in the anode current, and as a microammeter is already available to measure this change, the exact point at which the wavemeter is tuned to the oscillating circuit can very accurately be determined. It will be realised that this method of employing a separate absorption wavemeter has many advantages over calibrating the oscillator for a number of sets of coils.



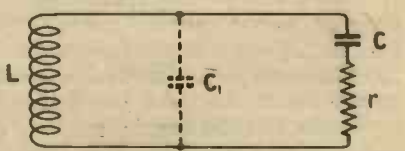


Fig. 3.—The self-capacity of the coil may give rise to notable errors if it is comparable to the capacity C.

Possible Errors

It is perhaps not easy to see at first why a straight line should be obtained when resistance is plotted against the reciprocal of the current change. It can be shown theoretically that this is what is to be expected, but since an explanation must involve a certain amount of mathematics, and as it is unimportant for our present purpose, it will be omitted.

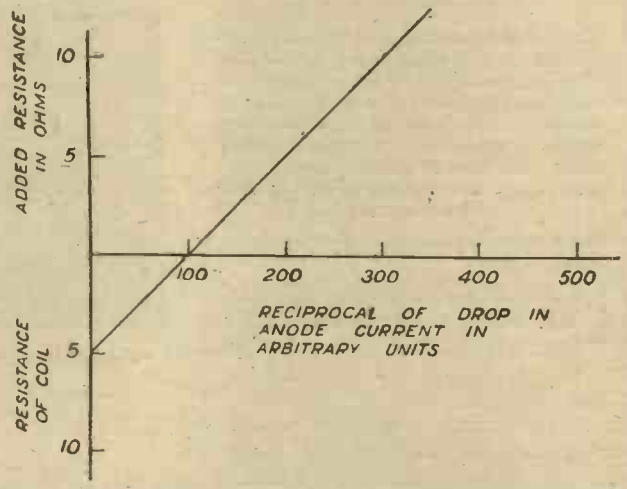


Fig. 2.—By plotting this graph the coil resistance can be read directly from the vertical scale.

The fact that a straight line is obtained, however, shows that the reciprocal of the drop in anode current is exactly proportional to the resistance of the coupled circuit. There is, however, a possibility that this effective resistance is not the same as the actual resistance, and this is more likely if the coil tested is coupled too closely to the oscillator.

For approximate work a stretched fine wire of known H.F. resistance per foot can be used in adding resistance to the circuit.

Coupling Effects

It was found on coupling the coil tested very closely to the oscillator that an extra low resistance was obtained, thus indicating too close coupling. However, if the coupling was loosened more than a certain amount the resistance obtained thereafter became constant. We are therefore justified in assuming that the oscillator does not affect the effective resistance of the tested coil under the conditions employed.

Coil Capacity and Its Influence

Another possible source of error lies in the self-capacity of the coil tested. In Figure 3 it will be seen that the added resistance (r) is in series only with that added capacity C which does *not* include the self-capacity C_1 of the coil. Thus, if the self capacity of the coil is comparable with that of the added capacity grave errors may result. It is therefore necessary for the most accurate results, and when measuring coils near their natural frequencies to apply a certain correction.

Condenser Losses

A still further source of possible error lies in the losses in the tuning condensers. Specially low-loss condensers were therefore employed for this purpose, and it was then found that by changing these for others of different types that no difference was noted in the apparent resistance, thus indicating that the losses in the condensers used were negligible.

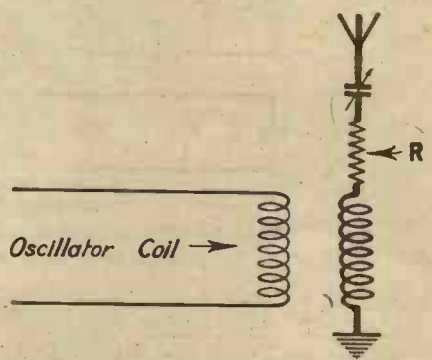


Fig. 4.—The method can be applied to the measurement of aerial resistance.

Praesis ut prosis

Latin motto: "Be first that ye may be of Service"

Brown Type H4

THE success of the Brown Loud Speaker runs parallel with the rapid growth of Broadcasting. Each year has seen the Brown more firmly established in public favour. Its long lead—for the Brown was the first Loud Speaker ever built in this country for wireless use—has never been seriously challenged.

True, the immense wave of popularity it has consistently enjoyed has often made a temporary shortage unavoidable. But S. G. Brown Ltd. have remained steadfast to an ideal—the continued production of a series of Loud Speakers worthy of the great reputation enjoyed by Brown Wireless instruments throughout the world.

Not for one moment would they permit a hair's breadth deviation from this most rigid standard of manufacture. Whether a man pays thirty shillings for a Brown H.4 or fifteen guineas for a Brown Q type, he obtains the same quality of materials, the same careful workmanship—and therefore the same dependable Service.

S. G. Brown Ltd., Western Avenue, N. Acton, W.3

Retail Showrooms:
19 Mortimer Street, W.1
15 Moorfields, Liverpool
67 High Street, Southampton

Depots (Wholesale Only):
2 Lansdown Place West, Bath
Cross House, Westgate Road, Newcastle

Scottish Depot:
120 Wellington Street, Glasgow.

Brown

Eight Types of Brown Loud Speakers

Type H.1. 21 ins. high. 120 ohms £5 5 0 2000 ohms £5 8 0 4000 ohms £5 10 0

Type H.2. Height 12 ins. 120 ohms £2 5 0 2000 ohms £2 8 0 4000 ohms £2 10 0

Type H.3. 15 ins. in height and in resistance of 2000 ohms £3 0 0

Type H.4. The smallest Brown Loud Speaker. Only 10 ins. high. 2000 ohms £1 10 0

Type H.Q. 20 ins. high. Resistance: 2000 or 4000 ohms £6 0 0

Type Q. 23 ins. high. In resistances of 120, 2000 or 4000 ohms £15 15 0

Cabinet Type In Mahogany or Oak Cabinet, 2000 or 4000 ohms £6 6 0

Crystavox The only Loud Speaker which works from a Crystal Set. £6 0 0

—three types of Headphones

Type A. As used by the Admiralty 120, 2000 or 4000 ohms £2 10 0 8000 ohms £3 0 0

Type F. Popular Broadcast type. Weight only 6 ozs. 2000 ohms £1 0 0

Type A.2. The New reed-type, unequalled for sensitiveness. 2000 ohms £1 10 0

and two Gramophone Adaptors

For converting your Gramophone into a Loud Speaker — H.1 (2000 ohms) £4 10 0; H.2 (2000 ohms) £2 0 0

¶ If the Trade have difficulty in obtaining Brown Wireless Instruments they should write to us without delay.

Above: Type HQ
Below: Type H3

Gilbert Ad. 4713

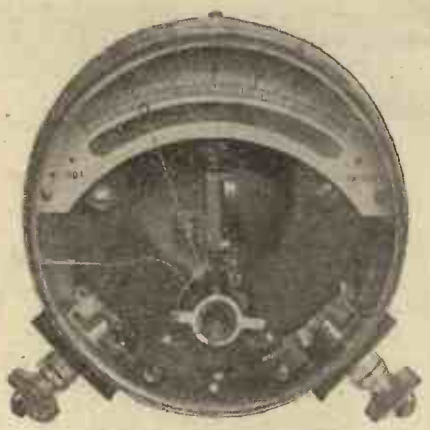
A Simple Method of Measuring H.F. Resistance

(Continued)

The high-frequency resistances consisted of fine resistance wire, either No. 43 or 47 Eureka, according to the resistance employed. These resistances were in fairly short lengths, so that their inductance could be neglected.

Uses of the Apparatus

It is needless to say that the uses of a high-frequency resistance apparatus of the type described are not limited to measuring resistances of coils. Losses in H.F. chokes, losses in valve holders, coil holders,



A micro-ammeter is required to indicate the change in anode current of the oscillating valve.

etc., the resistances of aerial and earth systems, and many other sources of high-frequency losses in wireless circuits may be investigated.

Figure 4 shows the method of connecting resistances for the purpose of finding the H.F. resistance of a particular aerial and earth system. It will be seen that there is no need to load the aerial circuit with any apparatus except a coil and a condenser, the resistances of which may be measured separately. It is hoped in the near future to give readers some sample resistances for various types of aerials, with a view to indicating the best type of aerial to employ under certain conditions. Further information with regard to different components and circuits will be given as they become available.

"The Radio Press Year Book"

Important Announcement.

"THE Radio Press Year Book for 1926" (price 1s. 6d.), now on sale, gives in a compact form interesting and useful information on every branch of the wireless science with which the experimenter is concerned.

The book is divided into sections, the first of these containing articles on modern wireless theory and practice contributed by representative authorities. Mr. J. C. W. Reith, the managing director of the British Broadcasting Company, writes on "Prophecies," while Capt. H. J. Round, M.C., M.I.E.E., chief of the Research Department of Marconi's Wireless Telegraph Co., Ltd., deals with the problems incidental to low-frequency amplification.

Valuable Articles

The control of self-oscillation in H.F. amplifiers is discussed by Major James Robinson, D.Sc., Ph.D., F.Inst.P., while the Technical Editor of *Wireless Weekly*, Mr. J. H. Reyner, B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E., contributes a valuable discussion on the subject of coil resistance and efficiency. Other technical articles are contributed by Mr. H. J. Barton-Chapple, Wh.Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E., on self-capacity in inductance coils, and by Capt. H. L. Crowther, M.Sc., on valve filaments.

British and American Conditions

Mr. Percy W. Harris, M.I.R.E., makes an enlightening comparison between British and American radio conditions. His thorough investigation of radio in the United States enables Mr. Harris to deal with this subject in an authoritative manner.

The reception of American broadcasting, a subject which is of particular interest owing to the scant success of the Transatlantic Tests this year, is dealt with by Capt. A. G. D. West, M.A., B.Sc., of the B.B.C. Engineering Staff, while Capt. Jack Frost, also of the B.B.C., indicates the points in the aerial system which require attention for good results.

Valve Data

In the section of the book devoted to valves will be found details of the various types of valves now available, together with a large number of characteristic curves.

The requirements of designers of wireless apparatus are met by the inclusion of simple wireless calculations and useful tables, such as those for frequencies and LC values and a metre-kilocycle conversion table.

General Information

The home constructor will find numerous hints on constructional work in the section provided for his benefit. A list of wireless societies, an up-to-date list of amateur call-signs, the international Morse code and the "Q" signals will be found invaluable for reference by the experimenter and the transmitting amateur.

THE "FIELDLESS-COIL" RECEIVER

A FURTHER TEST.

AS promised in last week's issue of *Wireless Weekly*, the "fieldless-coil" receiver has now been tested close to the London Station, actually on an aerial about 1½ miles to the north of it, and by a person who had not previously handled the instrument. With this aerial, although it is indoors and only about 30 feet long, it is normally practically impossible to cut out London altogether with, for instance, a straight single-valve receiver, or even a set using a stage of conventional H.F. amplification and a detector.

London's programme was, of course, received at practically loud-speaker strength and with excellent quality. It was found that 2LO could be cut out completely by detuning the three condensers about 5 degrees in either direction.

It was not anticipated that many distant stations would be picked up, owing to the nature of the aerial system, but actually a number of British and Continental transmissions were heard. In the absence of a wavemeter, identification was difficult, but it was noted that a British station and a German were picked up and separated with little difficulty, although less than a degree of the condenser dials lay between their settings.

The WEEK'S DIARY

OUR anniversary to-day, as the B.B.C. announcer would say, is the transfer of the telegraph to the Government, which took place just fifty-six years ago. In these days of rapid progress we are all liable to look upon line telegraphy as something which has been under the control of the Post Office since time immemorial. Yet for more than half the period during which the Post Office has had control of the telegraph, wireless telegraphy has been a practical proposition. It is just thirty years since Marconi came to England (he actually reached our shores in the month of February), and before many months had passed he had demonstrated his methods before Sir William Preece, then chief electrical engineer to the Post Office.

* * *

AS it was, he was looked upon as rather a mad young man. I wonder what would have been thought of him if he had predicted that within thirty years a giant radio station would be erected by the Post Office themselves and used for direct telephony with America? I am told that excellent experimental results are being obtained at Rugby with the telephony system, while, of course, the telegraphic installation is doing yeoman service.

* * *

WHATEVER one may think of prohibition in the United States, everyone admits that its enforcement has a humorous side. I see that once again the bootleggers have been using the broadcasting stations as a means of distributing a secret code. One of the leaders of the rum-runners at Seattle arranged with his wife, who was known as "Aunt Elsie," to broadcast bedtime stories of a special and particular kind. It seems that these stories contained instructions to the gang in code. In this way warnings to the men in the ships and their accomplices ashore were distributed with great rapidity!

BY the time this week's diary appears the Broadcasting Committee's report, if not actually in the hands of the Postmaster-General, will be to all intents and purposes finished. You will not find anything sensational in it, and some of the forecasts of its contents have been very wide of the mark. The Committee have been very considerably impressed by the excellent work the Broadcasting Company have already done, and have given the company full credit for it. Throughout the Inquiry and the subsequent preparation of the report Capt. Ian Fraser has distinguished himself by his commonsense championship of the viewpoint of the man in the street.

* * *

I SHALL be greatly surprised if Mr. J. C. W. Reith does not continue as Managing Director of the Broadcasting Company, for his administrative power has been one of the big factors in building up the organisation to its present high level. Most of us are inclined to look upon Mr. Reith as purely a business man, but while his abilities in this direction are very strongly marked, we are liable to overlook that he is also an engineer with a science degree. His war record, too, was very highly creditable.

* * *

SO the Savoy bands are to continue broadcasting after all! I am not very surprised that an arrangement has again been arrived at, for, on the one hand, the B.B.C. know that the Savoy Bands are popular and, on the other, the management of the Savoy is far too shrewd not to realise the immense publicity value of these broadcasts. When I looked in the other night I nearly collided with several members of the Tango Band coming "off duty" for a short time. Instead of the conventional evening dress, they wear a peculiar and highly picturesque Spanish garb, more suggestive of brigandage in the mountains than dancing on the polished floors of the Savoy Hotel. Such is modern life!

* * *

LONDON is wobbling on its wavelength again. The wavemeter at the *Wireless Weekly* laboratories shows that there has been a drop of a metre during the last few days. The etheric mess in Europe grows worse; you never know which of your favourite Continental stations will be heterodyned next. As if interaction between broadcasting stations is not bad enough, we needs must have wide mush bands over the relay stations, Birmingham and other regions. We really must do something about this harmonic interference. Listen to Bournemouth any night now and you are almost certain to hear interference from Aldershot.

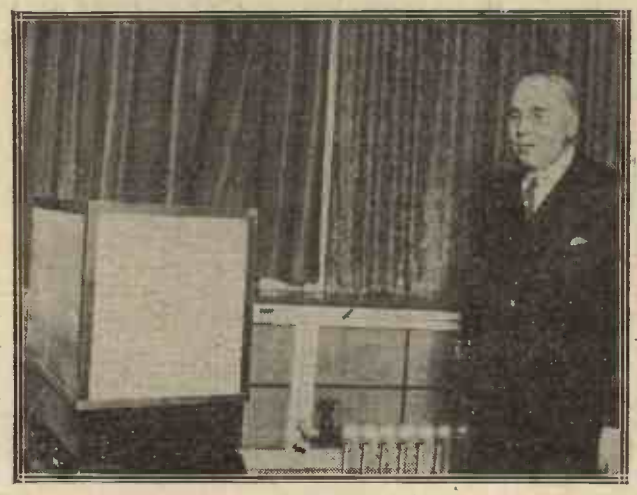
* * *

I AM not one of those people who think that because there are a number of broadcasting stations all working at once that such congestion is inevitable. It is true that at the present time there are more stations on the air than can be reasonably accommodated, but if only they would stick to their frequencies, and not wander about all over the place, there would be only a small part of the heterodyning which now afflicts us.

* * *

CLEVER and persistent advertising tells us that many bodily ills can be cured by a dose of salts. Do you know that salts are one of the greatest clarifiers of the ether? On the label of the bottle so intimately connected with "that little daily dose" you will find what purports to be an analysis of the contents. You will find, for example, several kinds of salts of soda and potash (which may or may not be a constituent part of the particular salts I have mentioned), known as Rochelle Salt, which have a most peculiar property. If a crystal of this salt is

placed in a certain way between metal plates and joined in a wireless circuit it can be made to control the frequency of that circuit in a remarkably accurate manner.



There are rumours that a new microphone is being tested at 2LO; certainly, the microphone is kept carefully hidden, as may be seen in this photograph, taken when the purser of the "Berengaria" broadcast a talk recently.

ACTUALLY Rochelle Salt is soluble in water and particularly fragile. The same property is possessed to a much smaller degree by quartz, and by taking a quartz crystal, grinding it in a certain way, and joining it in a particular circuit in a radio transmitter, the crystal can be made to maintain the transmitter with steady accuracy on the frequency allotted to it. A wireless set so maintained at its frequency is said to be "crystal controlled."

* * *

IN America the number of wireless stations so controlled is rapidly increasing, and if in Europe the same principle was adopted, there would be a wonderful clear-up. At present you never know when a Continental station is going to wander on to the wavelength of your favourite broadcasting station and heterodyne it out of all recognition. As Rochelle Salt is about one hundred times as accurate as quartz in this particular direction, a dose of salts would do the European ether a great deal of good.

* * *

PEOPLE who grumble about the patent position in this country should listen to this:—"Continued and expensive litigation," says Prof. J. H. Morecroft, M.I.R.E., the well-known American expert and past-president of the Institute of Radio Engineers, "points out the entire inadequacy of our present patent scheme. It seems nowadays that the granting of patents has scarcely more significance than a licence to others. The overworked staff of our patent office is so loaded up that frequently five years or more are required for patents to be issued. . . . At present it is worth practically nothing unless the inventor is backed by some powerful corporation." In this country a big law action is pending between a famous wireless company and a firm selling American receiving sets. Both sides have plenty of money, and you may rely on it that neither side will give in before the case has been to the House of Lords. By that time we shall know a lot of interesting things about the value of wireless patents.

* * *

SOME of our old nursery rhymes will need re-writing before long to bring them up to date. One of them, anyway, seems to be coming true in a sense, since riders behind the "iron horse" are to have music wherever they go. I read with interest the other day about the experiments in receiving on a moving train by the Great Western Railway Company.

Now the G.W.R. are equipping the dining cars of the Cornish Riviera express with loud-speakers. Passengers travelling in the ordinary first-class compartments will have to be content with head telephones, but I should imagine that they will be very well content.

WAVE-TRAP.

The special dance band organised by the B.B.C. solely for broadcasting has already been heard from 2LO.

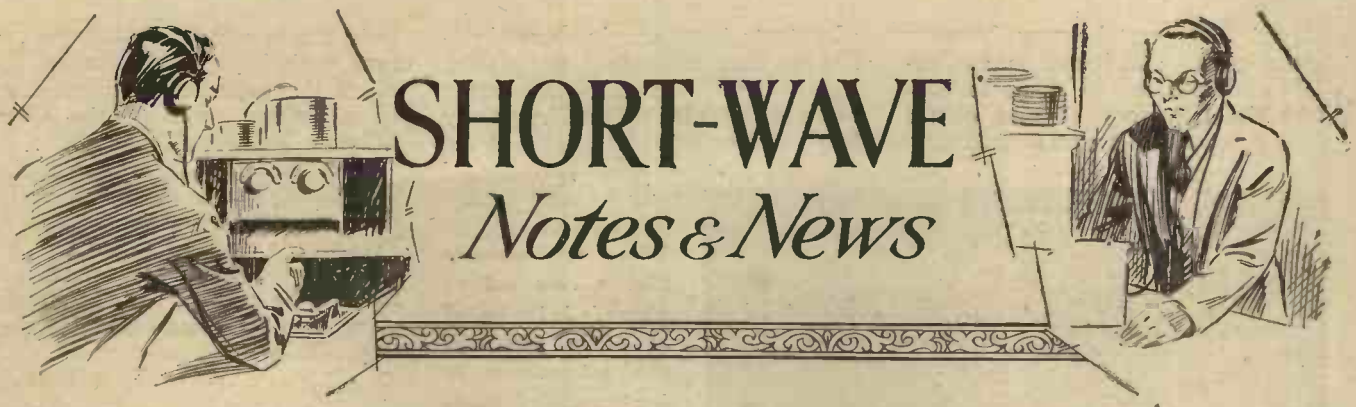
"The Dangers of Unwanted H.F. Currents"

With reference to the illustration of a home-made choke on the second page of the article which appeared under this title last week, it should be pointed out that a coil of low self-capacity is necessary for this purpose, and a single-layer winding is usually employed.

The whole subject of H.F. chokes and their requirements will be dealt with by Mr. Reyner in an early issue.

THE NEW "WIRELESS WEEKLY"

With reference to the announcement regarding Captain West in our issue of February 10, it should be noted that, whereas the contract with Captain Round was for a year, that with Captain West was for six months, but that the number of articles from Captain West will be such that, distributed, they will cover as much as a year.



SHORT-WAVE *Notes & News*

THE writer's pet theory connecting cold weather with good conditions for Transatlantic reception has been completely spoilt by an exceptional "burst" of American short-wave signals during a spell of warm, dry weather. On Saturday, February 20, he was surprised to hear several "Yanks" coming through at good strength as early as 21.00 G.M.T. By 22.30 they were audible several feet from the 'phones, using a detector and one note-magnifier. One peculiar point was that no weak stations seemed to be audible; all those that were coming through at all were R7 or R8! At the time of writing conditions are still extremely good, so let us hope that we are going to be repaid for the long spell of "dead" nights and fading signals.

Australia Disappears

Several stations have been in continuous communication with America, but work with the Antipodes seems to have slackened somewhat. The Australian stations report bad atmospherics, rendering reception of distant stations very difficult. The New Zealanders have also been stronger at this end than the Australians. Brazil seems to have faded out temporarily, but will doubtless appear with renewed "punch" before long.

6QB has at last persuaded his 10-watt transmitter to accomplish two-way work with America. He worked U-2CVJ on the night of February 20 at 23.30 G.M.T., and was reported R5. Possibly it was the invigorating effect of some enraged "BCLs" knocking at his door that gave his signals the necessary "push."

Good Work in the Free State

Ireland is showing signs of great activity now, practically all the active stations that can muster up 10 watts or so having worked the U.S.A. already. GI-2IT is putting out an ear-splitting signal, and seems to be heard everywhere. Incidentally, he has worked a station with the call TPAV, and would be very glad if any reader could inform him of the whereabouts of this station. Several other stations report hearing TPAV and TPAX. 6MU has not been very active of late, but will soon be back with increased power. As he has already been heard practically everywhere, one wonders what is going to happen!

Piracy Again

5NJ complains that someone is misusing his call-sign, and that he

A low-reading hot-wire meter of this type is useful for indicating the small aerial currents obtained at the higher frequencies.

is continually receiving reports of reception of his telephony on about 400 metres, mostly from the London area. As his activities are confined to 45-metre C.W. work, he would be very glad to hear from all who have received this pirate. In our opinion, the man who wilfully uses a call-sign that he knows to be allotted to another station deserves all he is likely to get. Things will certainly not be very pleasant for him if the G.P.O. succeeds in tracing him!

A Strange Phenomenon

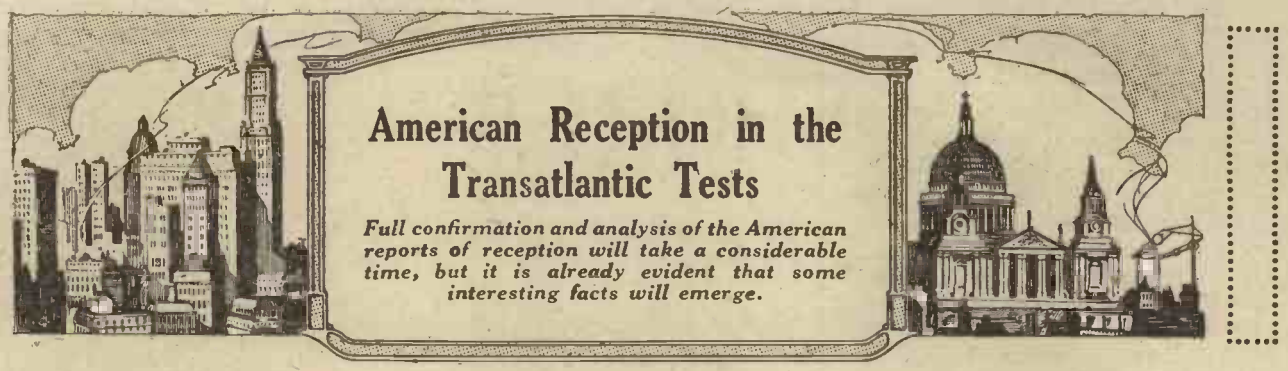
On one or two nights during the past week or so it has been noticed that the "local" stations (*i.e.*, French and British) have continued to come through at their usual strength during the hours of darkness, even as late as 23.00 G.M.T. On the same nights the American commercial stations, WIZ, WIR, WQO, etc., have all had a peculiar "echo" effect. Their C.W. signals have sounded rather like someone whistling at the end of a long tube, or in a subway. It seems that there is a definite connection between these two observations, although they certainly seem somewhat difficult to reconcile. Suggestions on the subject will be very welcome.

Who is It?

Rumour has it that a certain transmitter in the south of London, who is in the habit of using a considerable amount of power derived from chemically-rectified A.C., has invented a new game called "Tossing the Mansbridge," which is played as follows:—The players gather round the transmitter, and a paper condenser of the old Army Mansbridge type is placed across the plate and filament terminals of the valve. At a given signal someone is instructed to switch on the high tension; the winner is the player who succeeds in catching the largest piece of paper. The owner of the condenser is always awarded the booby prize.

Portuguese Success

A new station that has done all manner of DX work in a few weeks is P-3FZ, of Funchal, Madeira. This station was first heard about a month ago, and has steadily improved, as far as signal strength is concerned, ever since. The number of letters received asking for his address is a proof of his efficiency. The full address will be found in this week's "Amateur Transmitting Notes." Numerous other Portuguese stations are now to be found on the 7,500-kc. (40-metre) band, as well as on the 4,000-kc. (75-metre) band.



American Reception in the Transatlantic Tests

Full confirmation and analysis of the American reports of reception will take a considerable time, but it is already evident that some interesting facts will emerge.

A CONSIDERABLE number of American and Canadian listeners have reported reception of the B.B.C. stations during the week of the Transatlantic Broadcasting Tests, and upwards of 450 letters have been received in this country asking for confirmation of reception. While a number of these are too vague in their statements for definite checking, it appears that on the whole the B.B.C. stations were heard on the other side better than the American stations were in this country.

An Elaborate Hoax

Listeners in Omaha, Nebraska, were delighted to hear, on the night of Tuesday, January 26 (the morning of January 27 by our time), both 5WA (Cardiff) and 2BD (Aberdeen) at good loud-speaker strength. The news that these stations were not heard so loudly elsewhere in America caused an investigation of this "phenomenon" to be made. It then appeared that some local station, whose identity could not be discovered, had been sending out bogus transmissions purporting to come from Cardiff and Aberdeen.

The investigation revealed the fact that both of these stations transmitted on a wavelength of 351 metres, while the origin of the "orchestral selections" was assigned by some listeners to a gramophone, and the national accent of the "Welsh" and "Scotch" announcers was open to criticism!

Classification of Reports

A table is given on this page which shows the distribution of the localities from which reports have been received. It should be understood that this table does not represent actual reception, since the checking of the reports is not yet complete. A further table, giving the results of the checking, will be published in an early issue of *Wireless Weekly*.

Misleading Success of 2LO

It will be noticed that the great majority of the reports refer to the London station. This, however, does not represent the true state of affairs. It appears that many American listeners quoted London as the station which they heard, owing to the fact that they were unable to identify the transmission with certainty.

	STATION CLAIMED.									
Reception claim from	2LO	5WA	2BD	5IT	5XX	5SC	5NO	6LV	2DE	6BM
U.S.A.										
Alabama ...	1	1	—	—	—	—	—	—	—	—
Arkansas ...	1	1	—	—	—	—	—	—	—	—
California ...	8	1	1	—	1	1	1	—	—	—
Colorado ...	3	2	—	—	—	—	—	—	1	—
Connecticut	2	1	—	—	—	—	2	—	—	—
Delaware ...	2	—	—	—	—	—	—	—	—	—
Florida ...	1	—	—	—	—	1	—	—	—	—
Illinois ...	14	3	1	—	1	—	1	—	—	—
Indiana ...	2	1	2	—	—	—	—	—	—	—
Iowa ...	6	2	1	—	—	—	—	—	—	—
Kansas ...	1	1	1	—	1	1	1	1	—	—
Kentucky ...	1	—	—	—	—	—	—	—	—	—
Louisiana	—	—	1	—	—	—	—	—	—	—
Maine ...	1	—	—	—	—	—	—	—	—	—
Maryland ...	6	2	—	—	—	—	—	1	—	—
Massachusetts ...	13	2	1	—	1	—	2	—	—	—
Michigan ...	6	3	2	—	—	—	—	—	—	—
Minnesota ...	2	2	—	—	—	—	—	—	—	—
Mississippi...	3	—	1	—	—	—	—	—	—	—
Missouri ...	13	3	—	—	—	—	—	1	—	—
Nebraska ...	1	8	22	—	—	—	—	1	—	—
New Hampshire ...	2	—	1	—	—	—	—	—	—	—
New Jersey	28	3	5	—	2	—	2	1	—	—
New Mexico	1	—	—	—	—	—	—	—	—	—
New York...	27	2	2	1	4	—	1	—	—	—
North Carolina...	1	—	—	—	—	—	—	—	—	—
North Dakota ...	1	—	—	—	—	—	1	—	—	—
Ohio ...	22	7	5	—	—	2	—	—	—	—
Oklahoma ...	3	2	1	—	—	—	—	—	—	—
Pennsylvania	30	3	7	—	1	3	—	—	—	—
Rhode Island ...	2	1	2	—	1	—	—	—	—	—
South Dakota	1	—	—	—	—	—	—	—	—	—
Tennessee ...	2	—	—	—	—	—	—	—	—	—
Texas ...	4	8	6	—	—	—	—	—	—	—
Vermont ...	1	—	—	—	—	—	—	—	—	—
Virginia ...	40	1	—	—	—	1	1	—	—	—
Wisconsin ...	9	1	—	—	1	—	2	—	—	—
Cuba ...	—	—	1	—	—	—	—	—	—	—
Mexico ...	1	—	—	—	—	—	—	—	—	—
Canada ...	9	4	4	—	1	2	1	—	—	1

American Reception in the Transatlantic Tests

(Continued)

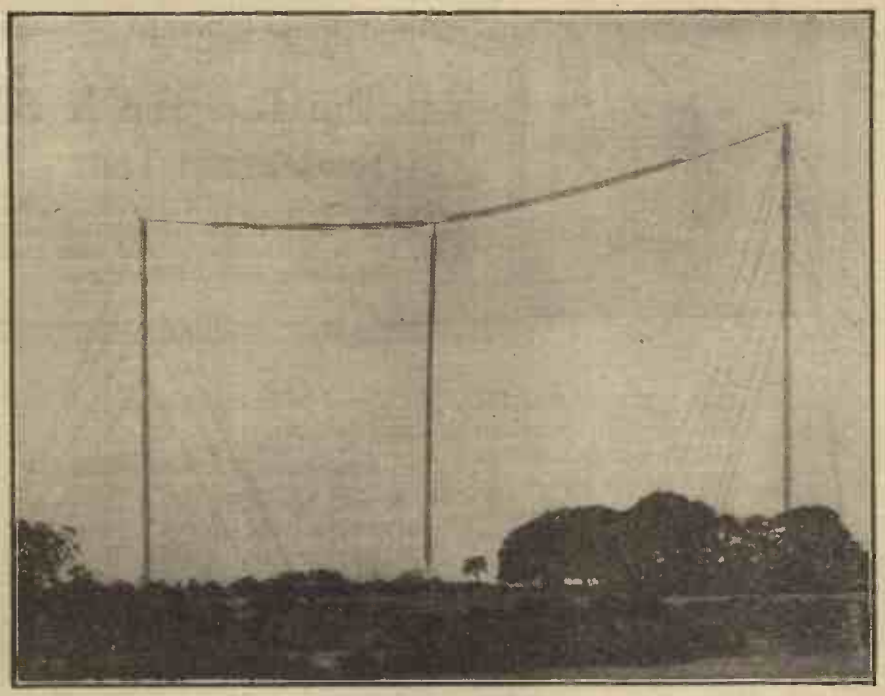
In the checking of the reports it will be possible, from the details given, to assign many of these reports to other B.B.C. stations. Only one report has come to hand for Bournemouth, a station which is usually heard well in America, but no doubt a number of the London reports will be found to refer to Bournemouth.

Some Results

A certain amount of information is available from the reports so far dealt with. A considerable number of these reports are practically useless through lack of sufficient data to provide an adequate check. Some, for instance, record the reception of "faint music," with no mention of wavelength or similar details.

The enthusiasm shown by American listeners for long-distance records is also demonstrated in some cases by an apparently too vivid imagination, and what one may describe as "the ear of faith." Thus some listeners record the fact that the call letters of the station heard were given by the announcer, whereas in fact no call letters were announced at all from the station in question.

There is no doubt, however, that the B.B.C. stations were heard in America. Most of the successful reception was carried out on the Eastern seaboard, but accurate reports have also been received from more than one listener in California.



The fact that very few reports claim reception of Daventry, in spite of its high power, may be due in some measure to the limited tuning range of many American receivers.

Jottings by the Way

(Continued from page 89)

less roofs in the entire garden. There is much to be said for that kind of aerial; it can be protected from damping by suspending several tarpaulin rick-covers between the wide spreaders, and when this is done it is frequently possible to have tea in the garden even during the English summer.

There are, however, several drawbacks. There are still some lukewarm wireless men who regard the garden as intended primarily for the growing of roses, hollyhocks and other vegetables, failing to grasp that its real purpose is to act as a support for the aerial and as an earth. Such folk will have nothing to do with the roofed-in aerial, maintaining that their sweet peas will not sprout properly beneath its generous shade.

An Aerial Nuisance

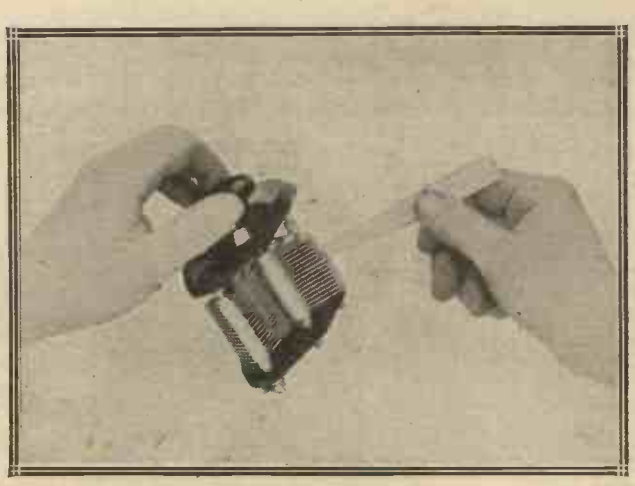
I am, myself, above any such petty considerations as these, but I have had to dismantle my tarpaulin-covered aerial for quite another reason. Aeroplanes became a positive nuisance. One was always going out and finding them in the place where the strawberry bed used to be, the pilots being under the mistaken impression that the tarpaulin covers were the roof of a hangar.

On thinking the matter carefully over, the Professor and I came to the conclusion that it is possible to design a crystal set which will operate not one loud-speaker but two when attached to any normal aerial. The circuit, as you will see from the diagram, is a perfectly straightforward one. The whole secret lies in the selection of the loud-speakers, and in placing them in the correct positions with regard to one another. The loud-speakers, which should be carefully matched in tone, should have a resistance of 2,000 ohms apiece. They are wired in series by means of an ordinary pair of telephone leads, and they are fixed with their spouts facing one another and about six inches apart. So that they shall remain in position, it is best to join them by means of a metal headband removed from a pair of telephones.

Operating the Set

To use the Goop-Wayfarer loud-speaker crystal set, place the head between the loud-speakers, with the right ear in the bell of LS1 and the left in that of LS2. Grasp the knob of C1 with the right hand, and tune in the desired station. Should the operator be left-handed he must thrust his face between the horns from the opposite direction, so that the left ear is adjacent to LS1 and the right to LS2. He will then be able to use his left hand for operating C1. The Professor and I have personally tested out this circuit, and have found that it gives perfect loud-speaker reproduction of the signals of any station that is within range of the crystal set. Even greater ranges are obtainable by those in whom the voice of conscience is not a loud-speaker.

WIRELESS WAYFARER.



CONDENSER NOISES

Causes and Cures

□ □ □

Crackling noises which only occur when the condensers are turned should be the signal for the operation illustrated on the left. Either a pipe-cleaner or a paper spill will serve.

ONE of the most annoying difficulties connected with short-wave reception is to be found in the fact that so many variable condensers make objectionable grating and crackling noises when the set is oscillating upon these high frequencies. It is not alone upon the high frequencies, however, that condensers are apt to give rise to troublesome noises.

Effects of Dust

More particularly upon the high frequencies, but also to some extent upon the broadcast band, an accumulation of dust between the vanes of the condensers may give rise to most troublesome scraping and crackling noises, which may be decidedly difficult to locate, unless this point is known to the operator. They will be heard only upon turning the condensers, and if these components appear to be in order in every other way, the spaces between the vanes should certainly be cleaned.

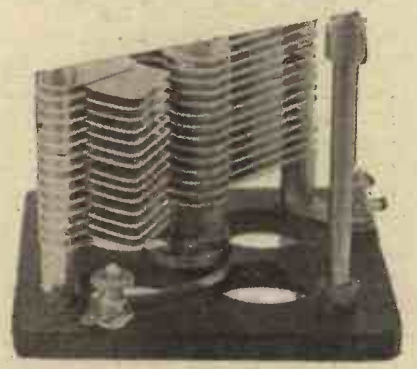
A pipe cleaner is the appliance almost invariably used for this purpose, and it would be difficult to improve upon, but non-pipe-smokers should remember that a folded " spill " of paper will serve almost equally well.

Contact Noises

Most condenser noises arise from a defective connection to the moving vanes, and when this connection consists of a rubbing contact in the bearings at the ends of the moving spindle, particular care is needed to see that the condenser is kept in proper adjustment, so that as good a connection as possible exists. Many condensers of the cheaper type rely upon this rubbing contact for the connection in question, and they are often provided with some adjustment for the amount of pressure upon the bearing surfaces. This point must be regarded as a possible source of noises, which will be particularly prominent when the set is oscillating, but which may be heard at any time, and a little care should be devoted at intervals to seeing that as much pressure is being applied by the adjustment in question as is possible without rendering the motion of the condenser unduly stiff.

" Pigtail " Connections

In more expensive condensers it is usually found that some more positive method of making connection to the moving plates is provided than that which occurs in the mere bearings of the condensers. For example, in some condensers a system of spring leaves make connection with shoulders or other points upon the moving spindle.



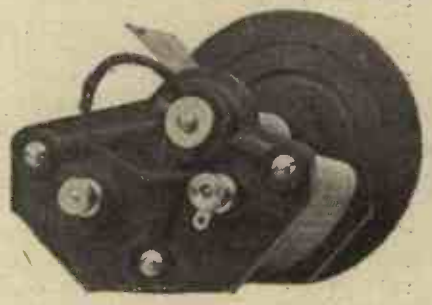
" Pigtail " connections may cause noises if many more turns are present than the number seen here.

If these connection points become dirty, noises are bound to result when the condenser is turned, and an occasional rubbing-up to a bright polished condition with emery paper is desirable.

It is a common practice, also, in good class condensers to use what is known in America as a " pigtail " connection to the rotors. In the common form of this device, a spiral phosphor-bronze spring is provided, whose inner end is soldered to the spindle and the outer to the terminal which provides a connecting point to the moving vanes.

Noises from Spiral Connectors

Now, this scheme is capable of providing very good results, and also, strangely enough, very bad ones. Upon the higher frequencies, more particularly, some types of pigtail cause intolerable rustling noises when the set is in an oscillating condition and the condenser is turned. It appears to be due to the fact that the pigtail consists of too large a number of turns, and that as the condenser is turned and the spring winds up or unwinds, the turns touch at irregular points, shorting upon each other and causing consequent very slight variations of inductance in circuit. Slight as these variations are, however, they are quite sufficient to cause objectionable noises, even to some extent upon the broadcast band.



A flexible insulated " pigtail " is sometimes helpful, on the higher frequencies in particular.

Insulated Pigtails

The remedy appears to lie in the use of a pigtail of the minimum number of turns required to give satisfactory operation, and in the majority of condensers now available it will be seen that only about

(*Continued on page 106*)

Random Technicalities

By Percy W. Harris, M.I.R.E.

The Later American Sets

FROM time to time I have expressed my views quite frankly upon the subject of American receivers and their relative merits compared with those used on this side of the Atlantic. As I tried a good number of them last year while in the States I have been particularly interested in the examination of the specifications of this year's models to see what advances have been made.

There seems to have been very little real advance in the last twelve months, save in two directions. First, the Americans are at last beginning to realise that many of their receivers are inferior on the audio-frequency side, and are accordingly using far better low-frequency transformers. Secondly, there is a general tendency towards one-dial control. Ready-built superheterodynes are sold only by the Radio Corporation of America, who are now marketing excellent single-dial superheterodynes, including the loud-speaker, while the majority of manufacturers are using exactly the same theoretical circuit as they used last year.

The Work of Haseltine

Receiver design in America probably owes more to Prof. Haseltine for its advancement within the last year or two than to any other man. This is not to say that all commercial receivers are his design—this is far from being the case. Neutrodyne receivers, however, were the first to give really efficient two-stage high-frequency amplification, and once the advantages of efficient "radio-frequency" were realised, the whole industry set to work to achieve satisfactory means of stabilising.

Future British Development

I feel convinced that within the next twelve months British designs will not only have caught up to the American, but will have beaten them, so far as the home constructor is concerned. With regard to factory-built sets, the British manufacturers can, if they really try, do much better than the American; if they do not try, then the Americans will come over here and take the trade.

There is one British receiver, the Marconi Straight-Eight, which, in my opinion, is definitely better than anything the Americans have yet produced, so far as sensitivity combined with selectivity and quality is concerned. I was one of the first people to try it, and the only criticism I would make is that six dials are at least three too many. As a matter of fact, as these dials are marked in wavelengths and are matched in their readings (save for the first) the difficulty of picking up stations is not so great as you might imagine.

A Good Reaction Control

The method of controlling reaction by shunting a continuously variable resistance across the reaction coil (which is fixed in relation to the grid coil) is one well worth trying if you have not yet experimented with it. Provided you pick the right size of coil and a good variable resistance (a variable anode resistance will serve) it is a very pleasing method to use. It is particularly convenient when it is desired to incorporate plug-in coils within a cabinet receiver in conditions where the use of a moving reaction coil would be inconvenient.

Rough Treatment

It is really surprising what punishment the average car battery has to put up with these days. When I look at the black box measuring about a foot by nine inches and of about the same depth, which supplies the electric starter on my car, I often wonder how on earth it does it. Nearly every morning, wet or fine, warm or freezing, it has to start up a heavy six-cylinder engine from the cold, and it rarely takes more than three seconds to do it. At the beginning of that three seconds it has to supply two or three hundred amperes at the least. I hold that accumulator in very healthy respect since I tried to start the car by hand one cold morning.

A Redeeming Feature

If it was not for the fact that the car accumulator is on charge practically the whole time that the car is running (save when the load taken by the headlamps, etc., is as great as, or greater than, the charging current), the cells would very rapidly deteriorate. It is probable that most of the deterioration of wireless accumulators is due, not to any load put upon them, but the fact that they are so often left in a semi-charged or uncharged condition for long periods.

CONDENSER NOISES

(Continued from p. 105)

two turns are provided. Under these conditions quite satisfactory operation generally results, but it is just as well to give a suitable remedy for the trouble which has been mentioned as occurring with this type of connection.

The expedient is quite simple, being merely to remove the offending pigtail and replace it with a length of about 1½ ins. or 2 ins. of single rubber-covered flex, also coiled into a spiral, the ends being soldered in place exactly as were those of the original pigtail. Since the turns of this spiral are now insulated, the same trouble cannot occur, and a particularly satisfactory contact will be found to be maintained. G. P. K.

OPERATING NOTES

Estimating hand-capacity—Leaks in reaction condensers—Dead spots on short waves—Backlash in geared condensers—Using a buzzer wavemeter.

ONE sometimes sees statements in articles upon the subject of hand-capacity to the effect that in a properly-designed receiver with good components working upon the broadcast frequency, hand-capacity troubles should be negligible, provided that the correct connections are made to the condensers. The fact remains, however, that every now and then one finds oneself endeavouring to operate a set in which bad hand-capacity effects are present, and without the time necessary to locate the cause of the trouble and remove it. Anything more irritating than to be compelled to work with a set in which one finds that as soon as a station has been tuned in and the operator's hands are removed, signals vanish entirely, would be difficult to imagine. The tip which follows is the result of experiences of this sort, and has been found the only practical course to adopt.

A Simple Expedient

The method is, very simply, to discover how many degrees upon the condenser dials are equivalent to the capacity of the operator's hands upon those dials, and then to add the aforesaid number of degrees to the readings found necessary to tune in any given station with the hands in position. For example, suppose that one discovers that the capacity of one's hands is equivalent to 1½ degrees on the scales of the two condensers in a set with a tuned aerial circuit and a tuned anode circuit. Upon tuning in any given station, note the readings for the loudest signals while the hands are still in position, add to each of these readings 1½ degrees, take the hands off, and signals should then be heard correctly.

Finding the Correction Factor

Very little practice will enable one to tune in in this way, once it has been discovered how many degrees, or fractions of a degree, are equivalent to the capacity of the operator's hand. To obtain this in the first place a very simple test will suffice:—Set the receiver oscillating, and search for one of the various harmonics of the long-wave C.W. stations which are heard on the broadcast band transmitting morse, and tune in carefully to the silent point of these signals. Now take the hands off the dials, and observe to what pitch the note of the signals rises.

Now place the hands back on the dials, note carefully the reading for the silent point of the signals, and

Observe the change in pitch of a C.W. note when the hand is withdrawn from the dial.

then turn the dials in the direction of increased capacity until the note arises to the pitch which had previously been observed. Note the new reading carefully, and remove the hands from the dial. The signals should now return to the silent point if the pitch of the note was observed and reproduced exactly. If it does not do so, try again until a setting is found for the dials such that the signals are heard upon their silent point when the hands are removed. The difference between this reading and the one required to give the silent point when the hands are in place in their normal position on the dials represents the correct factor for the capacity of the operator's hands when used in the way mentioned.

Leaky Reaction Condensers

Troublesome noises occurring in a set employing capacity-controlled reaction are very often due to a minute leakage of the high-tension across the plates of the reaction condenser if these happen to be covered with dust. A fixed condenser of about three times the size of the variable placed in series will cure this without altering the performance of the set in any other way. Another trouble that sometimes arises in a set of this type, when it is used for broadcast reception as well as on the higher frequencies, is that the value of the H.F. choke may be wrong. The writer uses a choke of about 300 turns for broadcast reception, and this functions *satisfactorily* on short waves, but results are usually improved by using a smaller choke in the latter case. One of about 50 turns is used for the 6,667-kc. (45-metre) band, and reaction is found to be easier to control when this is in use.

Dead Spots

"Dead spots" over which the set refuses to oscillate are usually due to the fact that the aerial has a harmonic (or perhaps its fundamental) within the band over which the receiver is used. A small loading coil in series with the aerial, or a loosening of the coupling of the latter to the set will generally get rid of any trouble of this nature. The writer has had one of these spots that has ultimately been traced to the earth. This was cured by the use of a counterpoise, which caused a similar spot in another place!

Backlash in Geared Dials

Geared dials are not always so perfectly constructed that there is no trace of mechanical

Operating Notes—*continued*

backlash in the movement. The practical effect of this in tuning is best illustrated by an instance. Suppose that a weak signal requires an exact setting at 50 deg. on the dial. On first bringing the dial to this point the mark is perhaps passed slightly and it is necessary to turn back. The turning back of the vernier knob has no effect till it has been turned through an angle corresponding to a movement of the dial of, say, 3 deg.

When this "free" portion is passed, the dial and, of course, the condenser plates will start to move. If the amount of backlash is not known, the dial may easily be turned back too far before it is realised that it has begun to move.

Note the Error

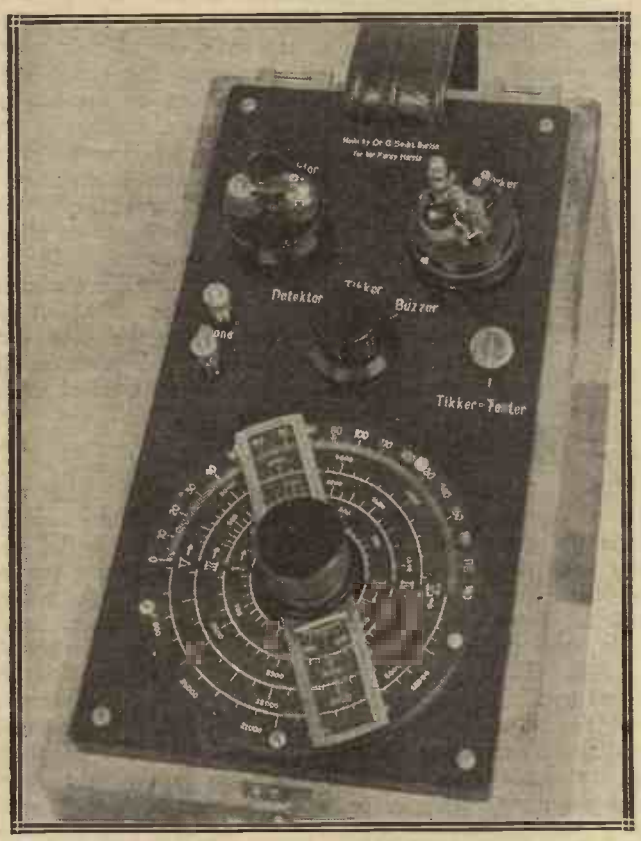
The best course to adopt under conditions of this kind is to make careful observation of the exact angle of free movement of the vernier knob before the gears engage in each direction of rotation. If desired, a scale may be marked on the dial round the base of the knob and a mark made on the knob itself. This will give an accurate visual indication of the amount of backlash to be allowed for, which will in most cases prove more satisfactory than adjustment by "feel" only.

Buzzer Wavemeter Troubles

Quite a number of experimenters are distrustful of, if not contemptuous about, buzzer wavemeters, their complaint usually being that the tuning obtained with them is too flat to be of any real service for checking wavelength. The trouble here is often that the wavemeter is operated far too close to the receiver, so that the signals force their way in over a considerable band of wavelengths.

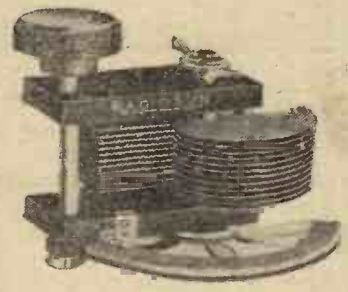
Obtaining Greater Accuracy

There are two ways in which a buzzer wavemeter may be handled in order to get the greatest accuracy of wavelength or frequency checking from it. One is to remove the wavemeter to such a distance from the receiver that the signals from it can only just be heard on the receiver at the point of resonance.



Even the best of buzzer wavemeters must be placed at a suitable distance from the receiver to permit really sharp readings to be obtained.

When one is using a superheterodyne receiver, for instance, it will probably be necessary to remove the wavemeter into the next room at least. With less sensitive receivers the procedure should be to adjust the wavemeter roughly quite close to the receiver and then move it further and further away, till the signals are just audible at the resonance point only.



When friction drive is used in a slow-motion device, little trouble is usually experienced from "backlash."

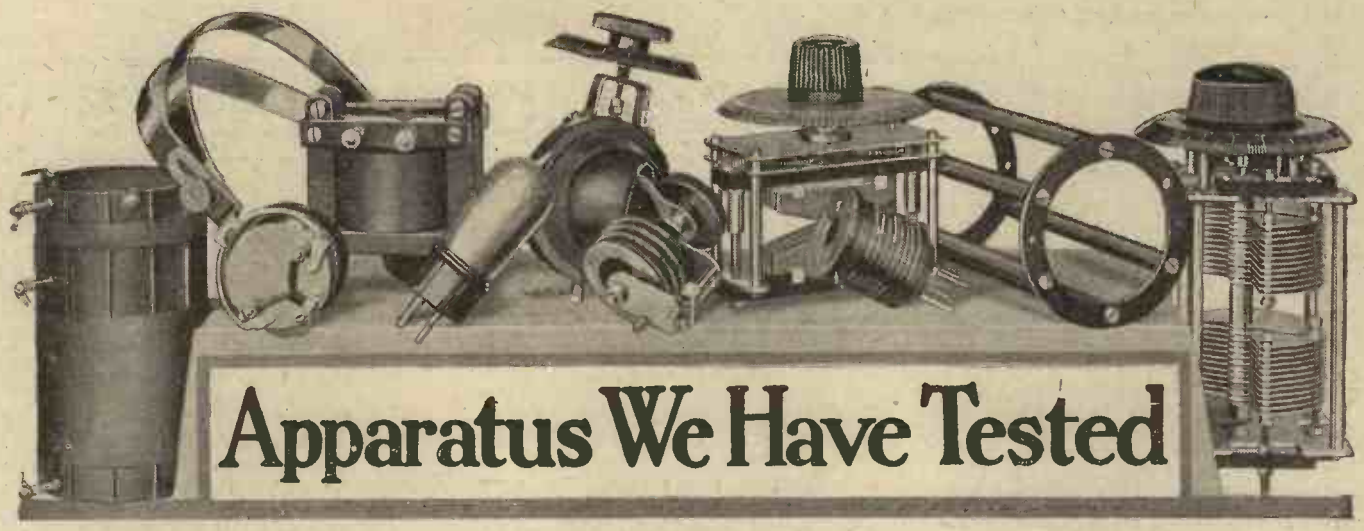
Orientation of the Wavemeter

This method has the disadvantage that it is troublesome for one person to carry out. There is an alternative method, which should be found satisfactory with some receivers. If the wavemeter is placed on the table, not too near the receiver, it will be found that in one position the buzz heard on the receiver is loudest. If now the wavemeter is turned round, it should be possible to find a position, probably at right-angles to the previous one, when the signals will be much weaker. More accurate checking will be obtained with the wavemeter in the latter position than in the former.

Other Precautions

It is as well to avoid bringing the headphones too close to the wavemeter when tuning, as sometimes direct induction from the buzzer coils to the telephones will result. This will make accurate checking more difficult.

Again, the hand should not rest on any of the terminals of or too near to the wavemeter when tuning, as this, too, may introduce buzzing in the telephones which has no connection with the tuning of the receiver or wavemeter.



Apparatus We Have Tested

Conducted by the Radio Press Laboratories, Elstree.

"Ondia" Wavemeter

Messrs. Goodchilds & Partners, Ltd., have submitted to us for test at our Elstree Laboratories a sample of their "Ondia" wavemeters.

Manufacturers' Claims.

It is claimed that this instrument is capable of reading wavelengths from 25 metres to 25,000 metres when used with the four coils supplied. A guarantee is given that the wavelengths can be read to an accuracy of from 1.5 to 2 per cent.

In the instruction booklet supplied with the wavemeter details are also given for using the wavemeter for the following purposes:—

(*a*) A generator of oscillations for checking purposes. For this purpose a small buzzer is operated by means of a switch on top of the panel. A small battery is also provided for working the buzzer.

(*b*) A check for measuring the outgoing waves of a transmitting station. In this case the buzzer is cut out of action, and a small lamp which is mounted on the top of the panel serves as an indicator of the current as the wavemeter comes near to the transmitter.

(*c*) As a check transmitter. In this case the wavemeter is used as an ordinary buzzer wavemeter.

Laboratory Tests.

This instrument was tested at our Laboratories against a standard wavemeter, firstly as an absorption meter, using the lamp as an indicator showing when the wavemeter was in resonance. In this case the wavemeter was found to be accurate, and thoroughly fulfilled its makers' claims.

As a buzzer wavemeter, however, considerable inaccuracy was noticed, to the extent of about 3 per cent. on 2LO's wavelength.

General Remarks.

The wavemeter is a convenient and compact instrument, and should prove of great use to amateurs. It is extremely simple to operate, and fulfils a number of useful purposes. Freedom from hand capacity was a very noticeable point.

Variable Condenser

Messrs. the Edison Swan Electric Co., Ltd., have submitted to us for test at our Elstree Laboratories a sample of their double-value variable condenser.

Manufacturers' Claims.

It is claimed that this variable condenser is of the low-loss type, and consists of two variable condensers united in one with a control in the form of a small knob which, when screwed in, connects the two condensers in parallel. When only the single condenser is employed, the capacity is 300 micro-microfarads, and when both are used together the capacity is brought up to a total of 800 micro-microfarads. The advantage of this is, it is stated, that the small condenser can be used for tuning over the higher broadcast frequency range when fine control is more important, and that on the lower frequencies a larger band can be covered by using both condensers in parallel.

Description of Component.

This condenser is provided with metal end plates, and can be fixed by three screws as well as by the usual single hole fixing. Both the main knob and dial screw on to the main shaft, and by screwing them tightly together the dial can be locked in position. The two condensers can be placed in parallel by screwing down a spindle which passes through the main shaft, thus making contact between the two sets of moveable plates.

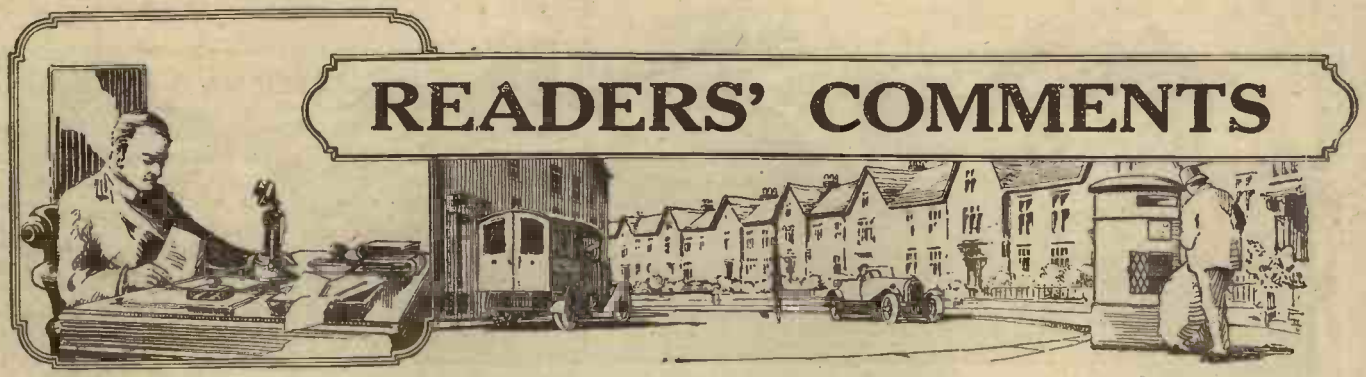
Laboratory Tests.

It was found on test that the capacity of the single condenser was .00033 μF, while when both condensers were employed in parallel, the capacity rose to .000825 μF. The corresponding minimum capacities were respectively 14 micro-microfarads, and 25 micro-microfarads. It was also found that the insulation resistance of this condenser was infinite, and that all connections were in good order.

General Remarks.

This condenser has some advantage over the more orthodox type as regards ease of tuning over different frequency bands, and it may therefore recommend itself to some amateurs.

The "Ondia" wavemeter, which is produced by Messrs. Goodchilds and Partners, is equipped with interchangeable coil units.



READERS' COMMENTS

TRANSFORMERS AS CHOKES

SIR,—With reference to the article, "Getting the Best from a Choke Amplifier," in the January 27 issue of *Wireless Weekly*, I am amazed to read the emphatic statement that the secondary of a low-frequency transformer is quite unsuitable for use as a choke, and I would be most interested to know the author's reasons for making this (as it seems to me) outrageous assertion.

I have used broken-down transformers of two or three different makes as chokes with every satisfaction, and have one in use now in my receiver which gives more uniform amplification than any transformer I have used (granted the number of these is not great).

I have to-day measured the inductance of a much-advertised choke, and it appears to be about ten henries. How can this compare for uniformity of amplification with a transformer winding having ten, twenty or more times that inductance?—Yours faithfully,

A. K. GORDON.

Cambridge.

[EDITORIAL NOTE: Mr. Barber referred in his article specifically to "the average transformer." The fact that certain particular transformers may be found suitable does not affect the argument. The choke measured by Mr. Gordon would certainly appear to be of inadequate inductance, but our correspondent is surely optimistic in considering that transformers having an inductance of 100 henries, 200 henries or more are commonly available.]

HIGH-POWER STATIONS?

SIR,—Permit me to point out a misapprehension under which your correspondent, Mr. H. C. Grant Watson, appears to be labouring in your issue dated February 10. He says that a high-power station erected twelve miles south of London would serve all crystal users in the Metropolis as well as at present, while causing less interference to valve users. But if the signal strength remained unaltered the interference would necessarily persist, as the actual currents flowing in the aerial systems of the city would not have been reduced, and would therefore be no easier to eliminate when desired.—Yours faithfully,

A. M. TURNER.

Altrincham.

A station which is familiar to many short-wave enthusiasts is that of Mr. F. L. Hogg, call-sign 2SH. He is in charge of the Icelandic enterprise referred to in "Wireless News in Brief."

WORK ON 3,333 KC.

SIR,—Having seen your query *re* the possibility of DX work on wavelength of 90 metres in *Wireless Weekly* of recent date, I hope the following information on my transmissions on that wavelength will be of some interest to you.

Using an input of 7 watts on two B4 valves with a single wire aerial, 30 ft. high and 30 ft. long, three-wire counterpoise 30 ft. by 7 ft., I have QSO'd the following stations:—

Germany.—KIW Halle (now KL4), R5 on 2V's; DE0122 (listener), Baden, R4 on 3V's.

Holland.—NoF3, Zeist, C.W., R4, 'phone R3 on 1V; NoWC, Utrecht, C.W., R4, 'phone R3 on 2V's.

Belgium.—BO8, Brussels, C.W., R3 on 2V's.

Sweden.—SMXT, Torup, C.W., R5, 'phone R4 on 2V's.; SMVG, Boden, C.W., R3 on 2V's.

Italy.—I1NC, Asolo, C.W., R4, 'phone R3 on 2V's.

Also, NOT, the U.S.S. Pittsburgh at Marseilles and Leghorn, C.W. R5.

All these have confirmed the results given.

I have also worked a number of French and German stations who have not QSL'd.

From this I think you will agree that 90 metres is not yet by any means played out. I went down to 45, but QRM was so bad that I returned to the present wave and don't intend dropping again for some time.

I have now raised my aerial to 60 ft. high, and hope to further extend my range.—Yours faithfully,

E. MENZIES (5MQ).

Liverpool.

P.S.—Your short wave dope in *Wireless Weekly* is the goods. Please let's have plenty more.

THE "SIMPLICITY" SET IN THE TESTS

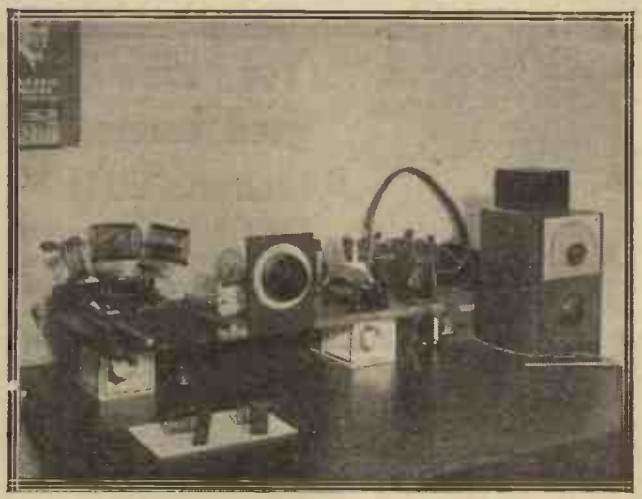
SIR,—During the Transatlantic Test Week I tried to listen to America, with small success. Using a "Simplicity" three-valve set (Radio Press Envelope No. 3, by G. P. Kendall, B.Sc.), I heard Madrid and Prague at loud-speaker strength. On January 30, just after 5 a.m., when Prague had closed down, I heard a piano and then a long announcement, the only part which I could catch, owing to distortion, being, "If you hear us, write to the Eastern Telephone Company." The address I could not catch.—Yours faithfully,

ROBERT CAMPBELL.

Clayton-le-Moors, near Accrington.

Notes for the Transmitter

ADDRESSES FOUND AND WANTED



It is often desirable to raise the short-wave receiver well above the level of the table. 2WJ does this by means of valve-boxes.

QRA's Found

OCMV: Poste Radio Montvalérien, Seine, France.

OCNG: Poste Radio, Nogent-le-Rotrou, France.

U-6VC: J. Nutt, 327, North Norton Avenue, Los Angeles, California.

U-8ANB: C. P. Goetz, 1128, Atwood Avenue, Cincinnati, Ohio.

U-1CAL.—1285 Boulevard Street, New Haven, Connecticut.

E-GEH.—Radio EGEH, Villa Victoria, Cairo, Egypt.

P-3FZ.—Ferraz, Rua St. Maria 261, Funchal, Madeira.

N-PC3.—W. F. H. Peeters, 2nd Hugo de Grootstraat 14, Amsterdam.

PE-6YX.—Flight-Sergt. Macly, R.A.F., Birsalem, Palestine.

QRA's Wanted

NOT, CHNM, KFUH, C-8AR, SHAD, SHEK, NISP, P-3BB, PE-6YX, Y-8UG, G-2BMD, YYY, E-1BK, CH-1CH, SDK, KY7A, NBA, GHA, N-STB, A-6NER, RCRL, D-7MT, D-7ZM, PR-4SA, GFP, TPAV, NEQQ, 6XI, 1PUR, G-2BAZ, G-2EP, G-6FT, D-7EW, LA-1B, B-I3.

General Notes

The following stations are now active, and would welcome reports on their transmissions:—

5AN.—Mr. E. W. V. Butcher, "Rogerum," 16, Manor Gardens, Purley.

5GG.—Mr. L. G. Young, Petit Cottage, Havant, Hants.

5WP.—Mr. W. E. Russell, 5, Walton Road, Woking.

6IY.—Mr. A. Pacy, 28, Church Road, Epsom.

6MB.—Mr. A. J. Buttress, 7, Limekilns Fields, Hill Top, Bolsover, near Chesterfield.

The address of G-2TK in future will be 35, Footscray Road, Eltham, S.E.9, and not as given in previous lists.

* * *

We are in possession of cards intended for the following stations, and would be glad if they would be so good as to write in and claim them:—

PE-6YX, PE-6ZK, PE-6ZM, B-Z9, B-I3, N-oPM, N-oKZ, N-oPX, NOT, P-3FZ, L-1AG, SQ1, U-8DPE, G-2BAZ, G-2EP, LA-1B, D-7EW.

We have received the following list of "Calls Heard" from Mr. R. J. Drudge-Coates, of Rawalpindi, India, whose call-sign is now DCR:—

Great Britain.—2OD, 2NM, 2LZ, 5LF, 5DH, GFT.

Germany.—KY5, KPL, KA8.

France.—8EM, 8DK, FW.

Brazil.—1AB, B2.

Sweden.—SMTN, SAJ.

Australia.—6AG, 2YI, 3BP, 6CJ, 6BN, 3BL, 7PF, 6BO, 5DA, 3BD.

New Zealand.—1AX.

India.—CRP, HBK, 2BG, 1WP, 2HP.

Finland.—2CO, 2NN, 2ND, 2SE.

Philippines.—1HR, 1AR, 1AU, NAJP, NAJD, 1CW.

Russia.—RRP, RCRL.

F-China.—8QQ, 8LBT.

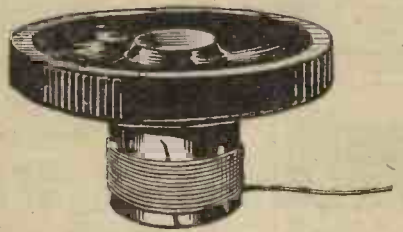
Unknown.—GHA, GFUP, GB1, B82, ONM, NEQQ, GFD, 1ER.

R. J. DRUDGE-COATES,
Radio DCR.
Rawalpindi, India.
January 22 to February 2, 1926.

REPAIRING A CRACKED KNOB

EBONITE is brittle stuff, as most of us have found to our cost at one time or another. A mishap which is very liable to occur is the cracking of the boss of a control knob into which the spindle of a condenser, variometer or rheostat is screwed. When the crack occurs the threads in the ebonite become so loose a fit for the spindle that the knob cannot be fixed. Quite a good repair can be effected in the way shown in the sketch. The boss of the knob is bound very tightly with the strong fine wire that florists use for making up "buttonholes."

If the crack does not gape when the knob is removed from the



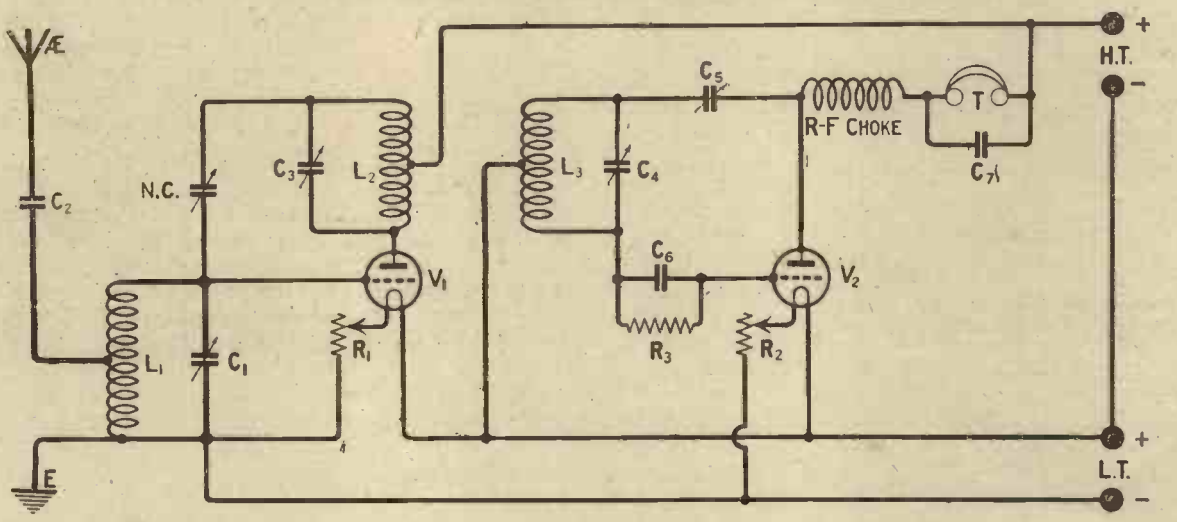
In winding the wire it should be kept as tight as possible.

spindle, it can often be repaired satisfactorily in another way. Remove the knob and place its boss between the jaws of a vice, tightening them until the crack is all but invisible. Now, take a very hot soldering iron and follow down the line of the crack with its point, making the ebonite run. This usually suffices to weld up the ebonite, and, provided that the knob is not forced too hard on to the spindle, a repair of this kind will often suffice to enable it to be used satisfactorily for a long time. Cracked rheostat formers and cracked or actually broken lugs of small ebonite cast condensers may be repaired in the same way with a hot soldering iron, though, in the case of rheostats, this method is not always satisfactory, since the former may warp under the influence of the applied heat.

R. W. H.

CIRCUITS FOR THE EXPERIMENTER

No. 7—A CIRCUIT FOR CENTRE-TAPPED COILS



A NUMBER of the well-known makes of coil are now obtainable in the normal sizes with the addition of a centre tapping, and this week's circuit is designed to show a number of ways of making use of these special inductances.

The circuit incorporates one stage of high-frequency amplification, with valve detection, no low-frequency amplification being shown, although, of course, it is to be understood that this can be added in the ordinary way, if desired.

The high-frequency stage is neutrodyned, and the actual inter-valve coupling consists of a high-frequency transformer composed of two plug-in coils L2 and L3, separately tuned on both primary and secondary sides by condensers C3 and C4.

Coupling Requirements

For this arrangement to be truly effective, it is important that the coupling between L2 and L3 shall be capable of being weakened considerably, and since both these coils will be of fair size, it is necessary that they shall be arranged in such a way that they can be placed at quite a wide angle to each other. Provided that the necessary weak coupling can be obtained, a high degree of selectivity is readily to be achieved.

Neutrodyne Connection

The centre tapping upon the primary coil L2 is connected to high tension positive, one end of the coil being connected direct to the anode of the high-frequency amplifying valve. The other end of the tuned circuit L2 C3 will, therefore, be, at any particular moment, at opposite high-frequency potential to that of the anode, and so we are provided with a convenient means of obtaining a neutralising potential to feed back to the grid circuit of this valve, via the neutrodyne condenser N.C.

This circuit is one which possesses several advantages in the way of constancy of neutrodyne adjustment, selectivity, and so on, but it is to be noticed that the use of the centre tapping in the way which has been described has the effect of placing both sides of the condenser C3 at high-frequency potential to earth.

CIRCUIT No. 7
SPECIAL FEATURES

1. **High selectivity.**
2. **Stable neutrodyne adjustment.**
3. **Reduced grid current damping.**
4. **Smooth reaction control.**

Hand-Capacity Precautions

A certain amount of difficulty from hand-capacity effects may therefore be expected, and provision made to overcome the difficulty. Various types of condenser are now available with a separate slow-motion drive, which removes the hand of the operator to some little distance, and one of these is to be advised. Failing such an arrangement, however, a short extension handle can be fitted to the knob, and will provide an effective cure.

A centre tapping is also employed upon the secondary coil L3, and it will be seen that here it is connected to the filament circuit. One end of the circuit L3 C4 is connected to the grid of the valve, and it will thus be seen that the valve is only connected across half of the circuit, with a corresponding improvement in selectivity as a result of the reduction in grid-current damping.

Reaction Control

The other end of the circuit L3 C4 is connected via the reaction condenser C5 to the anode of the valve, a high-frequency choke being provided to enable this method of reaction control to function satisfactorily. This method of arranging the circuit to produce a reaction effect resembles closely the familiar Hartley transmitting circuit, and it will be found to give a very smooth and convenient control of reaction.

Auto-Coupling

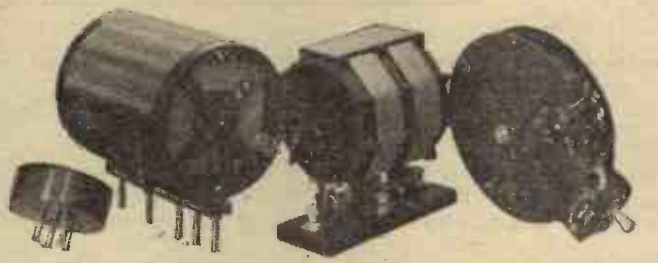
The grid circuit of the high-frequency valve consists of another centre-tapped coil L1 and the vari-

CIRCUITS FOR THE EXPERIMENTER

(Continued)

able condenser C1, and it will be seen that the centre tapping is in this case used to provide an auto-coupling connection to the aerial. Half a centre-tapped coil of a suitable size for tuning a secondary circuit will, of course, be too large a number of turns to include in the aerial circuit in the ordinary way for auto-coupling, and therefore the expedient of a small series condenser should be adopted, and this is shown at C2.

The value of this condenser may be something of the order of .0001 μF, and may be somewhat smaller on large aerials when working on frequencies at the higher end of the broadcast band. (It is a desirable refinement to use a series of condensers ranging from .00001 μF to .0001 μF, with a selector switch to adjust the capacity of C2 according to the frequency of the station being received, and in this way the desired ratio of signal strength to selectivity in the circuit L1 C1 may be obtained.)



This group of coupling units includes two centre-tapped inductances: on the right a Gambrell centre-tapped coil, and next to this a McMichael "Dimic" coil.

Neutralising

Upon completing the wiring up of this circuit, the first step to be taken is the adjustment of the neutrodyne condenser N.C. to give the desired conditions in the circuits L1 C1 and L2 C3. To do this the aerial should be disconnected, and the reaction condenser C5 set to its minimum value. Then, with a fairly weak coupling between L2 and L3, set all three tuning condensers, C1, C3 and C4, to the same reading near the middle of the scale. With the neutrodyne condenser set to its minimum value it will probably be found that the circuits of the high-frequency valve are oscillating, and the usual procedure of increasing the capacity of the neutrodyne condenser and revolving at intervals the condenser C1 should be gone through until it is found that the circuits do not oscillate at any setting of the various tuning condensers. Make sure that the receiver does not oscillate at either end of the scale of the tuning condensers, and then connect up the aerial and proceed to discover whether the adjustment of reaction in the circuit L3 C4 upsets the neutrodyne adjustment.

A Test

It should be possible to bring up the reaction control condenser C5 to such a point that the circuit L3 C4 is maintained in an oscillating condition without upsetting the neutrodyning and without a serious amount of radiation. For this state of affairs to exist, it is important that the coupling between L2 and L3 should be really weak, although, of course, not to the point of an actual serious loss of signal strength.

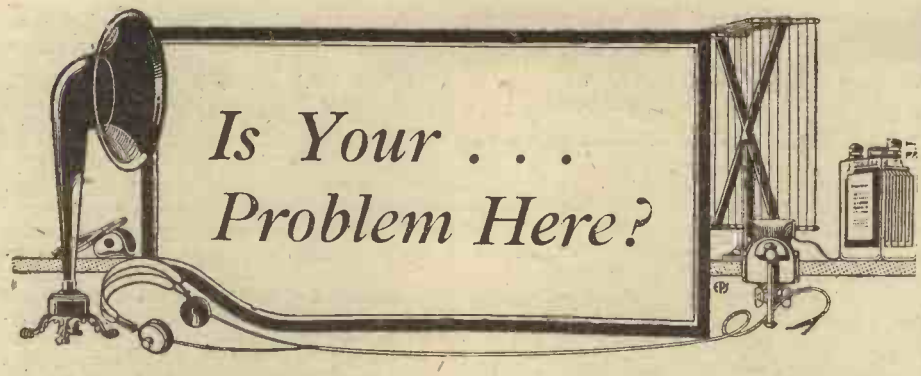
Coil Sizes

All three coils, L1, L2 and L3, are of the same size, namely a No. 60 or 75, or equivalent in lettered makes, and the tuning condensers C1, C3 and C4 should also be of the same size. A capacity of .0005 μF will be suitable for these condensers, and it will be found that stations are heard at practically the same readings upon all three, so that searching is rendered a much easier matter than would be expected.

A slow-motion drive for these condensers will be found a real convenience, especially in view of the fact, already mentioned, that the centre-tapped connection employed in the circuits L2 C3 and L3 C4 places both sides of the condensers above earth potential.

Fixed Coupling

It will be noted that the coupling between L2 and L3 is shown fixed in the diagram, and it is intended that this coupling should be adjusted once and for all when the circuit is first put up. Further readjustments are not desirable, since they upset the calibration of the circuits and the neutrodyne adjustment.



H.F. TRANSFORMER FOR BRIGHT EMITTERS

"I am experimenting with the low-loss H.F. transformers described by Mr. Harris on page 460 in the January, 1926, issue of *Modern Wireless* in order to alter them for employment with bright-emitter general-purpose type valves. At present the primary winding consists of two coils of 20 turns each of 24-gauge double cotton-covered wire, the separation between them being half-an-inch. On what lines should I work to suit these transformers to my valves?"

First try the effect of doubling the turns on the primary winding, placing 40 turns in each slot, for which purpose 28 or 30 gauge d.c.c. wire should be suitable. If the set is now found to oscillate too readily, the effect of reducing the turn numbers of the two coils of which the primary consists, by equal amounts, should be tried until a compromise is found which gives satisfactory working. Placing the two primary coils closer together, for example, at one quarter of an inch, may also prove advantageous.

IMPROVING REPRODUCTION

"How can I improve the reproduction from my two-valve resistance-coupled amplifier which is inclined at present to be high pitched and tinny?"

To overcome this difficulty the effect of increasing the size of the by-pass condenser across the first anode resistance should be tried, whilst if the coupling condensers between the valves are comparatively small in value, these may profitably be increased up to the order of .25 μF. Parallel condensers placed across the loud-speaker windings will also improve matters, and in this position values between .001 and .01 μF should be tried.

CALCULATING FILAMENT RESISTANCE VALUES

"I am constructing a 'Transatlantic-four' type receiver in which I wish to use three D.E.3 type valves and a D.E.5 type for the note magnifier, all valves to be run from a 6-volt accumulator. One filament resistance is to be employed for the two H.F. valves, one for the detector and one for the note magnifier. How can I work out the correct values of resistances?"

By a very simple application of Ohm's Law you can find the resistance required. These figures are obtained by dividing "the volts to be dropped across the resistance" by "the current taken by the valve or valves" which the resistance controls. The detector filament resistance should therefore be:—

$$\frac{3}{.06} = 50 \text{ ohms.}$$

For safety it is advisable to employ a 60-ohm rheostat in this position. The two high-frequency valves, working on the same lines, will require a 30-ohm rheostat, and for the D.E.5 one of bright-emitter type of 5 ohms will prove adequate.

A SUPER-HETERODYNE QUERY

"I have constructed a supersonic-heterodyne receiver and can only obtain the local station at feeble

loud-speaker strength with the frame tuning condenser set at zero. This condenser, however, works quite well in another set. What is the trouble ? "

From the symptoms given it is almost certain that the fault is located in our correspondent's frame aerial, and we should suggest that attention be paid to the points where the ends of the winding are brought out to the two terminals, whilst if flex leads are employed therefrom they should be replaced. If the frame is wound with enamelled wire and the enamelling has not been completely removed where the wire is placed under terminals it would account for the fault.

SEPARATING RADIO-PARIS AND DAVENTRY

" Although I can obtain Daventry without any trace of Radio-Paris in the background, I experience considerable interference from the former when listening to the French station. I wish to wind a suitable single-layer coil on a 3-in. diameter former to employ in a wave-trap, to achieve my purpose, since I understand that the arrangement will be simpler to handle than a loosely coupled receiver. What I require to know is suitable turn numbers, gauge of wire and the type of trap to use."

In practice you will probably find that an auto-coupled series rejector type of trap is the best to meet your requirements and employing a 3-in. diameter former 200 turns of 30-gauge enamelled

Is Your Problem Here ?—Continued

wire will be necessary. The coil should be tapped at every twenty turns up to 100 turns and the whole of the coil should be tuned by a parallel condenser of .0005 μF. The lower end of the coil, from which the tappings are counted, should be joined to the aerial terminal of the receiver, this latter employing plain parallel tuning, whilst the aerial lead-in should be joined to a tapping on the coil, the best point being determined by experiment.

The procedure to follow in using the trap is first to obtain the required station and then to switch the trap into circuit. The wavetrap condenser should then be rotated slowly until the interfering signals disappear completely or are very considerably weakened in strength. This absorption point will be found to be fairly sharp.

Having set the trap condenser, the required transmission should be retuned to maximum strength, which may necessitate slight readjustment of the trap condenser also. This type of trap should be found very effective in eliminating 5XX, and will not materially reduce the signal strength of Radio-Paris, in most cases.

Winding the single-layer coil will be a somewhat tedious business, and as it is by no means easy to make tappings with such fine wire, probably you would do better to construct a suitable lattice coil, for particulars of which we would refer you to an article by Mr. G. P. Kendall in *Wireless Weekly*, Vol. 4, No. 15.

ADDING A CHOKE AMPLIFIER

" I have recently added a single-stage choke amplifier to my receiver, but cannot get any signals. The amplifier has been checked and found to be wired correctly, the choke is continuous, as evidenced by the application of the well-known telephones and dry-cell test, whilst the coupling condenser has been tried in a resistance amplifier and found to function satisfactorily. Can you give me any indication as to where the fault is located ? "

It is quite likely that your trouble is due to wrongly connecting the amplifier into circuit. The choke should be joined across the loud-speaker or telephone terminals of the receiver, and it is essential that the end which is connected to the coupling condenser should be joined to the telephone terminal which in the receiver goes to the plate of the last valve. If the choke is connected the wrong way round the grid of the choke amplifying valve will be joined to high-tension positive through the coupling condenser, and since high-tension positive is to all intents and purposes at earth potential as far as the signal currents are concerned, no voltages will be transferred to the grid of the added valve, and hence no signals will be heard.

Published by the Proprietors, RADIO PRESS, LTD., Bush House, Strand, London, W.C.2, on Wednesday of each week, and printed for them by THE AVENUE PRESS (L. Upcott Gill & Son, Ltd.), 55-57, Drury Lane, W.C.2. Address for Subscriptions and Editorial Communications :—Bush House, Strand, London, W.C.2. Address for Advertisements :—ADVERTISEMENT MANAGER, "Wireless Weekly," Bush House, Strand, W.C.2. Registered as a newspaper and for transmission by Canadian Magazine Post. Subscription rates :—17/4 per annum, 8/8 for six months, post free. Sole Agents for Australasia :—GORDON & GOTCH (Australasia), LTD. For Canada :—IMPERIAL NEWS, LTD. For South Africa :—CENTRAL NEWS AGENCY, LTD.

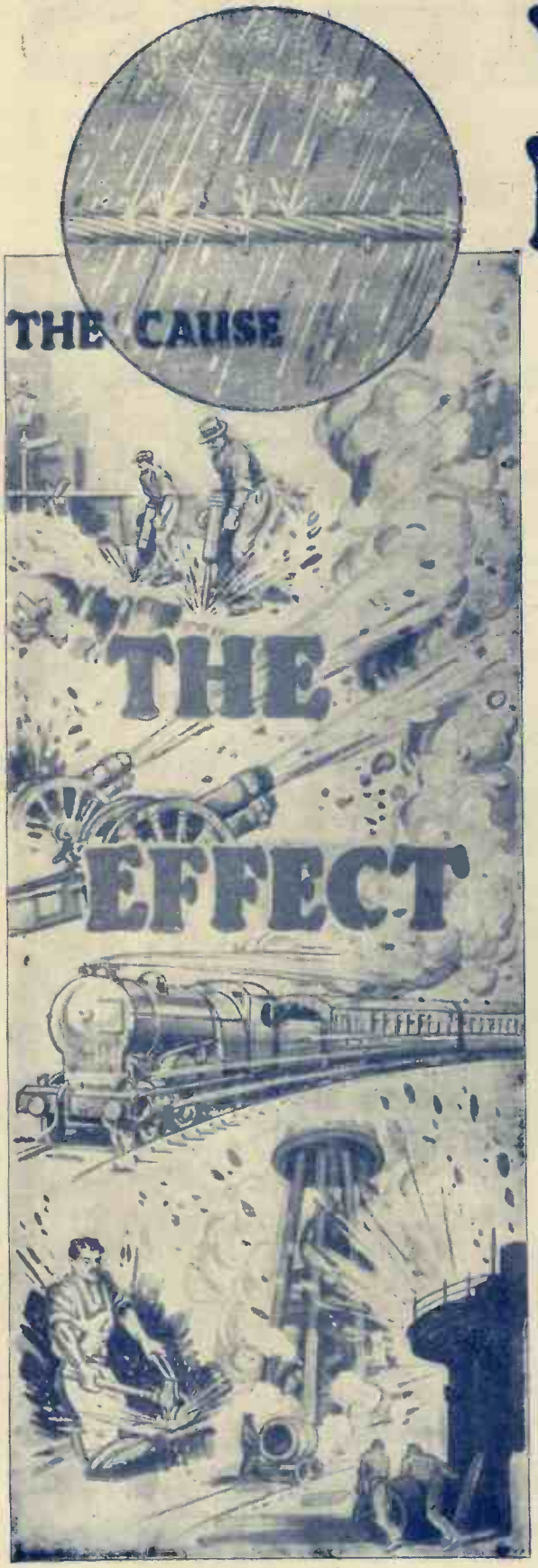
Wireless Weekly. March 10th, 1926. 3d.

Wireless Weekly

Vol. 8. No. 4.

A "SPLIT-COIL" SINGLE VALVE SET

By STANLEY G. RATTEE, M.I.R.E.



WHAT IS FIZZLY?

The Cause

There is an interference known to all experts as Fizzly. A most annoying interference caused by electrically-charged drops of rain, hail or snow falling upon ordinary aerials. Fizzly is most prevalent during the Winter months, and is always spoiling reception, anywhere and everywhere—and also during showery or thundery weather.

The Effect

Starting with a rattle, it quickly assumes the effect of an army of Drilling Machines breaking a concrete road. The noise rapidly develops in comparison into the bark of a Battery of Howitzers. Then again, into the roar of an Express Train as it rushes through the night, combined with the clamour and clang of anvils in a Blacksmith's shop.

The Cure

Fizzly is overcome by using **Electron Wire or Superial.** Both these Aerials are well and correctly insulated. Ordinary covered wire will NOT DO—it is the excellence of the vulcanised insulation and the further protective covering which gives your envied results.

Many enthusiasts whose reception is very good at times but seriously marred on perhaps the most important occasions, have hitherto disbelieved the merits of Electron Wire.

We ask you all to **" try Electron Wire or Superial at our expense."** If you are dissatisfied in any way, tell us and your money will be instantly refunded.

Many enthusiasts are probably also experiencing other forms of interference. All should take advantage of our offer.

ELECTRON, 1/8
For ordinary reception on indoor or outdoor aerials. *Postage 6d.*
ON SALE EVERYWHERE.

SUPERIAL, 2/6
including wooden spool to facilitate unwinding. Especially adapted for long distance reception. Heavily vulcanised insulation. Stronger in every way. *Postage 9d.*

THE NEW LONDON ELECTRON WORKS, Ltd.
(Members of the B.B.C.)
(Dept. 65), EAST HAM, LONDON, E.6.
Telegrams: Stannum, London. *Telephone: Grangewood 1408.*

ELECTRON WIRE
THE PERFECT AERIAL
THE CURE
SUPERIAL
THE KING OF AERIALS

It will only cost you 6d.

to obtain particulars for building this wonderful Radion 5-Valve Neutrodyne Set. The new Radion Book gives full constructional details of this and three other unique and efficient sets, a 1-Valve Set, a 2-Valve Amplifier and a handsome self-contained Loud Speaker Receiver. Fully illustrated with photographs and diagrams, it should be in the hands of every wireless enthusiast. From your Dealer, or 6d. post free from

American Hard Rubber Company (Britain) Ltd.

Head Office: 13a Fore Street, London, E.C. 2 *Depots:* 120 Wellington Street, Glasgow. 116 Snow Hill, Birmingham. *Irish Agents:* 8 Corporation St., Belfast.

RADION

the Panel with a Pedigree

Gilbert Ad. 4769

Modernise your set—

with Igranic Pacent Jacks and Plugs

Three Spring Automatic Jack. Generally used after last valve for connecting 'phones or loud speaker. As plug is withdrawn the filament supply is switched off. Price 2/6.

Igranic-Pacent Autoplug. This plug is entirely shock-proof. Connections made instantly by means of reliable spring connectors. Shell of Bakelite. No screws used in its assembly. Price 2/6. With gold plated metal parts. Price 4/-

Switching in modern receivers becomes simple and reliable when Igranic-Pacent Jacks and Plugs are fitted. Used for inter-stage switching, the mere slipping of the 'phone or loud-speaker plug into a jack determines the number of valves in use. Ten types of jacks are available for all radio purposes.

RADIO IGRANIC I-Pacent ESSENTIALS

Ask your dealer about Igranic Pacent Radio Essentials—they are standard equipment on 40 famous American manufactured sets.

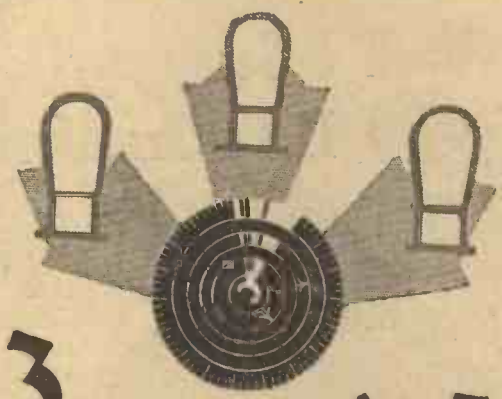
Write for List P.54 which describes the entire range.

Branches: BIRMINGHAM, BRISTOL, CARDIFF, GLASGOW, LEEDS, MANCHESTER, NEWCASTLE

COMPANY IGRANIC ELECTRIC LIMITED

149, Queen Victoria St., London. **Works: Elstow Road, Bedford.**

Exclusive Manufacturing Licensees of PACENT Radio Essentials



3 controls in 1

THE MULTISTAT will do all the work of two or three filament controls by itself, and do it easier and better. It saves panel space, simplifies internal wiring, improves the appearance of the set, and costs less than the usual separate controls.

Three independent knobs fixed to separate concentric spindles control the action of the contact arms. These arms engage on the resistance windings which are wound on a solid casting. Each resistance is thus controlled by its respective knob. A glance at the illustration will make this clear.

SPECIFICATION:

Heavily nickel-plated brass metal work. Resistances of best Eureka wire. Solid Ebonite knobs engraved and highly polished. Terminals for necessary connections. One-hole fixing. Highest class workmanship.

The MULTISTAT is made in the following standard units:—

Type A Double Filament 7/6
Type B Treble Filament 11/6
each

The resistance elements may be of 6, 8, 10, 25, or 30 ohms.

The perfect filament control the—

MULTISTAT

Patent No: 239,277 A Rayol Product

ENGINEERING WORKS LTD.

(Electrical and General)

Regd. Offices: 7 & 8, Gt. Winchester Street, E.C.2.

All applications to:

17-21, Thurlow Park Road, West Dulwich, LONDON. *'Phone: Streatham 2606.*

Send also for particulars of the 'Radiopal'—the four valve portable receiver described by the 'Wireless Times' as far and away the most interesting instrument at the Horticultural Hall Show.

Wireless Weekly

Phone: City 9911

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

RADIO PRESS, LIMITED, Bush House, Strand, London, W.C.2

Type L 525
Price
22/6

Type HL 512
Price
22/6

Type HL 310
Price
16/6

Type H 310
Price
16/6

Type H 512
Price
22/6

Type L 240
Price
18/6

The Valves for *Your* Set are in the BURNDEPT RANGE

NO matter what kind of set you own, there is a Super Valve in the Burndept range to suit your requirements exactly.

Burndept Super Valves are guaranteed. The extraordinary care and skill in manufacture and the rigorous tests each valve undergoes before leaving the factory, enable us to do this.

Ask your Dealer to show you the range of Burndept Super Valves and test their efficiency for yourself.

The Burndept range includes everything for radio reception from components to complete installations.

Write for technical catalogue.

BURNDEPT WIRELESS LIMITED

ALDINE HOUSE, BEDFORD STREET, STRAND, LONDON, W.C.2.

Telephone : **Gerrard 9072 (4 lines).** *Telegrams :* **Burndept, Westrand, London.**

Branches and Agents throughout the World.

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-Coil" Single Valve Set

By STANLEY G. RATTEE, M.I.R.E.

A number of new coils are appearing on the market in which the windings are divided into two sections, with many special applications. In addition to their uses in neutrodyne circuits these coils permit a variety of special reaction schemes to be used.

THOSE readers who have attempted long-distance reception will doubtless agree that unless a receiver incorporating at least one stage of high-frequency amplification is used, the success attendant upon the attempt is largely dependent upon the control of the reaction effect.

Assuming that this fine control is obtainable, it is a fact that many distant stations can be received at moderately good strength so long as the distance over which reception is attempted is not too ambitious.

Reaction Difficulties

In many single-valve receivers, however, the desired fine reaction adjustment is only possible by weakening the coupling between the grid and reaction coils *after* the circuit has been made to oscillate, whereas the correct and ideal method is to "bring up" the set to the most sensitive condition without oscillating, either by accident or intention, until maximum signal strength is obtained.

This last paragraph, of course, refers to the "swinging coil" method of reaction control, which, in addition to the disadvantages just given, has the equally important drawback of materially upsetting the grid circuit tuning adjustment whenever the reaction adjustment is varied.

The outward appearance of the set is pleasingly simple.

Points in Design

Bearing these facts in mind, the present receiver was designed to enable a fine reaction adjustment to be made without appreciably affecting the grid circuit tuning. The receiver is designed to cover the broadcasting band of 500 kc. to 1,000 kc., and in order that a reasonable amount of selectivity may be obtained, tight inductive coupling is used.

As for the receiver itself, the popular American type of vertical panel and baseboard have been adopted, all battery terminals being situated at the back of the baseboard, the variable components, aerial, earth and telephone terminals appearing on the front of the panel.

The Circuit

The theoretical circuit shows that the arrangement is somewhat unusual, though it is not by any means new. The coil L1 is of the plug-in type tightly coupled to the grid coil L2. This latter is of the "low-loss" type tapped

A "Split-Coil" Single Valve Set—*continued*

in the centre. Actually, the coil used is of commercial construction, and must be of low H.F. resistance, otherwise some difficulty may arise

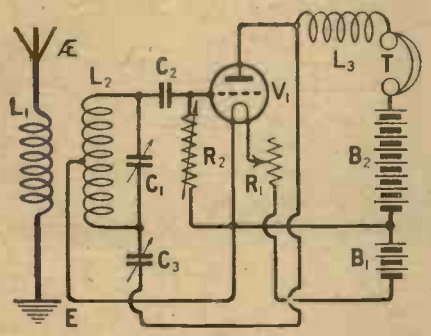


Fig. 1.—Reaction effects are obtained by adjustment of C3, without affecting seriously the setting of C1.

in making the receiver oscillate with the size of reaction condenser used.

This last-named component is shown at C3, and is in the present case a neutrodyne condenser, which with the valves recommended will be found sufficiently large to give a good reaction effect with satisfactory control. L3 is an ordinary high-frequency choke, and is in the present receiver, a commercial product.

Valves to Use

This circuit will be found quite effective and easy to handle so long as the grid coil L2 is of good make and valves of the D.E.5B. or Cossor P.2 or similar types are used with about 45-60 volts H.T. Reaction is obtained by increasing the value of the small condenser C3 without appreciably affecting the adjustment of the grid tuning condenser C1.

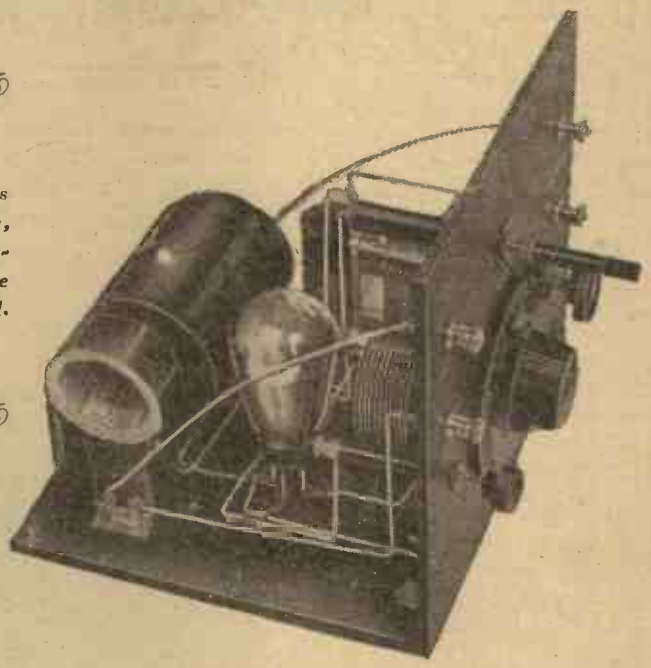
Materials and Components

The construction of the receiver does not call for any special skill, either mechanical or electrical. The components are well laid out for easy wiring, though a choice of components other than those given below may, of course, make a material difference in this respect.

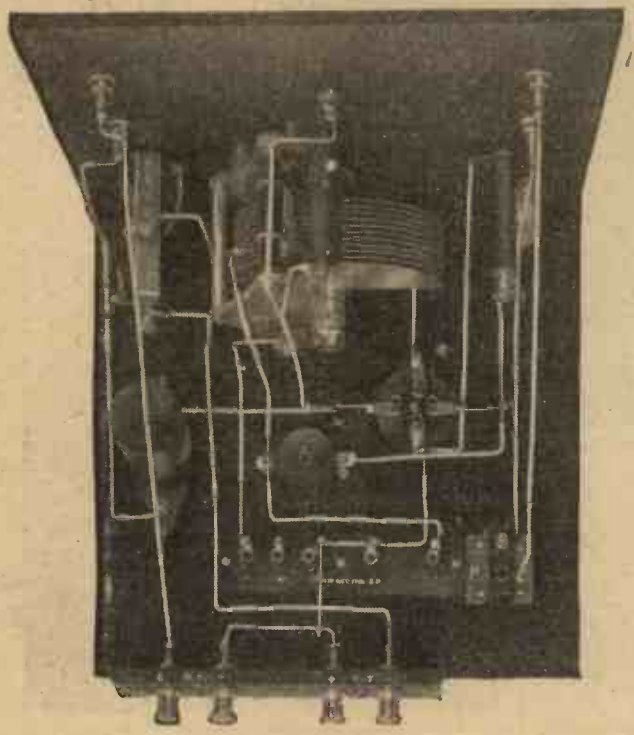
Before commencing the construction the following materials and components should be collected, and for the benefit of those readers who wish to duplicate the receiver in every detail, the names of the makers or their trade marks follow upon the particular component or material concerned. Other suitable makes may, of course, be found in the advertisement pages of this journal, so long as the values given below are respected.

One ebonite panel measuring 9 in. × 9 in. × ¼ in. (Paragon.)

One cabinet to take panel and baseboard 9 in. × 8½ in. × ¼ in. (Camco.)



The aerial coil is of the plug-in type, arranged co-axially with the centre-tapped coil.



The layout of the set should be made quite clear by this photograph.

One variable square-law condenser of .0005 μF capacity. (Igranic Electric Co., Ltd.)

One filament resistance (to suit valve). (C. A. Vandervell & Co., Ltd.)

One variable grid-leak, .5 to 10 megohms. (Bretwood, Ltd.)

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

One "Universal" coil with stand. (Peto-Scott Co., Ltd.)

One coil mount for board mounting. (Burne-Jones & Co., Ltd.)

Eight brass-finished terminals. (Burne-Jones & Co., Ltd.)

One radio frequency choke. (Lissen, Ltd.)

One Burwood valve-holder.

A "Split-Coil" Single Valve Set—*continued*

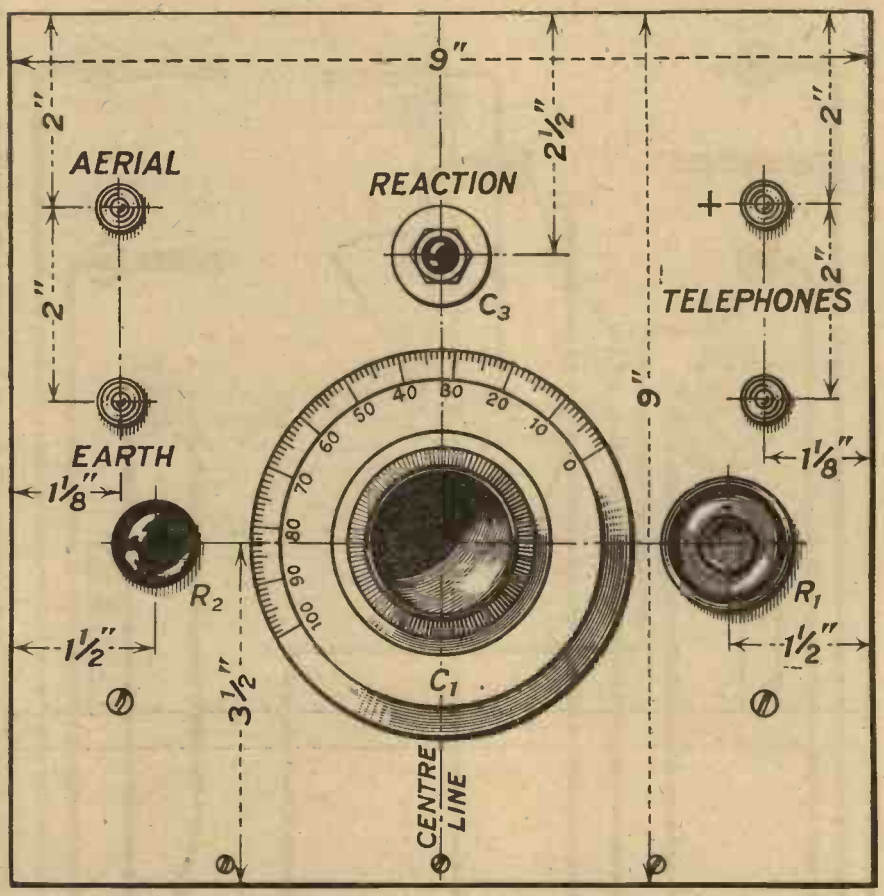


Fig. 2.—The battery terminals do not appear on the front panel, being disposed at the rear of the baseboard.

One fixed condenser of .0003 μF. (Watmel Wireless Co.)

Two right-angle brackets.

Quantity No. 16 " Glazite " connecting wire.

Radio Press panel transfers.

Strip of ebonite 2 in. × 6 in. × ¼ in.

Simple Construction

The constructional work involved in the making of the set is of quite a simple character, and provided the diagrams are carefully followed, no difficulty will be experienced.

The panel should first be marked out in accordance with the instructions given in the illustration of the panel layout. All the positions for the drilling centres, including those for the holes to take the screws for securing the brackets, should be carefully marked out to suit the particular components chosen.

When the panel has been prepared, the condensers, filament resistances, grid leak and terminals should be mounted, and the whole then secured to the baseboard, with the aid of the brackets and three small wood screws passing through the panel into the front edge of the baseboard.

Components on Baseboard

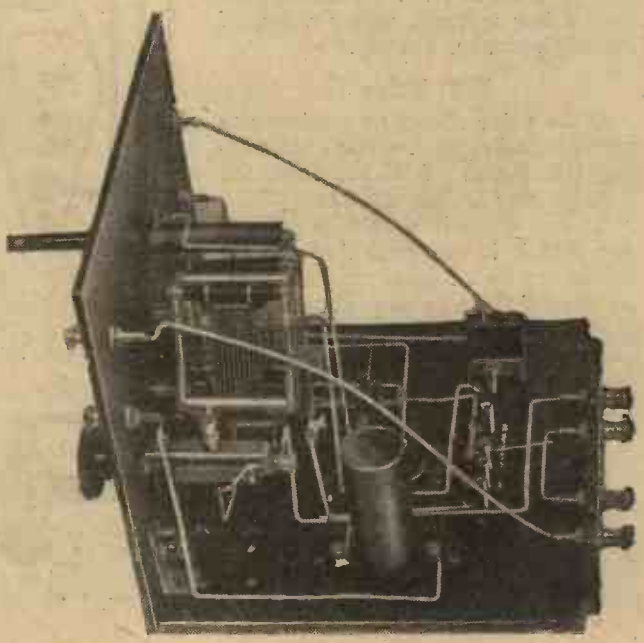
The valve holder, the stand for the grid coil L2, the coil holder for L1 and the terminal strip should all be placed in position on the baseboard and screwed down by means of suitable brass wood screws. The disposition of these components will be gathered quite clearly from the wiring diagram and photographs, but some slight rearrangement may be necessary if components of a make other than those mentioned are chosen.

It should be noted that the two coil mounts are placed as close together as possible, the two bases actually touching each other. It should be further observed that the grid condenser is held in position by means of the connecting wires which go to it.

Wiring the Set

In wiring up, the diagram showing the connections should be followed carefully in conjunction with the photographs showing the back of the receiver.

It will be observed that the coil for L2 has five tapping pins which make contact with five sockets on the stand. An inspection of the photographs and of the wiring diagram will show that one of these five points is left disconnected from any component; when wiring up, therefore, the two centre sockets of the holder for L2 should be con-



The careful disposition of the connecting wires merits attention.

A "SPLIT-COIL" SINGLE VALVE SET
(Continued)

nected together, while the two outside sockets should be connected to the fixed and moving vanes respectively of the variable condenser C1.

When connecting the variable grid leak care should be taken to see that the moving element of the component is connected to low-tension positive, and in this particular case, that contact near to the panel is the one to be so connected.

The moving elements of the "Neutrovernia" and grid tuning condensers should both be connected to that end of the grid coil which is remote from the grid of the valve, or, in other words, the fixed vanes of C1 should be connected to the grid condenser, while the fixed element of C3 should be connected to the anode of V1.

Testing the Set

Before connecting up the batteries and inserting the valve the wiring of the receiver should be carefully checked against the wiring diagram. Having assured oneself upon this point, then the valve may be inserted in its socket, the filament resistance turned to the "off" position, and the accumulator connected across the appropriate terminals. By slowly turning the rheostat to the "on" position the filament should light up to a brilliance decided by the position of the knob of the resistance. If all is well, insert the coil L2, connect the telephones, and across the H.T. terminals connect a low voltage, say, 3 volts, of the high-tension battery.

H.T. Value

If the valve shows no tendency to increase in brightness upon connecting this value of H.T., then the voltage may be increased to 45-60.

At this stage it should be pointed out that it is essential that the C3 condenser be of good manufacture, as should there by any chance be a faulty connection between the fixed and moving elements, then it will be seen that the H.T. battery would be short-circuited!

Reaction Control

Having increased the anode voltage as above and using a valve of the D.E.5B type, it will be found that with the L2 coil in position the set may be made to oscillate upon

(*Continued on page 129.*)

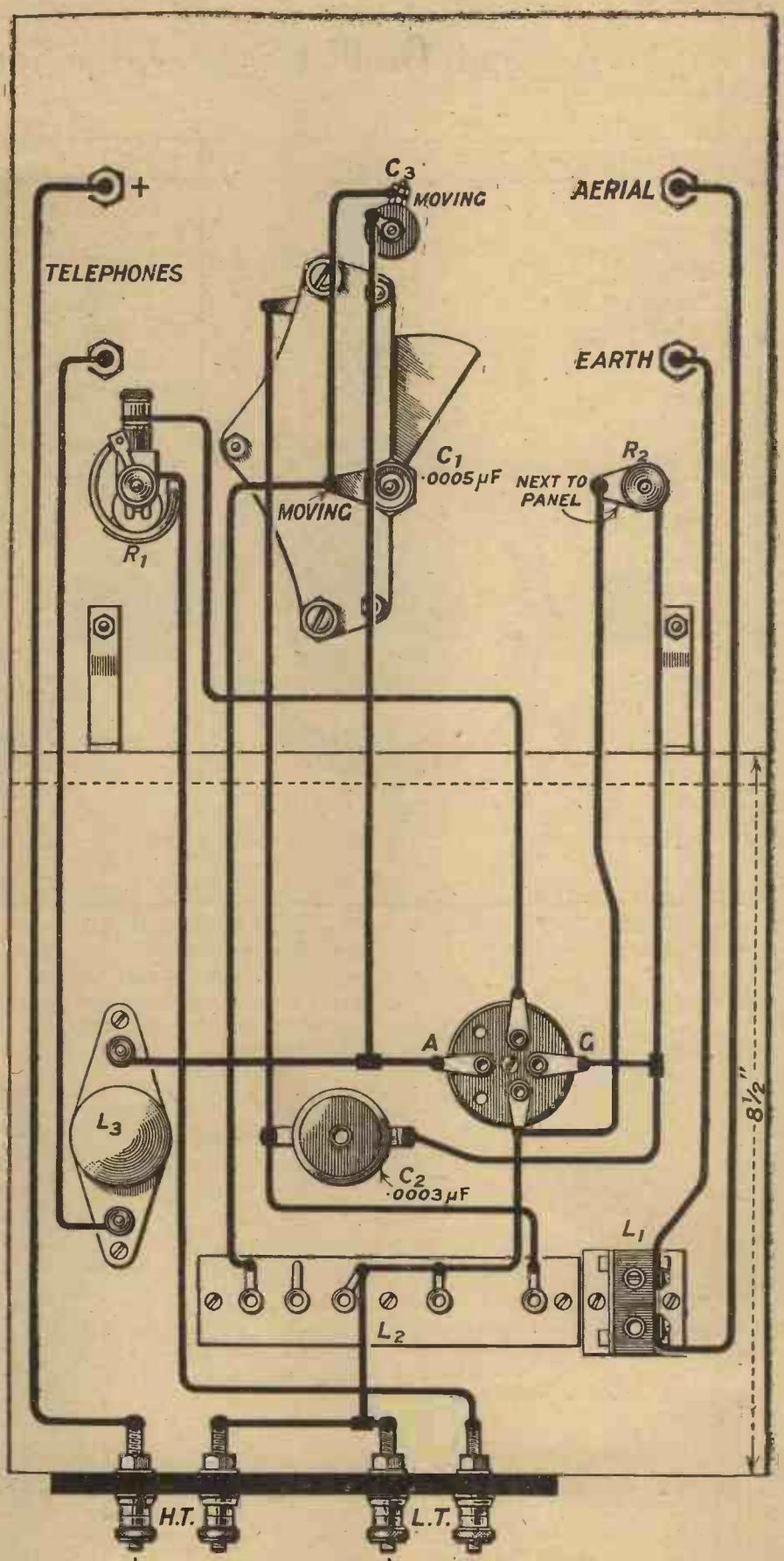


Fig. 3.—This diagram should be carefully followed by intending constructors.

Mysterious Oscillations which Spoil Reception

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

A simple explanation of some baffling troubles which are often experienced when working with several stages of high-frequency amplification.

The elimination of parasitic oscillations was one of the problems which confronted the designer of this receiver, the "Neutrophase Four," described by Mr. J. H. Reyner in the current issue of "Modern Wireless."

RECENTLY I described the curious troubles which may arise through undesired high-frequency currents floating about the receiver, thus causing oscillation, which is largely responsible for some of the obscure faults which sometimes occur. Quite apart from these high-frequency currents, however, there are many faults traceable to oscillation at frequencies quite outside those which one normally expects. Who, for example, expects high-frequency amplifiers operating on 365 metres to oscillate

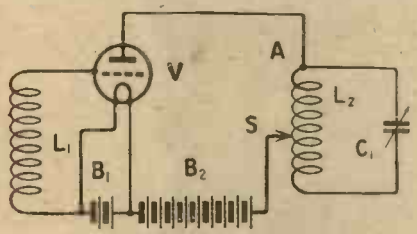


Fig. 1.—This type of circuit is prone to produce oscillations at a frequency distinct from the main frequency.

at 69? How many readers expect their low-frequency amplifier to oscillate at an inaudible frequency?

Puzzling Effects

In neither of these cases is there any audible indication of the trouble: you may simply get distortion or inefficient operation of the receiver. There will usually be no heterodyning of any kind, and for this reason you may think that you are free of oscillation.

As a matter of fact, many modern high-frequency amplifiers are capable of operating at *two* frequencies; they may oscillate either on the main frequency, in which case, of course, you get a heterodyne effect with the carrier wave of a broadcasting station, or you may get a parasitic oscillation which gives no heterodyne effect whatever. Sometimes you get the valves oscillating at both frequencies.

An Effect of Neutrodyning

A common modern method of overcoming oscillation where several stages of high-frequency amplification are obtained is that using neutralising condensers. Unfortunately, many of these methods actually tend to set up the additional parasitic self-oscillation, and further methods are required to neutralise this secondary effect.

I can best explain the subsidiary oscillation obtained in many neutralised circuits by reference to Fig. 1. Here we have an inductance coil L1 in the grid circuit, while in the anode circuit of the valve is an inductance L2 shunted by a variable condenser C1. A tapping S is taken on the coil L2, and this tapping is connected to the high-tension battery in the usual manner.

Conditions for Oscillation

If the coil L1 were shunted by a variable condenser, and had an inductance about the same as L2, then such a circuit would, in all probability, generate continuous oscillations, because whenever there is a tuned grid and a tuned anode circuit, both resonant to the same frequency, then in all probability the natural or inherent reaction between the two circuits will cause the generation of continuous oscillations.

If, instead of having a tuned grid circuit of the ordinary kind, we have a coil L1 of varied size, we will not get any oscillations corresponding to the frequency to which L2 C1 is tuned. By adjusting the size of the coil L1 to a sufficiently small value, it will frequently be found that suddenly the valve will begin to oscillate at a wavelength which, if L2 C1 is tuned to 365 metres, may be in the neighbourhood of 60 to 90 metres. We can tell that the valve is oscillating, either by having a wavemeter of the continuous wave type near to it and actually measuring the oscillations produced, or we might connect a galvanometer in the anode circuit. When the valve oscillates there will be a change in the reading of the galvanometer in practically every case.

Parasitic Oscillations

This rather mysterious oscillation corresponds to a frequency which bears no very definite relationship to the frequency of the circuit L2 C1, and it is not tuned by C1 in the same way that an oscillation produced in the circuit L2 C1 is tuned. The parasitic oscillation, as it may be called, is not a harmonic of the frequency to which L2 C1 is tuned;

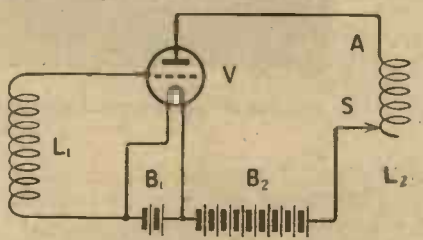


Fig. 2.—A simplified version of Fig. 1, including only the parts of the circuit responsible for the subsidiary oscillations.

the explanation of the oscillation is briefly as follows:—We do not get any main oscillation of a frequency corresponding to L2 C1, because the coil L1, combined with its self-capacity and the

Mysterious Oscillations which Spoil Reception—*continued*

small condenser formed by the electrodes of the valve, have a natural frequency very much higher than that of the circuit L2 C1.

Where they Originate

We have therefore to seek in the anode circuit of the valve some circuit other than L2 C1 which will have a frequency equal to that of the inductance L1 and the incidental capacities which turn it into an oscillatory circuit. This very short wavelength circuit in the anode circuit of Fig. 1 consists of the portion of the inductance L2 between the anode connection A and the tapping S. This inductance, which may be half of L2, or some other fraction, possesses its own self-capacity, and there is also the capacity of the valve in parallel with it. If this circuit happens to be tuned to the frequency of the grid circuit, then there is considerable likelihood of the valve oscillating at this very short wavelength.

In Fig. 2 I have taken out the part of L2 and the condenser C1, which take no part in this short-wave oscillation. I have, however, left in the inductance AS, and it will be seen in Fig. 2 that in both the grid and anode circuits we have inductances which are each shunted by capacities. If the grid and anode circuits are not in tune there will be no oscillation at this high frequency.

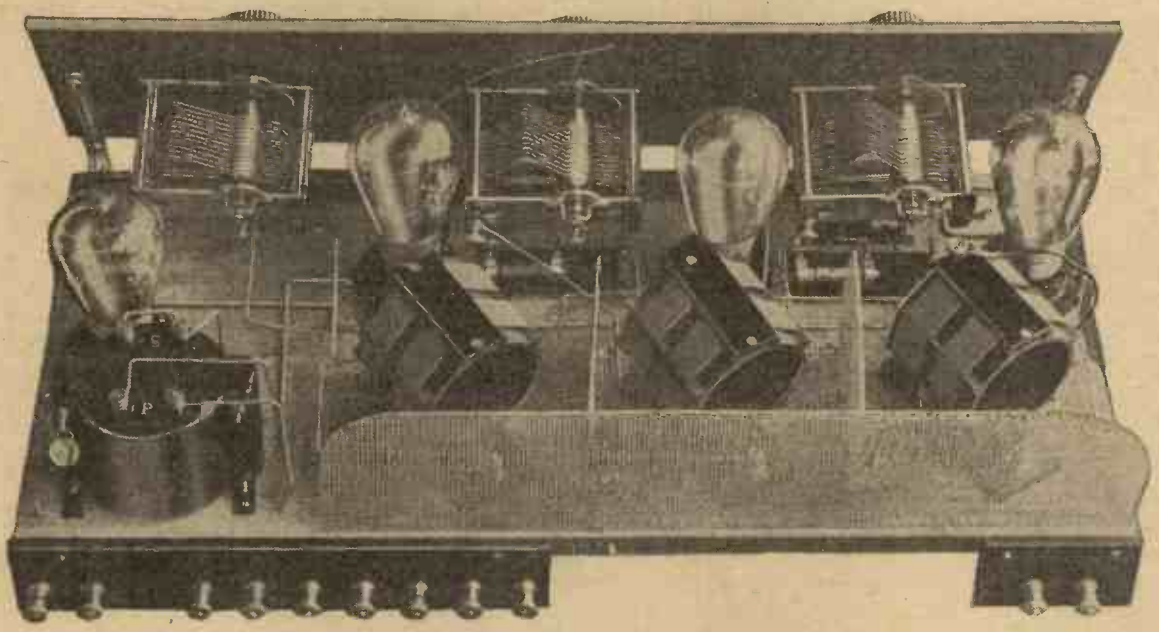
Practical Cases

The reader may at once say that the conditions in Fig. 1 are extremely unlikely, and that he knows of no circuit in which so few turns appear in the grid circuit of a valve. This may appear to be so at first sight, but when it is remembered that in many circuits there are tappings taken from coils, choke coils used, etc., etc., we will realise that there are all sorts of tuned circuits in a receiver which, if given the opportunity, will generate oscillations which mask the proper performance of the set.

A Common Type

The circuit of Fig. 3 will give the reader some idea of one example which may lead to a subsidiary oscillation of very high frequency. It will be seen that two tuned anodes are employed, middle tappings S1 and S2 being used. This circuit may be employed for obtaining greater selectivity, but more usually the tapping scheme is employed to enable neutrodyne condensers to be used for stabilising the set and prevent it oscillating at a frequency similar to that of the incoming signal.

Although stability may be obtained in this way, yet it may be accompanied by instability on these very high frequencies, and the reason is as follows:—The circuit L3 C2 is in the anode circuit of the first valve, and, although the whole of the inductance L3 is not directly in the anode circuit, yet the circuit L3 C2 is energised by the high-frequency component of the anode current. The circuit L3 C2 is also the grid circuit of the second valve, although only a portion of the inductance L3 is directly connected across the grid and filament (the tapping S1 being connected through the high-tension battery to the filament). The same applies to the anode circuit of the second valve, the circuit L4 C4 being not only the anode circuit of the second valve, but also the grid circuit of the third valve.



A view of the internal arrangements of the "Neutrophase Four," showing the lay-out of the coupling units and the partial screening between them.

The Valve Responsible

In this arrangement the second valve is the one which will generate the high-frequency oscillations corresponding to a wavelength of, say, 70 metres. This is explainable by the fact that the portion of the inductance L3 between S1 and A1 is in the grid circuit of the second valve, while the portion of the inductance L4 between A2 and S2 is in the anode circuit of the same valve. These two inductances,

Mysterious Oscillations which Spoil Reception—*continued*

tuned by their own self-capacity and the electrode capacities of the valves are, in most cases, in tune with each other, and consequently the second valve will generate oscillations.

I had to simplify the circuit, redrawing the essential parts in Fig. 4, and it will be seen that the part A and the part B are in the grid and anode circuits respectivelyof the valve V2. Of course, the whole circuits represented by Y and Z respectively are also connected to the grid and anode circuits, and will tend to oscillate, but I have presumed that some neutrodyne or other method has been used to prevent these two circuits from oscillating.

Neutrodyne Shortcomings

From these remarks it will be seen that ordinary neutrodyning does not prevent short-wave parasitic oscillations. One method of overcoming these parasitic oscillations is to vary the tappings of the inductances, *i.e.*, not to take the central point on each anode circuit. By this means the tendency for the normal frequency oscillation to occur is not really affected, but as far as the parasitic circuits are concerned, these are now differently tuned, and there will be no tendency for oscillation.

Prevention

Any method which can be applied to prevent oscillation on the normal frequencies may also be used, provided a little ingenuity is employed, to prevent the short-wave parasitic oscillation. Chokes, resistances and capacities may be tried in different positions so as to damp out, or neutralise, the unwanted high-frequency oscillations. Various T.A.T. arrangements may be employed: an untapped tuned anode circuit may separate two tapped anode circuits, the neutralising arrangement for the ordinary frequencies being suitably arranged.

I would also like to remind readers that these parasitic oscillations are not confined to circuits of the kind shown in Fig. 3, since they also apply to tapped transformers, to certain reaction coil circuits, and also those using choke coils. The dangers are particularly great when valves of substantial capacity between electrodes are employed, and when high values of high-tension voltage are employed.

The special tappings on the new R.I. transformer permit variations to be made in the natural frequencies of successive stages.

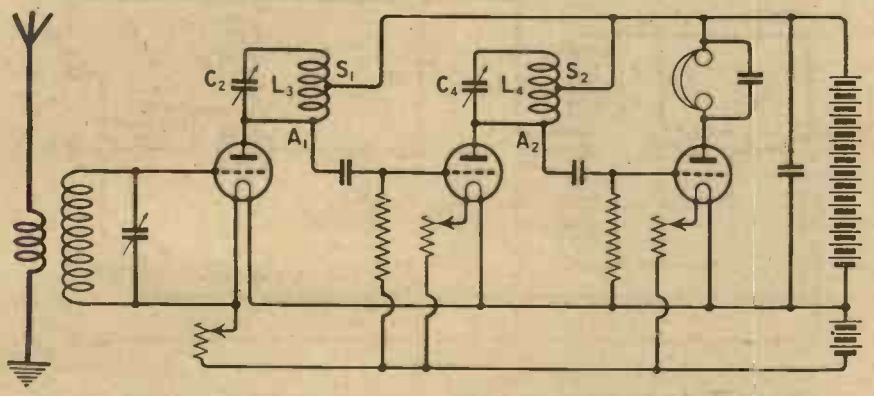


Fig. 3.—Taking the tappings S1 and S2 from slightly different points upon the coils L3 and L4 will overcome the tendency to parasitic oscillations, with little effect on oscillation at the main frequency.

Low-Frequency Troubles

As regards oscillation in low-frequency amplifiers, the best way of dealing with this is usually to try reversing the windings of the transformers, to employ resistances of the order of 100,000 ohms across the secondaries, and—a rather drastic suggestion—try different transformers, so that two with similar characteristics are not working together.

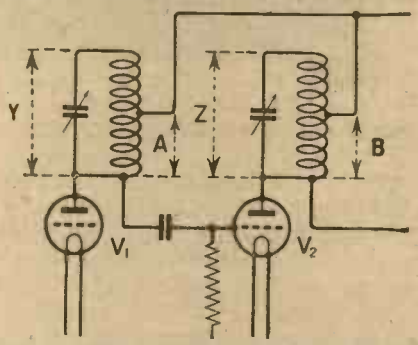


Fig. 4.—The essential portion of Fig. 3, redrawn to indicate the relationship between the portions A and B of the two anode coils.

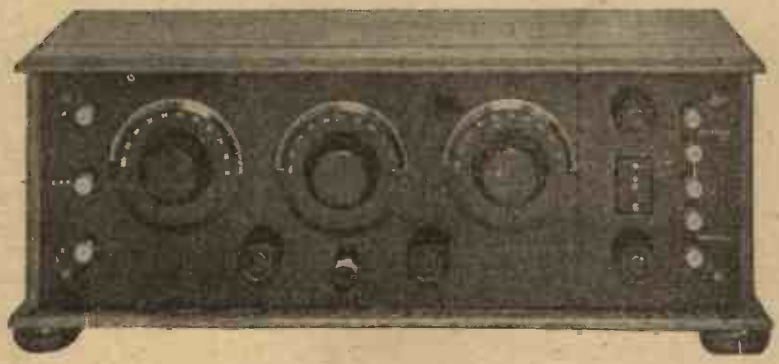
The new R.I. transformer with special tapped windings has a very distinct advantage from this point of view, because different tappings can be employed, and so we can avoid having two tuned low-frequency circuits together. Reversing one of the windings of one of the transformers is usually the simplest and best remedy, while in the case of either a low-frequency oscillation, or one of an inaudible high frequency, the use of shunting condensers, provided their size is not above .002 μF, also may be tried, and in many cases earthing the iron cores will provide a solution.

Although I have not gone into great detail on the question of preventative measures, yet I hope to have indicated the possible causes of certain kinds of sets not giving their full results.

NEXT WEEK

Look out for the special article from the pen of Mr. Reyner, describing some of the practical uses of his new screened coil.

Receiving Short Waves on Your Broadcast Set



By Captain H. J. ROUND,
M.C., M.I.E.E.

One is apt to think that reception on the higher frequencies involves the construction of a special set, but Captain Round shows that a simple adapter can be made which may be placed in front of various types of standard sets for the purpose.

FOR the reception of the very short waves such as those of KDKA, the only practical alternatives are to obtain all that can be obtained from a single valve with reaction and an L.F. amplifier, or to use a superheterodyne set.

Superhet. or Neutrodyne

Those already possessing a superheterodyne can change the oscillator coils and alter the frame, but there is a modified way which can be used which produces excellent results, and this same way can be used with neutrodyne receivers.

In general, the idea is to receive the short-wave signal on an aerial, heterodyne it to a wavelength such as 400 metres, and receive it on one's super or neutrodyne set. I have found it extremely easy to get results from both KDKA and WGY without seriously disturbing one's ordinary set.

Circuit Arrangement

The requirements are a short-wave oscillator, a tuned circuit, earthed and aperiodically connected to the aerial, this being coupled to the oscillator, and a linking arrangement between the rectifier valve and the receiving set.

The circuit I use is illustrated in Fig. 1. L_1 is an inductance coil of 14 turns of bell wire on a 6.5 cm. diameter former, the winding being split in the centre, and connected with a .01 μF condenser across the split. Each 7 turns takes up about 2 cms. length.

Across the coil I place a geared condenser C_1, .00025 μF capacity, which has preferably both its plates insulated, so that the frame can be earthed. Unfortunately most of the English condensers have one set of plates connected to the frame, and so some kind of earth shield or a long handle will have to be fitted to prevent hand-capacity effects.

Wavelength Range

I use a D.E.5 type valve and 45v. H.T., and the whole system oscillates very easily from 10,000 to 3,000 kc. (30 to 100 metres). Shorter waves can be obtained by using less turns on the coil L_1.

The coil L_2 I make about 7 turns of bell wire on the same diameter former, and place this parallel to the oscillator circuit coil and about 3 inches away. Across this coil is a non-geared condenser of .00025 μF capacity.

The Detector Valve

One end of this coil I couple to my aerial with a very small condenser C_4—something near the capacity between two pennies spaced $\frac{1}{8}$ inch apart—the other end I connect to earth. The rectifier valve is preferably a fine mesh valve of the D.E.5b. type, and its grid is connected to the live end of the inductance L_2.

Earth Connection

If your set is one not using an earth, such as most supers, it will be advisable to connect the negative end of the filament battery to earth, and to use this filament battery to light the oscillator and rectifier valves. The only remaining connections are the choke coil L_3, which may consist of one full layer of No. 42 wound on a 3-inch long 1-inch tube, and the .01 μF condenser C_3.

Adapting a Neutrodyne Set

If your set is a neutrodyne, the condenser (attached to terminal O) can in most cases be connected directly to the aerial terminal of the neutrodyne set, but if it is a superheterodyne a small coil of about the same inductance as your frame will have to be made up and connected in place of the frame, otherwise your frame aerial will pick up broadcasting, and this will be received as

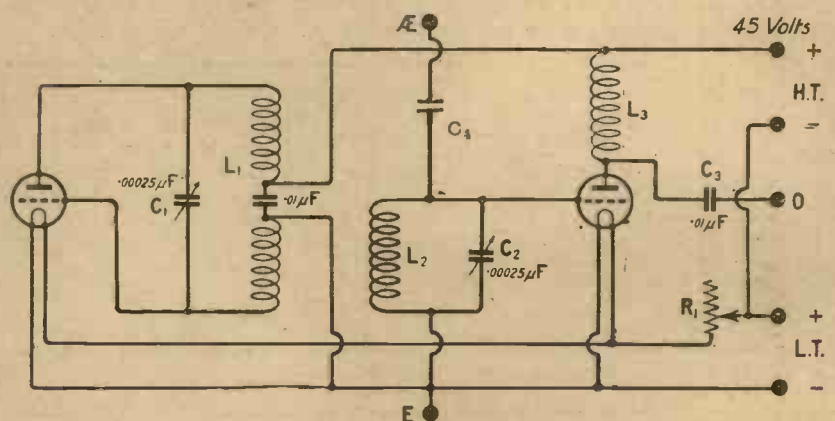
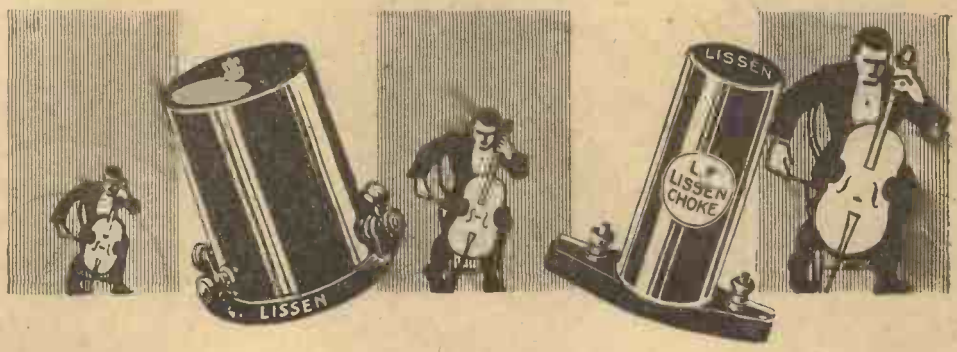


Fig. 1.—The complete circuit of the two-valve adapter. L1 and L2 are coupled together.



Building up volume without a trace of distortion

Lissen Amplifying Devices build up whispers into voluminous sound, yet never do they sacrifice tone purity for the sake of volume. Add a 2-valve Amplifier built from Lissen parts to your receiver and it's just as though the player had changed his instrument for one that was much larger—much more powerful. But volume is the only thing you add — harshness and distortion have no place in a Lissen Amplifier.

For the first L.F. stage use the Lissen T.1 Transformer, Price 21/-. Then follow this with a Lissen L.F. Choke, Price 10/-, or if you prefer it, use Lissen Chokes throughout.

When building a Choke Coupled Amplifier it is always advisable to use a variable grid leak having a wide range of variation. Use the **Lissen Variable Grid Leak**—you can obtain any resistance between ¼ and 12 megohms, smoothly, gradually and *noiselessly*. One hole fixing, of course. Price 2/6.

The capacity of the Lissen Fixed Condenser recommended for choke coupled stages is .01 mfd., Price 2/4. It is also worth while to fit **Lissen Fixed Condensers** in every stage of your receiver. Accurate to within 5% of their marked capacities they will not vary and will not leak.

NOTE THE NEW PRICES:
.0001—.001 1/3 .002—.006 2/-
(mica dielectric).

With each .0002 and .0003 there is included free a pair of clips to take a grid leak.

LISSEN

THERE IS NO 'WEAKEST LINK' IN THE LISSEN CHAIN

Lissen Limited, 30-32, Friars Lane, Richmond, Surrey

Phone: Richmond 2285 (4 lines). *'Grams: "Lissenium, Phone, London."*

I. 18

Blessings on Science, and her handmaid Steam!
They make Utopia only half a dream;
And show the fervent, of capacious souls,
Who watch the ball of Progress as it rolls,
That all as yet completed, or begun,
Is but the dawning that precedes the sun.

Yesterday - wind power
To-day - - steam power
What will to-morrow bring?

YESTERDAY wind power was the force that propelled our ships upon the ocean. To-day Science, after slumbering for so many centuries, has been harnessed in the service of man to conquer the elements.

Yesterday a pioneer sat in a mean-looking hut, set high among the bleak snow-clad hills near St. John's, Newfoundland, waiting to receive the first faint signals from distant Cornwall which should tell him—and the whole world—of man's latest victory. The conquest of the Atlantic by Wireless.

Yesterday the uncertain and insensitive Coherer was the only Detector available for these pioneers. To-day it is but a relic of the almost forgotten past. The supremacy of the valve is unchallenged. Evolved by Fleming, improved by De Forest, one inventor after another has made some notable contributions to ensure its greater efficiency and to increase its sensitivity.

But most prominent of all recent valve improvements has been the introduction by Cossor of the triple-coated low temperature filament. Used exclusively in the Wuncell Dull Emitter it enables the valve to function with a filament glow which is almost invisible. Heat—the destructive influence which shortens the lives of all valves is almost entirely absent. The result is an extremely robust valve yielding an incredibly long service.

Couple such a wonderful filament with the fact that this Dull Emitter utilises the electron-retaining hood-shaped Grid and Anode made famous by Cossor, and you'll readily understand why the Wuncell is being everywhere chosen for its greater sensitiveness, superior tone and proved economy.

Types and Prices:

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

Gilbert Ad. 4751

Receiving Short Waves on Your Broadcast Set
(Continued)

well as the short waves. C_3 can then be connected to the grid side of this frame coil substitute.

Calibration

Calibration is difficult to do, and some will have to be content with groping. I will give later rough positions of both KDKA and WGY on the aerial tuning condenser as a guide.

Method of Operation with Neutrodyne Receiver

Set the last two tuning condensers of the neutrodyne at some wavelength a little away from that of your local station, and put the aerial condenser at about the same reading. Then set the aerial condenser on the adapter set at about the KDKA position, and slowly move the Hartley circuit (*i.e.*, the oscillator) condenser until you hear a maximum of interference noises, crackles, etc.: there will be two positions fairly far apart.

If you can get nothing, grope downwards on the aerial tuning condenser of the adapter bit by bit, re-testing the heterodyne position, and you will undoubtedly find at least a Morse station, such as Dollis Hill, which will enable you to get the aerial condenser of the neutrodyne properly tuned.

Searching and Harmonics

After that all you can do is to go up and down on the aerial tuning condenser of the adapter, each time re-setting the heterodyne, until you find someone.

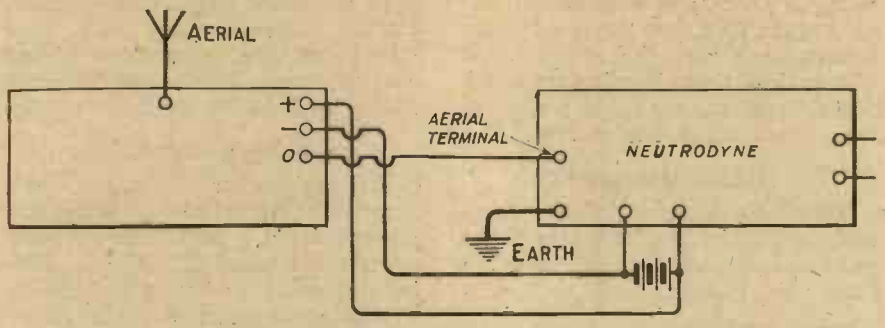


Fig. 2.—Showing how the adapter is connected to a neutrodyne set. The connections of the L.T. circuits are shown, but those of the H.T. terminals are omitted in this diagram, and also in Fig. 3.

My aerial tuning condenser is a non-square-law condenser of .00025 μF, and this I find reads about half way for KDKA (62 m.) and almost zero for WGY (42 m.) Its reading is fortunately fairly broad. Both positions on the heterodyne are about equal in strength.

If you are near a B.B.C. station plenty of harmonics will be found, and, curiously enough, even such stations as Radio-Toulouse I have heard quite strongly round about 50 metres. Adjustment is quite easy and stable. (By the way, when you have got KDKA, mark your adjustments carefully.)

Experimenters will, no doubt, want to put reaction on the aerial to improve things, but this I have neither tried nor needed.

Calibration with a Superhet

When using a superhet one little further difficulty is introduced, and that is that the harmonics of one's main oscillator beat with the adapter oscillator, producing a number of false carrier-wave positions. They can usually be spotted because they are always unmodulated by Morse or telephony.

If one of these happens to coincide with the wave wanted then the super set must have its frequency altered very slightly.

The adapter can be used with any set giving the required amount of H.F. amplification.

A Super-Sensitive Arrangement

Neutrodyne sets with the note mags. and detector removed easily fit on in front of supers, giving both extra tuning and extra magnification, and if, in addition, one puts on the two-valve adapter it is possible to get signals under extremely difficult conditions.

With such a set, containing 13 valves altogether, WGY comes in fairly well from 7—8 in the evening on most nights, and is, of course, enormously strong after 11 p.m.

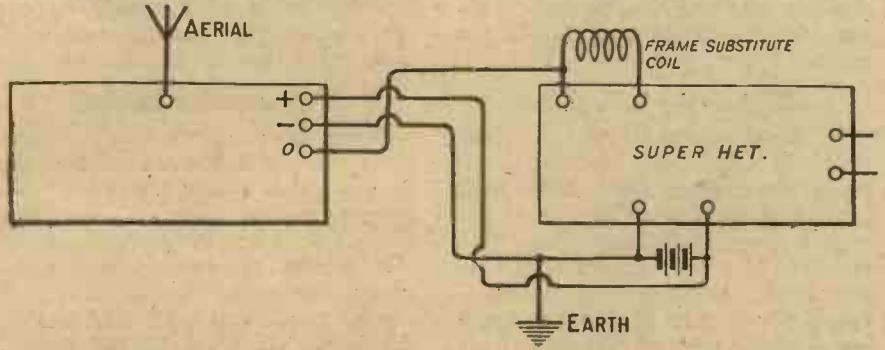


Fig. 3.—When the adapter is used with a superheterodyne the aerial and earth connections are as shown here.

Making the Most of Your Set

SOME NOTES ON PRACTICAL MATTERS

Using a series condenser—A curious fault—Watch your accumulator—A hint for the transmitter.

Series Condensers

THE beginner is often puzzled by hearing remarks to the effect that stronger signals will be obtainable if the tuning condenser is used in series with the coil instead of in parallel. On trying out the series arrangement, he sometimes finds that signals are very much weaker than they were before, and consequently gives up the arrangement in disgust. The reason for failure is generally this: hearing that the great benefit of a series condenser is that it enables more inductance to be used, the beginner puts, say, a .0003 μF condenser in series with his inductance, and turns it to the position of minimum capacity, so as to be able to use as large a coil as possible.

A Cause of Poor Results

Signals will almost certainly be abnormally weak in this case, as it has often been shown that the H.F. resistance of a variable condenser increases seriously when the setting of the dial is below about 20 deg. on the scale. Thus if a series condenser is used, the coil should be of a size which will enable a reasonably large reading of the condenser to be used. It is a good plan to make it a rule never to work below a reading of, say, 30 deg.

An Obscure Fault

The tracing of elusive noises in a short-wave receiver to an unexpected source, namely, the telephone windings, was the subject of some notes by Mr. Harris in Random Technicalities recently (*Wireless Weekly*, Vol. 7, No. 18). The writer's set recently experienced a similar visitation, but in this case the telephones were not to blame. A systematic search, using a process of elimination, revealed the fact that the low-tension accumulator was the offender. It was noticed that vibration made the noise worse, so that faulty connections were suspected at first.

The Accumulator at Fault

Thorough scouring of the accumulator terminals with emery paper produced no improvement, and the leads were found to be in good condition. The plates themselves were then examined, the cells being of a type made up in such a way that the plates may be lifted out of the acid containers without any trouble.

In one of the cells the cause of the noises was discovered. A piece of the paste had become detached from one of the plates, and had lodged between the positive and negative plates, effecting a partial short circuit. Vibration had caused this piece of paste to move slightly, and so give rise to fluctuations in the filament circuit of the valve.

Look after the L.T. Battery

While the actual fault described above is admittedly not likely to occur often, especially in cells with insulating separators, particles detached from the plates can give trouble if an accumulator is neglected. These particles normally fall to the bottom of the cell, forming a pasty sort of "sludge." If this deposit is not periodically cleared out, it will in time rise high enough to come in contact with the lower edges of the plates. Partial short-circuiting will then take place, the accumulator giving rise to noises in the receiver and failing to hold its charge properly.

Adjusting a Transmitter

The novice at transmission almost invariably starts with a very low power input, and consequently experiences some difficulty in finding out exactly what is happening. Probably the most worrying point of all is that, on most hot-wire ammeters, no reading below about .05 amp. can be taken with any degree of accuracy; thus it is impossible to tell by this means when the circuits are accurately tuned to resonance, and working in their most efficient state.

Watch the Input

The most satisfactory method of doing this when low power is used is by means of the input milliammeter. The closed circuit is first tuned to the wavelength on which it is desired to work by means of a wavemeter or calibrated receiver. The aerial coil, with its condenser in series or parallel, is then fairly tightly coupled to the closed circuit, and the condenser varied slowly.

The Indication

The condition of resonance will be shown by a fairly sudden dip of the milliammeter needle. This will enable tuning to be performed far more accurately than the method of looking for a very nearly imperceptible movement of the needle of a sluggish hot-wire meter.

A Spectacular Method

Many transmitters using higher power use this method of tuning; in fact, the owner of one well-known station adjusts his closed circuits until sparking occurs across the anode condenser, and then varies the aerial tuning until this stops, assuming that the energy previously devoted to the formation of sparks is then "going up the aerial."

A VALVE HINT.

The special high impedance, high amplification ratio valves, such as the D.F.A.4 and the D.E.5B., are somewhat expensive to buy, and one does not always want to obtain one or more specially to try a resistance-capacity amplifier.

To obtain the very best results from a low-frequency amplifier of this type it is, of course, desirable to use the correct valves, but it is well to remember that, at a pinch, there is another general type which will give quite good results. Most of the valve manufacturers produce a special H.F. valve of high impedance and high amplification ratio, and these serve fairly well as resistance-capacity amplifiers, provided that signals of only moderate volume are to be handled and adequate H.T. and grid bias are used.

Wireless News in Brief.

Forthcoming B.B.C. Items. Monday, March 15:—London: 8.43 p.m., Act 3 of "Rigoletto," by the B.N.O.C., relayed from Bradford; Bournemouth: An Instrumental Evening.

Tuesday, March 16:—Manchester: Two unannounced programmes.

Wednesday, March 17, St. Patrick's Day:—Special Irish programmes.

Thursday, March 18:—London: Symphony Concert; Manchester: A Ladies' Evening.

Friday, March 19:—Bournemouth: A Popular Evening; Newcastle: Syncopated Music and Humour.

Saturday, March 20:—Birmingham, Glasgow and Newcastle: "Listening Time" (second edition); Aberdeen: Musical Comedy and Drama.

* * *

On St. Patrick's Day, March 17, the London station will relay the speeches of the St. Patrick's Day Banquet of the Union of Four Provinces of Ireland Club at the Hôtel Cecil. The proceedings will commence at 8.30 p.m. and end at 9.15 p.m.

* * *

The New Rome Station. The reconstruction of the Rome broadcasting station is now practically complete, and tests have been carried out on the new power of 12 kilowatts. We gather that no considerable changes have been made in the type of transmitting apparatus, the only alteration being in the power used. The disused 6 kilowatt transmitter is to be used elsewhere in Italy.

* * *

Hunting the Oscillator. We hear that the Post Office authorities intend to bring a specially equipped motor-car into service shortly, in order to assist them in locating users of wireless receivers which cause interference by oscillating. The car will be fitted with a portable receiver and frame aerial, and it is proposed to patrol the London area and endeavour to trace the sources of interference. When an offender is located, an official warning will be sent to him.

* * *

Future of Broadcasting. A statement has been made by the Postmaster-General, Sir William Mitchell-Thomson, that it is unlikely that the Government will be able to declare its policy on the future of broadcasting until the report of the Committee has been considered. This will probably not be before the middle of next month.

* * *

Wireless in Trains. We hear that experiments in reception on the transcontinental railways in Canada have proved remarkably successful. On one occasion, when a train was about 1,000 miles west of Montreal, both Lima, Peru (OAX), and Oakland, California (KGO), were heard.

At the moment of going to press the decision is announced in the action by the British Broadcasting Co., Ltd., granting an injunction to restrain the Wireless League Gazette Publishing Company, Ltd., from infringing copyright by publishing summaries of programmes from the *Radio Times*.

* * *

Broadcasting Parliament. The question of the broadcasting of proceedings in the House of Commons has again been raised in connection with the introduction of the Budget by Mr. Churchill. This will take place after the Easter recess. We gather that this question is not likely to receive consideration until after the publication of their report by the Broadcasting Committee.

* * *

Struck by Lightning. During the evening programme on March 3 we hear that the aerial of the Daventry station was struck by lightning. It seems that no serious damage was done, since the station was out of action for only eight minutes.

* * *

A receiver and frame aerial used for broadcast reception on the Cornish Riviera Express. Interference from the lighting dynamos on the train was the principal trouble experienced, but this difficulty should not prove insuperable.

* * *

This Week's Interview

No. 4.—MAJOR A. G. LEE, M.C., B.Sc., M.I.E.E.

In this verbatim report will be found a most interesting series of answers dealing with the remarkable transmitting arrangements at the great new station at Rugby.

HOW RUGBY IS CONTROLLED.

Major Lee, the popular chief of the Radio Section of the Engineering Department of the Post Office, is one of the foremost radio engineers in the country. The explanations which he gave in this interview make very fascinating reading.

Q.—I should like to ask you a few questions concerning Rugby, Major Lee. From all accounts this station makes use of some entirely new principles?

A.—That is so. While the fundamental principles adopted are the logical outcome of experimental work which has been proceeding for the past three or four years, the actual manner in which they have been carried out is decidedly novel.

Q.—Have you experienced any serious troubles involving radical alterations in design?

A.—No. There have, of course, been minor difficulties, but the main principles of the design have remained unchanged.

Q.—That is very interesting. Your whole output is controlled by a small tuning fork, is it not?

A.—The output is actually derived from the tuning fork, which produces a current having a large number of harmonics. One of these (actually the eighth) is selected, amplified and passed to the aerial.

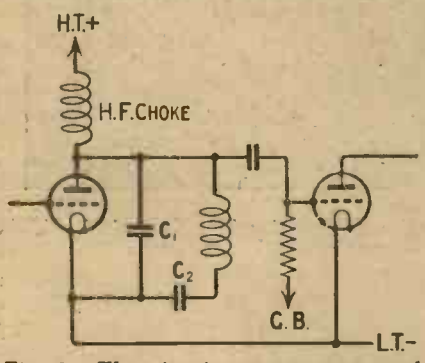


Fig. 1.—The circuit arrangement used at Rugby to filter out unwanted harmonics.

Q.—Do you not introduce fresh harmonics in the high-frequency amplifying stages?

A.—Yes, but these are filtered out as fast as they are produced.

Q.—That is a matter of some interest in view of its application to receiving circuits. Could you explain exactly how this filtering is effected?

A.—Certainly. A tuned anode arrangement is employed to couple the various valves together and the anode circuit is only tapped across a portion of the tuned circuit. The particular advantage of the arrangement lies in the use of a condenser tapping instead of a tapped coil.

(Major Lee here drew a circuit which is reproduced in Fig. 1.)

You see, the main oscillating circuit includes both the condensers C1 and C2. The harmonics, however, being at a much higher frequency, take the short circuit path through the condenser C1, and so are not passed on to the next valve to any appreciable extent.

Q.—Is this method, then, completely effective?

A.—Absolutely so. In fact, we have had no complaints of harmonic interference whatever.

Q.—That is a most important achievement. Do you not have trouble in the amplifying circuits, however, due to parasitic currents?

A.—Yes, troubles were experienced at first both from this source and due to the generation of parasitic oscillations at very high frequencies, but these have been successfully overcome.

Q.—How do you find that the valves in use stand up to the work?

A.—Very well indeed. Naturally some difficulties were encountered during the testing stages, due largely to the troubles just mentioned, but a stable condition was very quickly achieved and everything is proceeding smoothly.

Q.—I see that considerable trouble was taken to insulate the masts. Has this been justified by results?

A.—Very much so. The radiation is nearly 20 per cent. more efficient with the insulated masts than with the older system.

Q.—Do you find the granite insulators satisfactory?

A.—The granite blocks at the base of the masts are not employed as insulators, but serve to reduce the capacity to earth. This must be kept small to avoid heavy capacity currents. The actual insulation is effected by means of special porcelain insulators.

Q.—I had not appreciated that point. Are you obtaining the same satisfaction from your aerial insulators?

A.—Yes. This problem was a difficult one to handle in view of the very high voltage, 160,000 volts, which is probably the highest aerial voltage in the world. A special type of porcelain insulator has been designed, however, which is giving every satisfaction.

Q.—I am a little surprised, in view of the trouble taken with other parts of the aerial system, that an ordinary buried earth is employed. Why is this?

A.—The earth system is hardly an

This Week's Interview
(Continued)

ordinary one. Special care has been taken to allow for the uneven distribution of current in the earth. Actually the resistance is ¾ ohm, which is as low as we require.

Q.—That appears to be very good, but I do not quite understand that last remark. Surely the lower the earth resistance, the better?

A.—No. The aerial circuit must have a certain minimum resistance to enable high-speed telegraphy to be carried on. Otherwise the signals tend to run together.

The oscillatory circuits of one of the intermediate amplification stages at Rugby.

Q.—One more question. What arrangements are being made regarding a receiving station for Rugby?

A.—None. Rugby is not at the present time a traffic station in the ordinary sense of the word, but is employed for sending out news and reports of all kinds. We have a number of reports indicating that it is possible to receive Rugby in Australia and New Zealand on a single valve, but naturally for selective reception one would expect more valves to be used.

A "Split-Coil" Single Valve Set—*continued from page 120*

turning the "Neutrovernia" from its "all out" position towards the "all in." It will be observed in these preliminary operations that with the C1 condenser set at its minimum reading, there will be less of the C3 condenser required to make the set oscillate than will be the case when C1 is set at its maximum.

Having satisfied oneself upon these points, connect the aerial and earth to the appropriate terminals and insert a No. 30 coil in the L1 socket. So long as this test is conducted outside the hours devoted to broadcasting, the valve should be lighted, and with the C3 condenser set at its minimum, the C1 condenser should be slowly turned until some sort of signal is heard; whereupon the value of C3 may be increased, observing that signal strength is improved by so doing, until at a certain setting the receiver will begin to oscillate, when the C3 condenser should be immediately turned in *anti-clockwise* direction until oscillation ceases.

The Aerial Coil

On a given adjustment of C1 at which a fairly weak signal is received, various sizes of coil should be tried for L1, remembering that the smaller the size of this, the greater the selectivity, though too small a coil will, of course, mean loss of signal strength as well.

Having found a coil which for your own particular conditions is a good compromise of both signal strength and selectivity, attention should now be turned to the adjustment of filament current and anode voltage.

Smooth Reaction

It may be noticed (on the other hand, it may not!) that the receiver goes into oscillation with a slight "pop," which sound is again repeated when the reaction condenser is turned into an anti-clockwise direction.

It should be the ambition of the builder of this set to dispense with this pop as far as possible, by so adjusting the value of anode voltage and filament current until the set "slides" into oscillation without his being aware of the fact save for the distortion of signals which results.

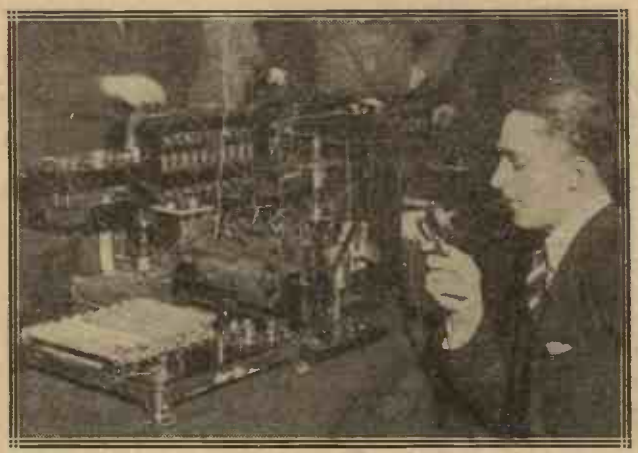
This adjustment is not difficult, even though it may sound so, and by varying the position of the H.T. wander plug which is connected to the positive of the H.T. battery, and lowering the brilliancy of the valve somewhat, it will soon be found that the set may be made to oscillate in the manner referred to. Reducing these values too far will, of course, result in poor signal strength and inability to make the receiver oscillate at all.

What You May Hear

Using the set in South-East London upon a badly placed aerial, with either a D.E.5B or Cossor P.2 valve, quite good signals can be received from Radio-Belgique, Birmingham, Kiel, Bremen, Rome and Newcastle. The value of anode voltage used in the reception of these stations is 45 volts, while the aerial coil is a No. 30 of the ordinary plug-in type. The set is, with these values, very easy to operate, and is also moderately selective.

On the whole, a receiver made to these specifications will be found to be a very considerable improvement upon the more common type of single valve set, using a "swinging" reaction coil.

(Further results and the Elstree test report will be published next week.)

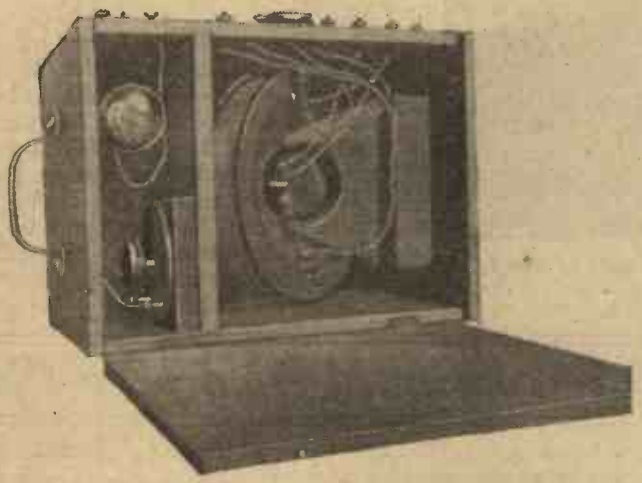


Mr. P. H. Dorte recently read a paper at the Institute of Electrical Engineers and carried out experiments in short-wave transmission.

What Happens When a Valve Oscillates?

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

We are apt to speak somewhat loosely of a valve "oscillating," forgetting that the oscillation takes place in the circuits of the valve. Mr. Barton-Chapple describes in this interesting article some experiments in which he actually recorded photographically the form of the currents in the various circuits, and shows the effect of unduly tight reaction coupling and so on.



The oscillator used in these experiments was designed for low frequencies. The valve may be seen in the compartment on the left.

IT is fairly well known to readers of this journal that a three-electrode thermionic valve, if connected to a circuit having a natural period of oscillation, will, provided certain conditions are satisfied, generate alternating currents of a frequency fixed by various factors. These factors include inductance (self and mutual) capacity (taking into account the distributed capacity of the coil, the inter-electrode capacity of the valve and the capacity of the valve holder), and the resistance of the circuit to which it is connected.

Timing of the Impulses

This vibratile circuit has its mechanical analogy in the pendulum of a clock, or the balance-wheel of a watch, for both the pendulum and the balance wheel can be sustained in vibration by properly timed impulses transmitted from the mainspring through the escapement, the timing being accomplished by the vibrating member itself. Similarly, the vibrating electrical system can be sustained in operation if properly timed E.M.F.'s are applied, and the timing can be done by the vibrations of the system itself.

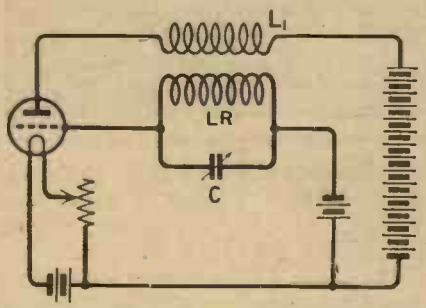


Fig. 1.—In this diagram LR represents the inductance and resistance of the coil in the grid circuit of the valve.

Another Analogy

Again, the action is nearly analogous to that of a violin bow; although the force and velocity of the bow are essentially constant, the peculiar friction between the bow and the string enables the string to absorb more power from the bow when string and bow are moving in the same direction, than is given back to the bow by the string when the motions of bow and string are in the opposite direction.

The muscles of the arm actuating the bow constitute a source of continuous power; it is obviously impossible for an arm muscle to supply (directly) power to a string vibrating, say, one thousand times per second. The arm supplies energy to the bow at an essentially constant rate, and the reactions between bow and string serve to utilise this power to maintain the string in a state of rapid vibration.

A Simple Case

One of the simplest circuits for generating oscillations is shown in Fig. 1, where LRC is a lightly-damped oscillatory circuit placed in the grid circuit of the valve. (R represents the resistance of the circuit.) In passing it should be noted that neither the balance wheel nor the violin string will vibrate if the damping of the oscillating member is too high; if too much friction occurs in the bearing of the balance wheel, the watch or clock will stop. The same effect exists in generating valve circuits, and hence the necessity for the expression "lightly damped."

Dissipation of Energy

Now, while these oscillations are taking place, energy is being lost,

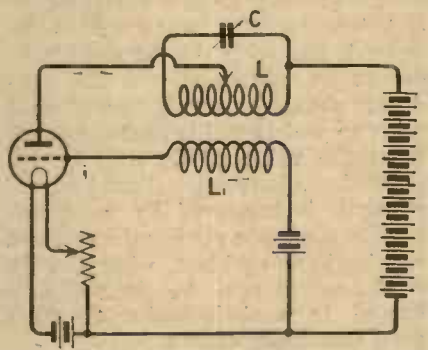


Fig. 2.—The use of an anode tap makes possible an adjustment for the maximum oscillatory current without alteration of the coupling.

this energy being proportional to the square of the oscillatory current multiplied by the resistance. If no external energy is supplied to this circuit, the oscillations will die down in a similar manner to that of an ordinary damped wave. Due to the varying current passing through the inductance L, what is known as a self-induced E.M.F. is produced across the extremities of the coil. This means that a change of voltage is applied across the grid of the valve, which in turn will cause an amplified fluctuating current to pass

WHAT HAPPENS WHEN A VALVE OSCILLATES?

(Continued)

through the inductance in the anode circuit.

If we regard these two inductances as being coupled together by a magnetic effect, then the fluctuating current in the coil of the anode circuit will produce an E.M.F. in the inductance coil situated in the grid circuit.

Conditions to Satisfy

Now, it can be proved mathematically that this re-introduced E.M.F. can be in phase or out of phase with the current already flowing in this oscillatory circuit. If we are to assist the oscillations in this

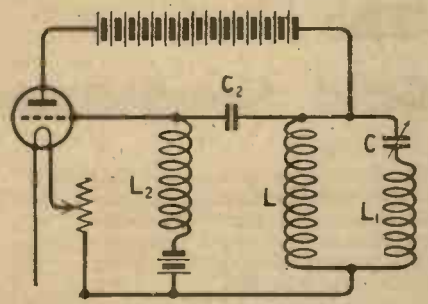


Fig. 3.—This circuit incorporates most of the features met with in practical reaction circuits.

oscillatory circuit, it is obvious that the E.M.F. must be *in* phase with the existing current.

If the coupling is in the correct direction and its magnitude exceeds a certain critical value, then the energy sent back from the anode circuit into the grid circuit will be more than sufficient to compensate for the losses in this oscillatory circuit, and hence oscillations will be maintained.

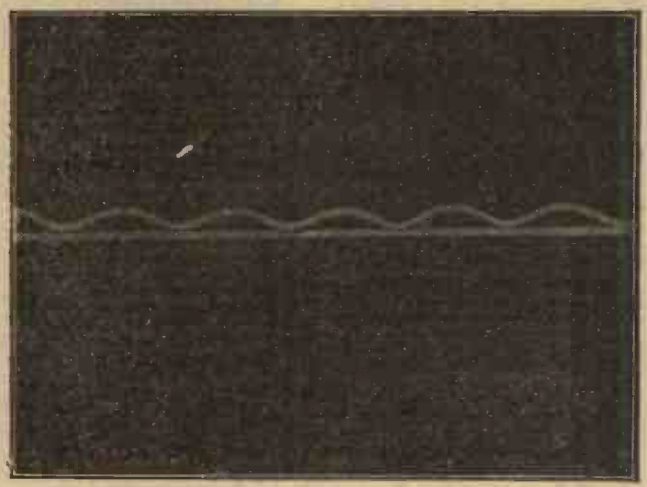
Another Case

The circuit which we have just examined is the type usually adopted for the reception of wireless signals under certain circumstances, but for the purpose of supplying power to another circuit the LRC branch is often inserted in series with the anode battery, the untuned inductance being in the grid circuit. The conditions operating in this circuit are somewhat more complicated than those of Fig. 1.

Certain Limitations

There are certain limitations which can be studied with this circuit which will be of special interest to the transmitter. As far as the maximum oscillatory current in the oscillating circuit is concerned, limitations are imposed by the saturation current of the valve itself in one case, and by the applied anode potential in another case.

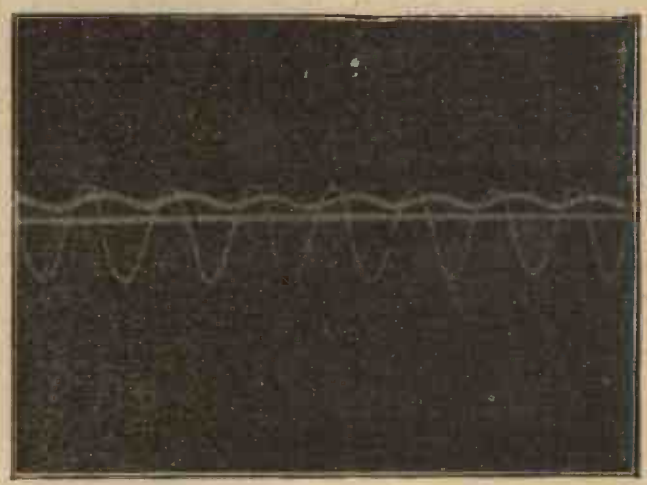
Without going into a mathematical interpretation of the circumstances, it is interesting to note the final conditions which need to be satisfied in a circuit of this nature.



Photograph A.—The anode current of the valve just oscillating at 150 cycles per second took the form shown here.

The Anode Tap

With the voltage on the grid adjusted to make the normal working anode current half the saturation current, the product of the inductance and the capacity, *i.e.*, CL, must be kept constant in order to keep the frequency at the given value. To adjust the oscillatory current to its maximum value, however, the ratio $\frac{C}{L}$ must be altered with consequent alteration of the coefficient of coupling (*i.e.*, the reaction coupling).



Photograph B.—Showing the addition of the oscillatory current at a frequency of 210 cycles per second.

In actual practice this operation may be very inconvenient, and almost the same result can be secured by providing too small a ratio of $\frac{C}{L}$ in the oscillatory circuit and including only a portion of L in the anode circuit, as shown in Fig. 2, the point at which the anode is joined to L being commonly known as the "anode tap."

An Important Case

The circuit shown in Fig. 3 is a very important one, as if the condition to maintain oscillation is investigated it will be found to include many of the cases met with in actual practice. The resultant expressions are somewhat unwieldy, so will not be given here, but it should be mentioned that their very nature emphasises the extreme importance of avoiding stray capacities and inductances, as these complicate the results and lead to erroneous conclusions.

Does the Current Oscillate?

It is often difficult for experimenters to conceive the idea that the current is actually oscillating in a circuit possessing inductance and capacity, and any apparatus which enables the current and voltage

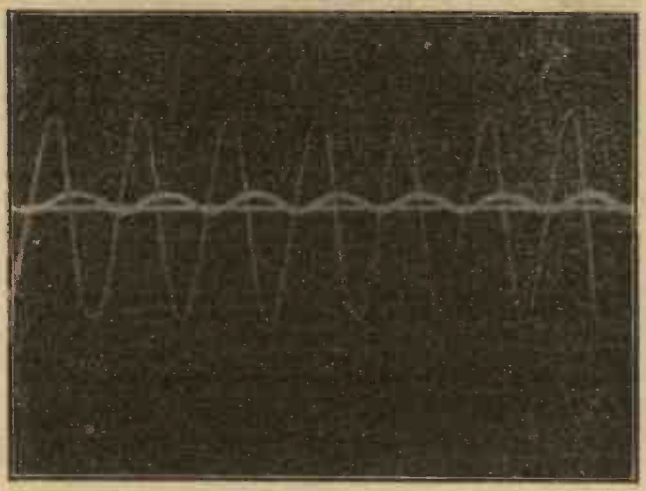
WHAT HAPPENS WHEN A VALVE OSCILLATES?

(Continued)

effects to be actually seen naturally lends added interest to a particular experiment.

Some Practical Investigations

Some time ago I undertook some research work in order to prove the validity of the theoretical equations derived for a valve when generating oscillations under certain specified conditions. Part of the oscillator employed with the coils and valve is shown in one of the accompanying photographs, the oscillator in question being essentially designed for low frequencies, the lowest value reached being 150 cycles per second. To meet this necessity the untuned grid coil was wound to give an inductance (air-core) of over 3 henries.



Photograph C.—Too great an increase in reaction coupling produces harmonics and distortion, due to a flattening of the crests and troughs of the "wave."

A Duddell Oscillograph

To observe what was actually taking place in the circuit resort was made to what is known as a Duddell high-frequency oscillograph, the term "high" in this case meaning a maximum of 300 cycles per second.

The details of this ingenious piece of apparatus, while particularly interesting, will not be dealt with here, except for saying that the principle of the instrument is that of a moving coil galvanometer, in which the coil is replaced by a double strip of phosphor-bronze, stretched in such a way that the strip responds to very rapid changes of current sent through it.

Method of Recording

By the aid of a spot of light and a patent magazine camera actual photographic records were made of the alternating currents which were previously observed on a special tracing desk. The scheme of connections is made clear by an examination of Fig. 4, which shows the positions of the two strips (*a*) and (*b*), the former giving anode current changes and the latter actual oscillatory current in the tuned circuit.

The Oscillating Anode Current

Photograph A shows the anode current of the thermionic valve as indicated by strip (*a*) alone. It is seen to be displaced from the zero line, since the point on the anode current grid voltage characteristic at which the valve was operating was halfway up the wave. The apparatus was working exactly at "maintenance," *i.e.*, the circuit was just, and only just, kept oscillating. It will be seen that the curve is not exactly sinusoidal, the presence of a third harmonic being indicated by the flat top of the curve. The frequency of the oscillations in this particular case was 150 cycles per second.

The Phase Difference

Photograph B shows both the anode current (small amplitude) and the oscillatory current (large amplitude), and in the case of the latter it is seen to approximate very closely to a sine wave, oscillations taking place at "maintenance," as before, the frequency being increased to 210 cycles per second.

It can be shown mathematically that there is a 90 degrees phase displacement between the oscillating anode current and the current in the oscillatory circuit, the former lagging, and this is seen to be the case if the two curves are compared carefully.

Introducing Harmonics

Any increase in the mutual inductance (*i.e.*, what is commonly called the reaction coupling) above its maintenance value causes the current in the tuned circuit to increase while the oscillating anode current increases also until its excursion is located in the top and bottom bends of the characteristic curve.

This will cause the anode current variations to deviate considerably from a sinusoidal form, and the alternations become flat-topped with the consequent introduction of harmonics and excessive distortion. The importance of limiting the energy feed-back is thus made clear, and an examination of photograph C shows the effects just explained.

Application to Higher Frequencies

These experiments enabled much interesting information to be acquired, and it must be borne in mind that, although they were conducted with an oscillator purposely designed for low frequencies, so that a photographic record could be secured with the apparatus available, the same features are operative at the high broadcast frequencies. Actual photographs can be obtained at these very high frequencies, but the instrument to be employed in these cases is the Cathode Ray Oscillograph, which works on quite a different principle.

The Cathode Ray Oscillograph

This piece of apparatus consists of an exhausted glass tube with a cathode which emits a stream of electrons, situated at one end. These electrons normally pass along the tube in a straight line through a small aperture in a mask located in the tube, the beam being directed on to a fluorescent screen.

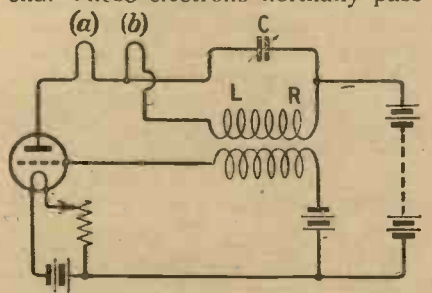


Fig. 4.—The oscillatory circuit used in the experiments from which the photographic records were obtained.

By influencing this beam by a fluctuating magnetic field corresponding to the alternations in the circuit under test, the spot on the screen becomes a visible straight line. The introduction of a device to give a "time axis effect" enables a photographic record to be made.

The WEEK'S DIARY

IN the last hundred years many strange feats have been performed for wagers, or to achieve notoriety, and at one time the newspapers gave much space to such feats as Blondin's tight-rope walk across Niagara and the hazardous feat of floating over the same falls in a barrel. With the coming of films, such feats have become increasingly common, as the financial inducement often offered is a powerful temptation to certain temperaments.

* * *

I SEE that the other day an attempt was made to fly under the Eiffel Tower, and whether or not the possibility of a film thrill was the actuating motive I do not know; it is sufficient that attempts were made to film the episode, and, as it terminated tragically, the film has been seized, and will not be shown, I believe, in any picture theatre. Everyone who has sauntered round the base of the Eiffel Tower must have observed the intricate network of aerial wires leading down to the station, which, by the way, is concealed beneath the ground. When I was there last year Commander Metz, who is in charge of the famous station, explained to me that experiments are being constantly conducted on all kinds of wavelengths, down to the very shortest. Aerials of all sorts, sizes and shapes spread themselves around, and the most perfunctory examination should have shown any aviator that there was barely a ghost of a chance of not fouling the wires when flying through the arches. Why no one prevented the attempt is a mystery.

* * *

IT won't be long now before you will be able to ring up your friends and acquaintances in New York, Boston or Philadelphia, or wherever else in the States you are privileged to have friends. The transatlantic telephony experiments between Rugby and America are developing successfully, and I do not suppose many new telephone directories will be published before details are given of how to ask for America. It is an intriguing thought. Goodness knows what the cost will be—perhaps £5 for five minutes. Certainly it will be a test of friendship, to see whether one's transatlantic conversation is valued at that figure. And fancy being called out of bed about 2 a.m. (nine pjp emma in New York) for a conversation something like this:

"Say, is that Birmingham 1111?"

The junction of one of the groups of cables with which Lieut. Collet's aeroplane collided, may be discerned on the right of the Eiffel Tower in this view.

"Yes, this is Birmingham 1111."

"Well, tell Mr. Pretzelbaumer that we are still waiting for the sauerkraut!"

"I'm sorry, but I am not Mr. Pretzelbaumer."

"Isn't that Pretzelbaumer's Delicatessen Store on Foiteenth Street?"

"No."

"Ain't you Birmingham, Alabama?"

"No, this is Birmingham, England!"

After which you crawl back, half frozen, into bed.

* * *

I HAVE been very amused by the series of newspaper prophecies of the report of the Broadcasting Committee. They have been so varied that one of them is sure to be right. In any case, whether the report pleases you or not, I am sure you will agree that the whole inquiry has been of great value, and will do much to stabilise the industry. Most of the interests concerned have had the opportunity of expressing their views, and really some of the grievances have made a very poor showing when brought into the light of day. It is always thus. Grievances that never have an outlet always seem as bad as they possibly can be. Many of our troubles vanish into thin air when we attempt to express them.

* * *

I HAVE recently been trying the remarkable receiving set used at the *Wireless Weekly* laboratories during the B.B.C. silent period for examining the ether conditions at the time. It incorporates all kinds of modern improvements, and gives a selectivity and purity which are positively uncanny. The set really originated from some experiments designed to eliminate a particularly irritating fault in a set. Before the fault was remedied several interesting discoveries were made, and the ideas so gained were duly incorporated in the new set. A general invitation was issued to the Pressmen present during the tests to name any European station they liked, and it would be immediately turned on the loud-speaker. In each case the station asked for was turned on within a minute or two, although some of them were badly heterodyned.

The Week's Diary—*continued*

I AM afraid that a paragraph of mine in last week's Diary may have mystified some of my readers. The explanation is quite simple. In typing my manuscript a line was dropped, and, as the words "carried on," it was not noticed at the time. In speaking of a breakfast table companion, I said, "You will find, for example, several kinds of salts of soda and potash, which may or may not . . . etc." It should have read: "You will find, for example, several kinds of salts of soda and potash. Now there are certain salts of soda and potash, which may or may not, etc." The paragraph will then (I hope) read sensibly, which it certainly did not before!

A view of the rigging shop at Farnborough. Part of one of the wireless installations may be seen on the work-bench in the foreground.

* * *

DAVENTRY is really not up to scratch at the present time in its quality of reproduction. With the general improvement in receivers and loud-speakers, slight defects which would have passed unnoticed a year ago are really obvious even to the untrained ear. The satisfactory design of a station of the power of Daventry is no easy task, and I am not surprised that it has been found more difficult to get Daventry to give good quality than, for example, 2LO. Defects in reproduction are not very marked; still, they are there, and no good purpose is served by disguising the fact. Surely the B.B.C. engineers are clever enough to remedy the trouble. There are some really brilliant men among them.

* * *

LISTENING the other day to the broadcasting of a public dinner, I overheard several remarks which I am sure would not have been made within reach of the microphone had the speakers known. I wonder if it is anyone's business to warn diners that they are within listening distance of several million people. Personally, knowing how these things are arranged, I carefully refrain from making such remarks as "I think there is still a little in the other one, isn't there?" within a dozen feet of any pretentious table decoration.

* * *

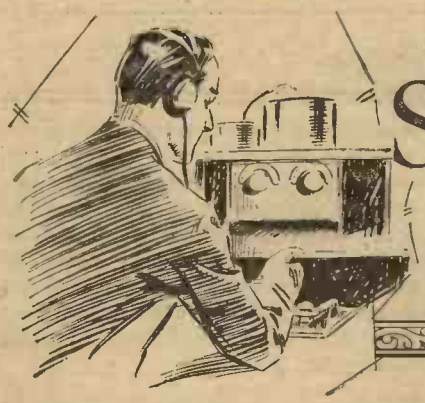
SERIOUSLY, I have a great admiration for the B.B.C. engineers for the way they arrange their microphones, amplifiers and the like for broadcasting all such functions. Almost invariably we get excellent reproduction of the speaker, although as likely as not he is turning from side to side and addressing his audience without any regard to the position of the microphone. At ceremonial functions other than dinners there is always a chance that a notable speaker will vary his position on the platform, whereupon the carefully-laid plans will get seriously mixed up. On some occasions a speaker has addressed his audience at three or four times the distance from the microphone that was anticipated by the engineers, and yet we have all heard perfectly and extra amplification was used to bring up the strength.

* * *

IT is very interesting to listen in these days to the transmission from the German broadcasting stations. A little while ago one could reckon with certainty on hearing a very large number of what appeared to be sententious talks and lectures. Those in charge of the broadcasting stations were at first far too inclined to use the service for educational talks and general propaganda. I understand that the German public has kicked, and kicked hard, against such talks, and insists on a good measure of jazz and light music. The educational element still seems large, and I have been very fascinated on several occasions to listen to the English lessons. To listen to a German instructor endeavouring to speak with a "correct" English accent is really a delightful experience. Try it and see. The London *Times* gives excellent and detailed programmes of Continental stations each morning; I always admire the way in which the *Times* gives the British and foreign broadcasting programmes. Many people have been led to take the *Times* regularly for this particular feature.

One of the foremost experimenters in radio television in America is C. F. Jenkins, of Washington, whose latest invention is seen here. It is an apparatus which reproduces by means of a travelling pen the handwriting transmitted from a distant station.

WAVE-TRAP.



SHORT-WAVE Notes & News

AFTER the short "burst" of signals at the beginning of the week, all long-distance work seemed to fall off again. There have been very few American amateurs audible during the whole week, and KDKA has been received only with great difficulty, yet the new 8,571 kc. (35 metres) transmission from WGY has been coming through fairly regularly and at very good strength. Some readers report hearing WGY as early at 7 p.m.; the writer has had him on the loud-speaker with two valves at 7.30.

Brazil

It is exceedingly curious that the Brazilian stations should only be audible when the North Americans are weaker than usual, but this is almost infallibly the case. Last week-end the North Americans were literally coming through in dozens, while only one or two Brazilians were to be heard; during the week several "BZ's" and a few "R's" have been heard nearly every night the writer has listened, but the United States stations that are usually so numerous were nowhere to be found!

The East

The Philippine Islands stations have fallen off badly in strength, as have also the few stations working in French Indo-China. It seems as if they will disappear during the summer. The Indians (only about five in number) also seem to have gone. In short, things are becoming decidedly dull on the 6,667 kc. band of frequencies altogether, particularly as far as the East is concerned.

Palestine

The *Near* East is, however, showing signs of business, thanks to the work of the Air Ministry. There are a tremendous number of stations now working in Palestine and Egypt on the amateur bands, and when their allotted work is finished they work with the amateurs. Using the prefix "PE," the stations most often heard are 6YX, 6ZM, 6ZL, 6MY, and 6ZK. They all use rectified A.C., if one can judge by their notes, and they are generally extremely strong. Then there is the mysterious GB1, giving his location as "the south-east corner of Europe," and another station, 8UG.

The use of crystal control is universal in the Westinghouse broadcasting stations in America. The illustration shows one of the crystals and a ten kilowatt oscillator valve.

Altogether they make quite an imposing little bunch of signals, ranging from about 7,895 kc. (38 metres) to 7,143 kc. (42 metres).

Ourselves

There certainly appear to be more and more British stations active on the 6,667 kc. band than there have ever been on any other band of frequencies allotted for amateur use. The rapid growth of "DX" work has been almost incredible when we look back to the days when, working on 1,500 kc. (200 metres), it was considered highly creditable to be heard in France when one was using "a mere ten watts." Then on the 3,333 kc. band it was quite good work if one could reach Italy or Denmark, whereas Sweden and Finland were unthought of. The 6,667 kc. band of frequencies certainly seems to have popularised amateur radio work to a great extent.

Conditions in the North

The varying signal strengths of the Northern stations are a constant source of worry to listeners in London. The Midland stations are the worst offenders, their signals suffering enormous changes from hour to hour on certain days. The writer is rather inclined to attribute this partly to the large amounts of smoke in this district, which must act as a kind of variable screen. This seems very likely, as the stations in and around such towns as Aberdeen are much more constant in their behaviour. The Midlanders do not seem to "fade" in the usual sense of the word, but one may hear one of these stations at about R6 early in the afternoon, and, on listening later to a station that is a bare R3, find it to be the same! Any reports from readers who have noticed this effect will be welcome for inclusion in "Short-Wave Notes and News."

New Stations

Several Air Ministry stations in Great Britain are operating on short waves, particularly during the evenings. They are mostly conducting work with the stations in Palestine, previously mentioned, and with GEH (Cairo) and GHA (Malta). Those that seem to be most prominent are GFC (Cranwell), GFD (Leuchars, Scotland), and GFP (Calshot). Their calls are rather apt to mystify one unless their identity is known. Another newcomer to the British ether is a station signing

(*Continued on page* 144.)

American Reception in the Transatlantic Tests

Continuing last week's report, we are now able to give full details of the results of the Transatlantic Broadcasting Tests on the American side.

HE checking of the reports from America is now complete, and the table on this page gives details of the results. In comparing this table with that published in *Wireless Weekly* last week it should be noted that a few extra reports have been added to the total given there.

Tabulated Results

As will be seen, each station is allotted three columns in the table. Column A in each case gives the number of reports claiming reception of that particular station, column B the number of reports definitely correct, and column C the "possibles" and "probables." In the "Totals" section will be found a fourth column, D.

This contains all the reports which are definitely wrong, or which, for one reason or another, cannot be verified. Reports, for instance, which make only a meagre claim of reception, without any details which can be checked, are included in this column D.

Success of 2LO

As suggested in the preliminary

	2LO			5WA			2BD			5IT			5XX			5SC			6BM			6LV and 2DE			5NO etc.			Totals.			
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	D
U.S.A.																															
Alabama ..	1	.	1	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	2	.
Arkansas ..	1	.	.	1	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	2	.
California ..	9	3	1	2	1	1	2	.	2	.	.	.	1	.	.	2	.	.	.	.	.	2	D	E	1	.	.	17	4	4	9
Colorado ..	3	.	.	2	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	6	.	1	5
Connecticut ..	3	1	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	2	3	.	.	.	.	.	.	.	6	4	1	1
Delaware ..	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	2
D.C.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	2	1	1	.
Florida ..	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	2	.	.	2
Illinois ..	16	.	2	3	.	1	2	.	1	.	.	2	1	.	.	1	.	.	.	2	1	.	.	.	2	.	.	25	2	7	16
Indiana ..	2	.	.	1	.	.	2	.	.	.	.	1	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	5	.	2	3
Iowa ..	5	.	.	3	.	1	1	.	.	.	.	1	.	.	.	.	.	.	.	.	1	6	LV	.	1	.	1	10	.	5	5
Kansas ..	2	.	.	2	.	1	1	.	1	.	.	.	.	.	1	1	.	.	.	.	.	1	.	.	1	.	.	8	.	3	5
Kentucky ..	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
Louisiana ..	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
Maine ..	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	2
Maryland ..	6	3	1	2	1	1	1	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	4	4	1
Massachusetts	14	4	1	3	1	.	1	.	1	.	.	.	1	.	.	.	.	.	1	5	.	.	.	.	2	.	.	22	10	2	10
Michigan ..	7	3	2	3	1	1	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	13	5	4	4
Minnesota ..	2	.	.	3	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	5	.	2	3
Mississippi ..	3	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	4	2	.	2
Missouri ..	14	.	.	3	.	1	1	.	.	.	.	2	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	19	.	4	15
Nebraska ..	2	.	.	11	.	1	23	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	37	.	1	36
New Hampshire	2	1	.	.	.	.	2	1	1	.	.	.	.	.	.	.	.	.	1	1	1	.	.	.	.	.	.	5	3	2	.
New Jersey ..	29	8	5	4	1	.	5	.	1	.	.	.	2	.	.	.	.	.	1	2	8	1	.	.	3	.	1	45	11	16	18
New Mexico ..	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	2
New York ..	29	7	5	6	1	1	2	.	1	1	.	1	4	.	2	.	.	.	2	3	2	1	.	.	2	.	1	47	11	14	22
N. Carolina ..	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
N. Dakota ..	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	2	.	.	2
Ohio	24	8	1	7	.	1	5	1	2	.	.	2	.	.	.	2	.	2	1	1	1	.	.	.	1	.	1	40	10	11	19
Oklahoma ..	3	.	2	3	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	7	.	3	4
Oregon ..	.	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.
Pennsylvania	29	7	3	3	1	1	8	.	5	.	.	.	.	.	.	1	.	1	4	6	1	.	.	.	3	.	.	48	14	11	23
Rhode Island	2	1	1	3	1	2	3	1	.	.	.	.	1	1	.	.	.	.	.	.	1	.	.	.	.	.	.	9	4	4	1
S. Carolina ..	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
S. Dakota ..	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.
Tennessee ..	2	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	1	1
Texas ..	4	2	.	8	.	1	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18	2	1	15
Vermont ..	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
Virginia ..	42	16	3	1	.	1	.	.	1	.	.	.	.	.	.	1	.	.	.	2	.	.	.	.	2	.	1	46	18	6	22
Wisconsin ..	9	2	2	3	.	.	2	.	1	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.	.	16	2	4	10
Cuba	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
Mexico ..	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.
Canada ..	11	.	1	5	.	2	3	.	.	.	.	.	1	.	1	1	.	.	2	1	4	.	.	.	1	.	.	24	1	8	15
TOTALS ..	290	67	35	35	8	23	77	4	20	1	.	9	12	1	4	10	.	4	15	27	23	7	.	.	21	1	5	518	108	120	281

American Reception in the Transatlantic Tests

(Continued)

article last week, a certain number of claims on other stations can be definitely assigned to Bournemouth. It is curious, however, that London was heard so much better than any other station. Bournemouth is only a very poor second, whereas under more favourable conditions Bournemouth's transmissions have been quite frequently audible in America.

Eliminations

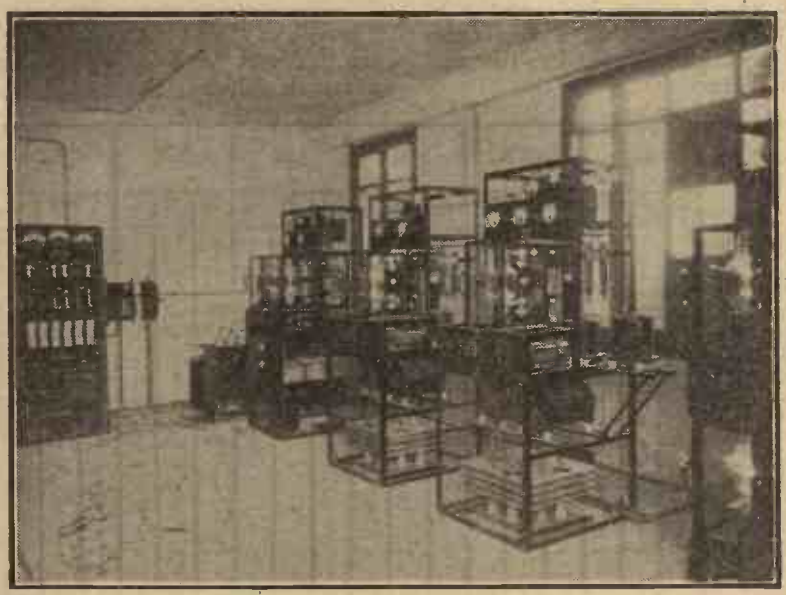
The claims on Newcastle, Liverpool and Dundee can, of course, be set aside without question, since these stations took no part in the tests. Some of these claims were, no doubt, due to imperfect reception of the call-signs of some American stations which did not close down during the silent period. A few, judging from the letters, may be ascribed to a combination of faint reception of unknown stations and a personal interest in the localities in question, such reports being sent in by people who emigrated from this country.

The Hoax

The effect of the hoax on Omaha, Nebraska, is readily apparent. Out of 37 claims on various stations 36 are definitely unsound, while the remaining one is "possible" only. It is noteworthy, on the other hand, that London was heard by three separate listeners as far west as California. The small number of reports on Daventry's transmission in all probability merely indicates that the majority of the receivers used had a limited tuning range, 4- and 5-valve neutrodynes being popular with many listeners, so that there was more concentration on the normal broadcasting band.

Continental Stations

The two stations in Madrid, one of which was working "unofficially," got through to America quite well. Prague, Munich, Berlin, Hamburg, Brussels and Munster were also widely reported. Generally speaking, in fact, it seems that most of the stations on this side were audible in America at one time or another, but the conditions were too unfavourable to permit anything in the way of enjoyable reception of the programmes. The identification of a transmission was something in the nature of a feat calling for skill, patience and not a little luck.



The transmitter at Madrid, a station which was successfully received in America.

The Best Period

The most successful period of the tests from the point of view of the American listener was undoubtedly the last two nights, when transmitting periods of a quarter of an hour were allotted to stations in prearranged zones. This provided listeners with an opportunity to log distant stations without the necessity for tuning out local interference. Since there were about 550 American, 37 Canadian, 16

American Reception in the Transatlantic Tests

(Continued)

Mexican, 36 Cuban and a few South American stations taking part in the tests, it will be realised that there was a considerable field for the enthusiastic listener.

Mr. Godley's Results

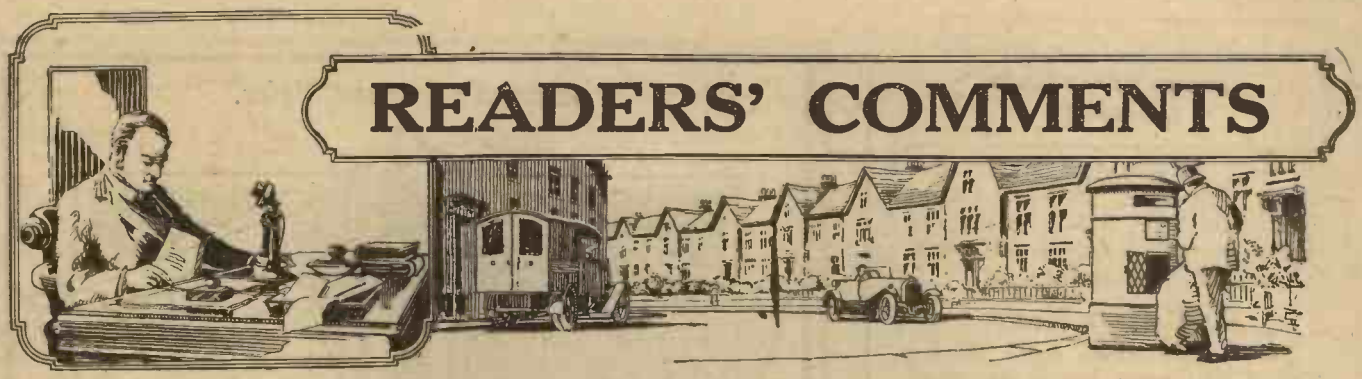
The transmissions from Mexico City (CZE) were heard at good strength all over the United States. A large number of listeners also heard Lima, Peru (OAX) and the stations in Buenos Aires. Mr. Paul F. Godley, whose name is familiar in connection with early attempts at amateur transatlantic working, listened at Barnegat, New Jersey. He reports that, in his experience, reception during the tests was much better in a north and south than in an east and west direction. On one evening, for instance, he was able to hear the whole programme from Lima, Peru, while not even a carrier wave was audible from Europe.

The "Bloopers"

A recurrence of the oscillation nuisance, or, as it is called over there, "blooping," completely spoiled reception in a number of areas. We have received reports from some listeners who used 1- and 2-valve receivers in vain attempts to hear the programmes from this side.

Lessons of the Test

Commenting on the tests as a whole, our contemporary, *Radio Broadcast*, which, with a committee representative of radio in America, handled the organisation of the tests in the U.S.A., draws attention to the sporting spirit in which the challenge implied in the tests was accepted. It is significant that, in spite of the "failure" of the tests as far as transatlantic reception was concerned, the general attitude of the listening public in America is to ascribe this to our present uncertainty and ignorance about the best conditions for radio. There has been no suggestion that radio itself has failed, or that this year's tests have been in any way wasted energy.



SOME EXPERIMENTS WITH SUPERHETERODYNES

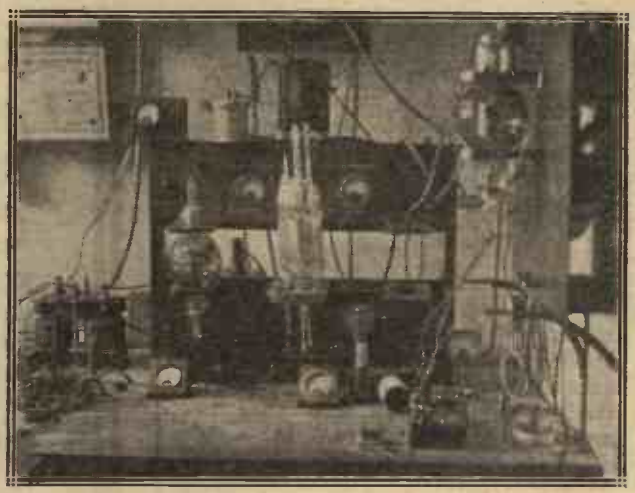
DEAR SIR,—I have been much interested in Mr. Wilson's letter *re* his superheterodyne difficulties and the replies thereto. As I have had similar experiences with valves, perhaps my experiences may be of some help.

I experimented with the tropadyne arrangement when it first became known in this country, and must say I had no difficulty with the oscillator portion, using on occasion as low an intermediate wavelength as 1,000 metres, but I had a great deal of trouble with the I.F. amplifier when I tried to use valves similar to Mr. Wilson's, *i.e.*, H.F. .06 valves with commercial transformers, so much so that I disposed of these instruments.

In subsequent trials of these valves in various H.F. circuits on the fundamental I came to the same conclusion as Mr. Wilson, that probably grid current had something to do with the lack of selectivity and poor amplification obtained.

I found, however, that these valves behaved best in circuits similar to your DX 4 and 5, with plenty of high tension and a small negative bias on the grid, and I made up a rough experimental superheterodyne to test this principle. The experiments were only carried on for a few days, but the results were very promising.

The circuit values were as follows: I can't at the moment give exact turn numbers, etc., as I kept no note of them. The filter consisted of two home-made coils tuning to about 2,000 metres when tuned by a .0005 condenser across the primary. The chokes were wound to about 6,000 metres and the rejector circuits to 2,000 when tuned by .0005 variable condensers. These can be of the old semi-circular plate design and were quite cheap.



A view of the main transmitting apparatus at 2NM. The main oscillator is a Mullard 1 kw. silica valve.

The coils were multilayer of No. 30 enamel. Each rejector was tapped at intervals and the lead from the anode tapped in as in auto-coupling. The blocking condensers were quite large, .01 μF Mansbridge, and the set oscillated readily with the tap direct on the grid. The taps were moved down till stability was obtained, and a little reaction was applied between the second detector plate and grid. This enables the set to be worked in its most sensitive condition, but spoils quality somewhat.

90 volts H.T. was used, with 1½ to 3 volts negative bias. I do not know what effect the application of grid bias would have on Mr. Wilson's set, but he might care to try a high value of H.T. and negative bias and possibly the effect of a variable capacity across one or other of the windings of his transformers, assuming, of course, that his set is initially quite stable.

One of the best known amateur transmitters in this country is Mr. Gerald Marcuse (2NM), who is here seen at his short-wave receiver.

Another trouble which seems to be neglected in this country which applies more particularly to multi-stage amplifiers is that one valve may oscillate before the remainder reach their most sensitive point. Nearly all American articles on Super Het. work stress this point and give elaborate instructions regarding the matching of the I.F. valves.

This, of course, is a relatively simple matter in American practice, where eight or more similar valves are used. For the British amateur the matter is more complicated, as he prefers different valves for various duties; but if Mr. Wilson's set suffers from this type of instability and he has one or two spare valves he might test them on the oscillator stage of his receiver or on a separate oscillator with a view to discovering two valves which would

Readers' Comments

(Continued)

oscillate under similar conditions, or he might experiment with variable damping resistances in either grid or anode circuits of both valves, although how far this would be effective I am not prepared to say.

It might also be as well to ask the Silver Marshall people what valves their transformers are designed for, as this is sometimes rather important. I am sorry I cannot give any more definite information, as I have abandoned that line of research for the present, but hope the information given may be of some use. Wishing you continued success.—I remain, yours faithfully,

R. E. FISHER.

Glasgow.

[EDITORIAL NOTE: The valves recommended for use with Silver Marshall transformers in America are the ¼ ampere power valves and the .06 ampere general purpose types.]

(similar to "Reflex" coil), 128 mhys., 5.8 ohms resistance. (6) Single-layer coil, 2 in. diameter wound to 140 mhys. with 30 S.W.G. enamelled wire, unspaced; H.F. resistance=6.3 ohms.

As the inductances of the above coils varied so much, I worked out the R/L ratio of them in order to get a proper comparison. The following was the result of these tests:—

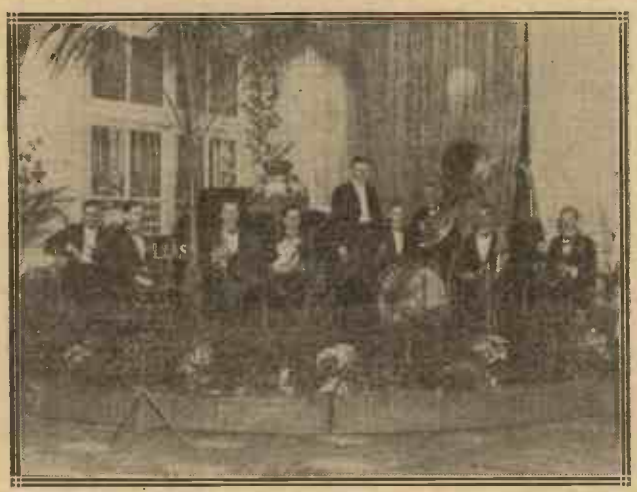
1st	... No. 3	...	R/L = .014
2nd	... No. 2	...	R/L = .015
3rd	... No. 1	...	R/L = .029
4th	... No. 6	...	R/L = .045
5th	... No. 5	...	R/L = .046
6th	... No. 4	...	R/L = .064

I hope this will be of interest to you.—Yours faithfully,

C. S. ENDERSBY.

London, S.W.18.

[EDITORIAL NOTE: The results obtained by our correspondent are not quite of the order of those determined by Mr. Reyner, to whom they have been submitted. He suggests that Mr. Endersby should check up the first two in particular, with a view to locating any possible experimental errors.]



A very popular dance band recently added to the list of those carrying out regular broadcasts is that at the Hotel Cecil, London.

H.F. MEASUREMENTS

SIR,—I have for a long time been interested in low-loss coils, and I have read the various articles on H.F. resistance with much interest.

A few weeks ago I constructed the auto-resonator, and have since spent much of my time testing various coils. I thought that some of my results might interest you. The coils tested were: (1) A loosely-bound basket-weave coil of 22 d.c.c. wire wound to 130 mhys. inductance with a 3-in. diameter. The H.F. resistance was 3.8 ohms (measured at 750 kilocycles). (2) A single layer self-supporting coil of 16 d.c.c. on 3¼ in. diameter to an inductance of 102 mhys.; resistance=1.5 ohms. (3) 141 mhy. coil on 3-in. low-loss squirrel cage former with Litz wire; H.F. resistance=2 ohms. (4) "Lissenagon" No. 60 plug-in coil, 253 mhys.; resistance=16.2 ohms. (5) Ordinary commercial basket coil

PRESS STUNTS

SIR,—With reference to Mr. K. L. Henson's letter under the above heading in a recent issue, I cannot help feeling that, while he may be perfectly correct as far as he goes, he has lost sight of the technical Press altogether.

Anyone sufficiently interested in wireless to call himself a "radio-fan" must almost certainly read one or more periodicals regularly, and if he *reads* them at all he cannot be so foolish as to take any notice of the regular "scares" published by the daily papers.

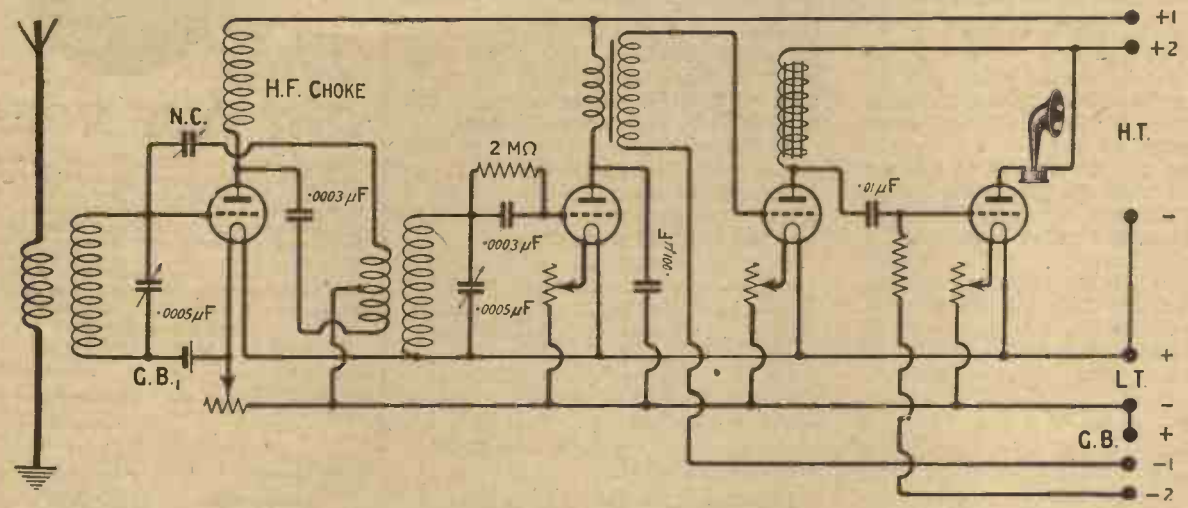
Best wishes to all Radio Press periodicals.—Yours faithfully,

A. H. COOPER.

Mitcham.

CIRCUITS FOR THE EXPERIMENTER

No. 8—A NEUTRODYNED PARALLEL-FEED CIRCUIT.



THE parallel - feed method of intervalve coupling is one which has been found to have a number of extremely useful applications, its particular attraction being that it is possible to obtain an arrangement which is stable in operation without any particular devices being provided to neutralise the normal reaction feed-back effects through the valve. In these circuits, it may be remembered, a high-frequency choke is included in the anode circuit of the amplifying valve, and a parallel path to the filament circuit is provided through a small blocking condenser and some sort of coupling winding, so that the high-frequency component of the anode current may take this alternative path.

In passing through the coupling winding, of course, these currents effect the desired transfer of energy to the circuits of the succeeding valve in the amplifier, and by suitably arranging the various parts it is possible to obtain the desired degrees of selectivity, stability, and so on, in quite a simple way.

Securing Stability

For example, if it is found that there is an undue tendency to self-oscillation in one of these circuits, a reduction in the size of the blocking condenser will usually have the desired effect of producing stability, as will also a reduction in the size of the coupling winding. Interesting examples of receivers employing this system of intervalve coupling are to be found in the DX 4 and DX 5, described by Mr. D. J. S. Hartt, in the October, December and January issues of *Modern Wireless*, which sets have achieved considerable popularity.

Effective as this scheme undoubtedly is, there are yet occasions when a little difficulty may be experienced in achieving the desired degree of stability with some special type of valve, or under some special conditions as regards the coupling between the primary and secondary of the intervalve unit. It is therefore desirable to examine the various methods of increasing the stability of these circuits, and this week's circuit has been drawn to illustrate one of the more effective expedients.

CIRCUIT No. 8
SPECIAL FEATURES

1. **Complete stability.**
2. **Only two tuning controls.**
3. **Constancy of neutrodyne adjustment.**
4. **Ready-made coupling units can be used.**

A Special Method

It will be seen that the arrangement consists of the use of a form of neutrodyne stabilisation, which closely resembles that employed by Mr. Percy W. Harris in his "Special Five" receiver described in the November issue of *Modern Wireless*. We have in the anode circuit of the H.F. valve the usual high-frequency choke, with a parallel path through a blocking condenser of .0003 μF and half of the primary winding of the coupling unit to filament. The other half of the coupling unit primary constitutes the neutrodyne winding, its end being connected via the neutrodyne condenser N.C. to the grid of the high - frequency amplifying valve.

Practical Details

This circuit was actually tested with one of the identical transformers used in the "Special Five" receiver, and this proved quite successful, the control of the neutrodyne adjustment being particularly satisfactory and reasonably constant over the whole tuning range of the circuit. The construction of the intervalve coupling unit may therefore be closely modelled upon that of the "Special Five" type of transformer, which was described in detail by Mr. Harris in the January issue of *Modern Wireless*, or alternatively some other scheme may be made up, using one of the fine wire coils for the secondary, which have been shown by Mr. Reyner to be possessed of the desired low resistance.

This secondary, for example, may consist of 40 turns of No. 34, or 36 double silk covered wire upon a

Circuits for the Experimenter

(Continued)

3 in. tube, the primary being a small basket coil arranged inside this at one end, consisting of, perhaps, 30 turns or 40 turns of No. 30 double cotton covered wire, with a centre tapping. The location of the centre will be rendered easier if the primary is composed of two small basket coils of, say, 20 turns each, their two ends being connected to place them in series, the centre then, of course, being this connecting point.

Standard Components

The other constants of the circuit are all of typical values, the primary and secondary of the aerial tuning arrangement being conventional, and may well be composed of plug-in coils, with a No. 25 or thereabouts for the aerial coil, and a No. 60 or 75 or equivalent for the secondary. The grid circuits of the high-frequency valve and the detector valve are tuned by means of .0005 μF variable condensers, and it is not likely that a slow-motion drive will become necessary for either of these, since the sharpness of tuning is not above the average in either of these circuits.

Grid Bias

A small amount of negative grid bias is shown upon the high-frequency valve, and this is a somewhat desirable provision, since a perceptible increase in selectivity was found in testing out this circuit when grid bias was provided.

It will be noticed that the connections of the grid-bias battery supplying the potential upon the grid of the high-frequency valve—that is to say, the battery GB1—are such as to render the adjustment of grid bias independent of the potential drop across the filament rheostat of the valve.

Of course, if a standard type of bright emitter is to be used, running from either a 4- or 6-volt accumulator, or one of the $\frac{1}{4}$ ampere 5-volt filament valves, it will be probably adequate to make use of the small drop of potential across the filament rheostat, but when such valves as the .06 ampere type are to be used from a 4-volt accumulator or a 6-volt accumulator with a suitable filament rheostat, it is better to provide the necessary grid bias entirely separately by means of the small battery shown.

Low-Frequency Stages

It will be noticed that two stages of low-frequency magnification are shown as being added after the detector valve, and the particular arrangement indicated is that employing one stage of transformer coupling and one of choke coupling. The by-pass condenser of .001 μF connected between the anode of the detector valve and the filament circuit may or may not be found necessary, but its provision is desirable in most cases.

The conventional value for the choke intervalve coupling components will be found satisfactory, a value of .01 μF for the coupling condenser being indicated in the diagram. A grid leak of $\frac{1}{2}$-megohm or $\frac{1}{4}$-megohm value will be found to be effective, while 4½ or 6 volts grid

(Continued on page 146)

Short-wave Notes and News

(Continued from page 136)

G-AKA, but we have no information concerning his QRA at present, except that he is in Yorkshire.

Austria

Other rather confusing stations are the Austrians, using the intermediate Ö (– – – .). Their call-signs proper consist simply of two letters. They are to be heard on various frequencies, having apparently chosen no particular band on which to work. Otherwise no new European countries have "cropped up." YS-7XX continues to keep the Yugo-Slavian flag flying, being the sole representative of that country.

Cards for Foreign Amateurs

One is often puzzled about the best way to get cards to foreign amateurs heard or worked, especially when they are unlicensed (as most of them are!) There are now such a variety of sources, however, that there is really no cause for worry. We have heard from several readers who are willing to forward cards to various stations, and some of their addresses are published below :—

Cards for French amateurs : Via this office; via Journal des 8, Rue du Cauche, Rugles, Eure, France; or via *Radio-Amateurs*, 45, rue Saint-Sebastien, Paris.

Cards for Belgian amateurs : Via Reseau Belge, 11, Rue du Congres, Brussels.

Cards for Dutch amateurs : Via Hollandsche Sectie, I.A.R.U., c/o R. Tappenbeck, Hoogduin, Noordwijk-aan-Zee, Holland. Those intended for PB99, PC3, oKC, oMD, and oAS may be sent via Mr. W. E. Russell (5WP), 5, Walton Road, Woking.

Cards for X-GB1 may be sent either through this office or c/o Mr. H. T. Littlewood (2XY), "Esholt," Wedgewood Drive, Roundhay, Leeds. 2XY would be glad if readers would send 1d. stamps separately, as GB1's cards have to be sent under cover.

QRA's Wanted

POF1, G-2ST, G-2GC, G-2ATZ, G-5UN, G-5EE, G-6NC, G-6HA, Y-HBK.

QRA's Found

RRP : Moscow (formerly RDW).

PR-4JE : J. Agusty, 25, Pershing Avenue, San Juan, Porto Rico.

PR-4SA : R. Bartholomew, Garrochales, Porto Rico.

U-9BLI : J. E. Ruckman, Linby, Iowa.

U-9CK : R. J. Palmer, Cambridge, Iowa.

U-2ACP : F. Boardman, 553, Chrisler Avenue, Schenectady, N.Y.

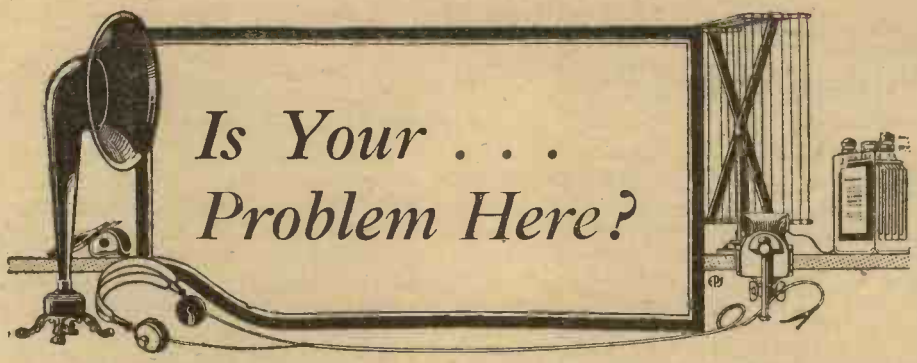
U-3AHA : G. P. Houston, 3rd, 4,247, Park Heights Avenue, Baltimore, Md.

Reports Wanted

The following are now transmitting, and would be glad of reports : G-5GQ, B. G. Wardman, 5, Pollards Hill South, Norbury, S.W.16 (new address); G-2MA, P. L. Savage, 14, Norwich Road, Lowestoft.

QSL Cards Held

We have cards addressed to the following stations, and will forward them on application :—5JW, 5UQ, 6YR, 6FA, 2OQ, 5GS, 2IT, 5HG, 2LF, 2IA, 6EP, GW-11B, 2ZA.



SYSTEMS OF DIRECTIONAL RECEPTION

"I have often seen two large triangular loops near Brentwood, attached to various masts and wires. What is the use of these loops?"

The two large triangular loops to which you refer in your query form part of a Bellini-Tosi arrangement for obtaining directional reception. The directional properties of frame aerials are too well known to need any comment here, but in practice difficulties would occur with the very large loops which are necessary for certain purposes. These difficulties are overcome by the system mentioned above, which is worked as follows: Two large triangular loops are erected at right-angles to each other and are suitably connected to an instrument known as a "Radio-Goniometer." This latter consists of two fixed coils arranged at right-angles which are connected one in series with each loop and a moving coil which is coupled to the receiver is arranged to rotate between them.

By rotating the coupling coil within the two fixed coils a similar effect to rotating a large loop is obtained, since when the coupling coil is in the same plane as one of the fixed coils it picks up from one loop and not from the other, which is placed at right-angles. Similarly with the coupling coil in the plane of the second coil the receiver picks up from the other loop. It follows, therefore, that by rotating the coupling coil through 90 deg. it is equivalent to rotating the aerial system through the same angle.

OSCILLATOR-COUPLERS

"I am winding a Tropadyne oscillator-coupler for the higher broadcast frequency-range on a 3 in. diameter former. What numbers of turns, and what spacing between coils, shall I require?"

For the grid coil, which should be tapped at its nodal point, we would suggest that 41 turns of 36 double silk-covered wire be employed. It is necessary that the nodal point or electrical centre of this coil be obtained fairly accurately if the receiver is to function in an efficient manner. This point will not necessarily be at the centre turn, and it is best to tap the coil at the 21st turn, and one or two tappings should be taken on either side of this point at one or two turn intervals. The plate coil of the oscillator is best placed at about ½ in. from the grid coil, and should consist of 25 to 30 turns, as determined by experiment. If the coupling is too tight or the plate coil too large, the receiver will squeal on the higher frequencies, but by experiment with the size of this coil and its distance from the grid coil this difficulty may be overcome satisfactorily so that the oscillator will function well over the whole of the lower broadcast band.

ANODE BEND RECTIFICATION FOR SUPERSONIC-HETERODYNE RECEIVERS

"Do you think it worth while me trying anode bend rectification in my Supersonic-heterodyne receiver, and, if so, should it be used for both first and second detectors?"

Leaky grid rectification is generally found more sensitive than the anode bend method, and we would suggest that you adhere to the former sys-

Is Your Problem Here?

(Continued)

tem for the first detector of your receiver, but it is likely that the employment of the latter method for the second detector will improve purity of reception, and often selectivity is improved also, whilst greater freedom from long wave interference is sometimes noted. The increase in selectivity is, of course, due to the fact that the grid of the detector valve is negatively biased, which prevents grid current flowing, and hence reduces the damping of the detector grid circuit with a consequent increase in sharpness of tuning.

A FRAME AERIAL FOR 5XX

"I find I cannot receive Daventry successfully on my 'Transatlantic Four' receiver, employing a frame aerial, although the 1,100 to 3,000 metre type H.F. transformers are inserted into the set. The frame is obviously not faulty, since on it 2LO, at a distance of ten miles, gives fair loud-speaker strength, and tunes definitely."

To receive 5XX on a frame aerial it is essential that this be of correct size, and it is by no means surprising, therefore, that you do not obtain results on your frame, which is suitable for reception of your local station, and others on the 1,000 to 600 kc. band. There are two alternatives open to you, namely, that of constructing a larger frame or alternatively that of loading your present one. The former method is to be preferred, and we would suggest that one of four feet sides be constructed with between 25 and 30 turns of 20-gauge wire spaced at 3/16th of an inch between turns. Fairly satisfactory results can, however, be obtained by loading the frame with an ordinary plug-in coil, which should be a No. 200 or 250. This should be connected between the end of the frame, which is joined to one side of the tuning condenser and the grid of the H.F. valve, care being taken to ensure that the tuning condenser is connected across both the loading coil and the frame.

CIRCUITS FOR THE EXPERIMENTER

(Continued from page 143)

bias upon the GB-2 terminal will be desirable with the majority of power valves in the last socket.

Valves

Good results were obtained when testing this circuit with a valve of the ¼ ampere power type in the first socket, that is to say, as the high-frequency amplifier, one of the special high-impedance resistance-capacity low-frequency amplifying valves as a detector, another valve of the same type as the first note magnifier with a grid bias of 1½ volts, and another ¼ ampere power valve in the last socket.

Reaction Control

No special reaction arrangements are shown, but it would be possible to add reaction on the grid circuit of the detector valve with advantage, provided that the additional control is not disliked by the operator. Care must be taken in applying reaction not to upset the neutrodyne adjustment, as this is somewhat easily done if the ordinary form of magnetic reaction is employed. A small reaction coil might be coupled to the grid end of the secondary of the intervalve transformer, it being understood that the primary is placed inside the filament end, provided that some form of condenser control of reaction is incorporated.

Published by the Proprietors, RADIO PRESS, LTD., Bush House, Strand, London, W.C.2, on Wednesday of each week, and printed for them by THE AVENUE PRESS (L. Upcott Gill & Son, Ltd.), 55-57, Drury Lane, W.C.2. Address for Subscriptions and Editorial Communications:—Bush House, Strand, London, W.C.2. Address for Advertisements:—ADVERTISEMENT MANAGER, "Wireless Weekly," Bush House, Strand, W.C.2. Registered as a newspaper and for transmission by Canadian Magazine Post. Subscription rates:—17/4 per annum, 8/8 for six months, post free. Sole Agents for Australasia:—GORDON & GOTCH (Australasia), LTD. For Canada:—IMPERIAL NEWS, LTD. For South Africa:—CENTRAL NEWS AGENCY, LTD.

Wireless Weekly. March 17th, 1926. 3d.

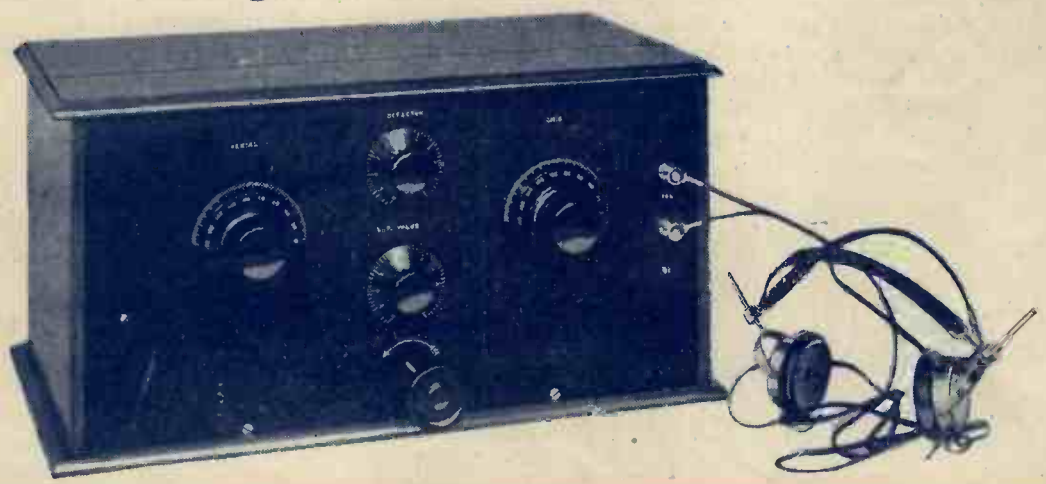
Wireless Weekly

Vol. 8. No. 5.

SELECTIVITY WITHOUT H.F. STAGES

FULL CONSTRUCTIONAL DETAILS

By L.H. THOMAS



The "Wireless Constructor" is THE monthly journal essential to all wireless enthusiasts.

"Talks to Beginners." By PERCY W. HARRIS, M.I.R.E. This new series of articles is designed for those who are just taking up the hobby of wireless whether or not they have a set in use. The first article entitled "Making a Start" is a general talk about reception and the purpose of the microphone. Subsequent "talks" will deal in detail with the functions of the various parts and accessories of a wireless receiver.

"A Three-Valve Set with One Dial." Only one variable condenser, hence ease of tuning. Other features are stability, good range and volume.

The Wireless Constructor

ON SALE EVERYWHERE

PRICE 6D EVERY MONTH

Chief Contents:—

"HOW-TO-BUILD" ARTICLES:—

A Three-Valve Set with One Dial.
By Stanley G. Rattee, M.I.R.E.

An H.F. Amplifier for the "Midget" Set.
By A. S. Clark.

Distance or Volume?
A 2-valve double-purpose receiver.
By A. V. D. Hort, B.A.

Four Circuits in a Crystal Set.
By George T. Kelsey.

PUBLISHED BY

RADIO PRESS, LTD.
BUSH HOUSE, :: STRAND,
LONDON, W.C.2.

GENERAL ARTICLES:—

Your Aerial System.
By H. J. Barton-Chapple, Wh.Sch., B.Sc., A.C.G.I., D.I.C., A.M.I.E.E.

How Radio Records Bridged the Atlantic.
By S. McClatchie.

Keeping Reaction in Check.
By Major James Robinson, D.Sc., Ph.D., F.Inst.P.

Oscillations in H.F. Amplifiers.
By J. H. Reyner, B.Sc., A.C.G.I., D.I.C., A.M.I.E.E.

Wireless Weekly

Phone: City 9911

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

RADIO PRESS, LIMITED, Bush House, Strand, London, W.C.2

If in doubt, decide on Burndept!

IF you could see the efficient manufacturing organisation which produces Burndept apparatus and the fully-equipped laboratories where everything we make is the subject of continuous research and strict tests, you would have no doubt whatever that the best components for *your* set bear the name Burndept! Those who have seen our factories realise why we are able to guarantee all our products—including the now famous Super Valves.

Price 16/6

A Dull-Emitter Valve for a 4-volt Accumulator or Dry Cells.

Type H.L. 310, a general purpose dull-emitter valve, has the great advantage of being absolutely non-microphonic. Its filament current is from 2.8 to 3-volts, .1 ampere.

Note the special method of marking Burndept Super Valves. "H" means "high-frequency"; "L," "low-frequency"; and "H.L." "general-purpose." The figures indicate filament current. Thus "H.L. 565" indicates "a general purpose valve with a filament current of 5 volts .65 ampere."

Of the range of Burndept Super Valves, particular interest will be taken in type H.L. 310 which is intended to replace the .06 ampere type over which it has many advantages, having a stronger filament and being non-microphonic. It is a General Purpose Valve, excellent as a detector and high-frequency amplifier and quite good for one stage of low-frequency amplification. A 30 ampere-hour battery lasts 250-300 hours using one valve.

Ethophone Wavemeter, double-range buzzer type. Range, *without* special coils, 200-500 and 1000-2000 metres. In mahogany cabinet. **Price £6 6 0**

An appliance which simplifies the manipulation of your set to a surprising extent is the Ethophone Wavemeter. It enables you to tune to any desired station with ease and certainty and without oscillating to the annoyance of your neighbour. It also enables you to identify any station picked up by measuring the wave-length and consulting the broadcast programmes. The Wavemeter is very "sharp" and extraordinarily accurate. It is simplicity itself to use and will increase the pleasures of your experiments in distant reception tremendously.

Ask any Burndept dealer to demonstrate our products to you. He will with pleasure.

HEAD OFFICE:
Aldine House, Bedford St., Strand, London, W.C.2.
Telephone: Gerrard 9072.
Telegrams: Burndept, Weststrand, London.

BRANCHES:
At Belfast, Birmingham, Brighton, Bristol, Dublin, Glasgow, Leeds, Liverpool, Manchester, Northampton and Nottingham.

BURNDEPT
WIRELESS LIMITED

The Burndept range includes everything for radio reception—components, complete installations and valves.

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.

Using the New Screened Coils

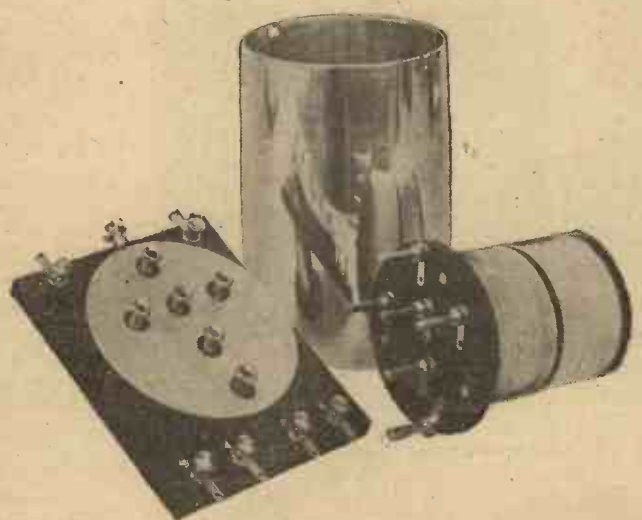
By J. H. REYNER,
B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

This week Mr. Reyner is giving some further details of his development of the screened coil, with some interesting examples of its actual practical use.

A SHORT time ago I described the construction of a special new type of plug-in coil in which the external magnetic field was almost completely neutralised by enclosing the coil in a metal box, and I indicated that very beneficial results were likely to accrue as a result of this fact. This view has been fully confirmed by subsequent experiments, and the following preliminary results will be of interest.

Effective Screening

As a matter of interest, the effectiveness of the screening was tested on several coils which had been made up in accordance with the specification given in my previous article. A simple receiver, consisting of a detector valve and a note magnifier, was provided with a plug-in coil of the usual type, and a wavemeter was placed a few feet away and set in operation. The receiver was tuned in to the signals radiated by the wavemeter and the pick-up was so considerable that the signals produced operated a loud-speaker at considerable strength.



In this commercial version of Mr. Reyner's screened coil (made up by Messrs. Peto-Scott), the inductance itself is an interchangeable unit inside the screen. Provision is made to enable a variety of coils to be used with the same case.

A Test

Without altering the position of the components in any way, the ordinary coil was replaced by one of the new screened units, and the receiver was again tuned to the wave radiated by the buzzer wavemeter. The signals in this case were so weak that they could only just be detected on telephones, even if the wavemeter was brought quite close to the set.

In view of the fact that the whole arrangement was only hooked up on the bench, there is little doubt that a large percentage of this energy was actually picked up on the wiring of the receiver. There would thus appear to be no doubt as to the efficiency of this screened type of coil, the external magnetic field being, for all practical purposes, completely negligible.

Applications

The next development was to use this coil in various types of circuits, and one of the first that

USING THE NEW SCREENED COILS
(Continued)

was tried was a simple tuned anode arrangement such as that shown in Fig. 1. Such a circuit has been shown to be comparatively poor in selectivity in view of the heavy damping introduced by the internal resistance of the first valve which is in parallel with the tuned anode circuit. Even so, however, there was a noticeable improvement using the screened coils, both as regards selectivity and ease of operation.

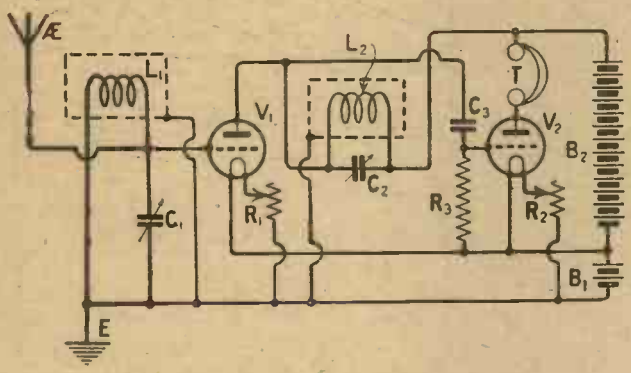


Fig. 1.— Screened coils gave a perceptible improvement in even this simple circuit.

An improvement on this circuit, of course, would be that shown in Fig. 2. In this arrangement, suggested by Mr. Percival, of the Radio Press Laboratories, the damping due to the valve has been minimised by transferring the energy from the anode circuit of one valve to the tuned circuit itself through a small condenser. The high-tension supply is fed to the valve V1 through the high-frequency choke. The smaller the coupling condenser in the anode circuit, the more selective does the arrangement become, although after a certain point the signal strength is reduced at the same time.

Special Coils

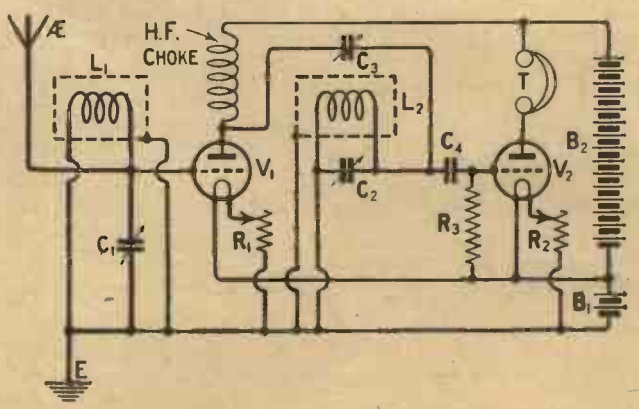
It was quickly realised, however, that the great majority of the circuits employed nowadays use a special coil, and really before any satisfactory circuits can be evolved it would be necessary to devise further screened coils with suitable tappings at different points. Centre-tapped coils have had a considerable vogue lately, but there are many circuits in which even a centre-tapped coil is not satisfactory, and a tapping at a much smaller number of turns is required.

Transformer Circuits

There are also a large number of circuits in which transformer arrangements of some sort are employed, and finally there is the question of applying reaction to the coils, and it rapidly became obvious that in order to comply with the conditions required, a series of screened coils, similar in general construction, but differing actually in the coil itself, would be required.

Messrs. Burne-Jones' version of the screened coil incorporates a tapping switch.

Fig. 2.—This circuit yields somewhat greater selectivity than the simple tuned anode.



This, of course, was hardly an economical arrangement, because the screening is a somewhat troublesome business, and if the coil is to be bought ready-made, expensive. It was decided, therefore, that the best plan would be to evolve a screen of such a nature that some portion thereof would be removable in order to obtain access to the coil, and, if necessary, to change the coil or make alterations to it. After a little consideration it was decided to make up the screen in two portions.

Screen Details

First of all there is a base containing a series of sockets, the connections to which are brought out to suitable terminals. The coil employed is provided with plugs which fit into the relative sockets, while over the whole is fitted a suitable sheet-metal cover. When this cover is fitted in place it is held tight by a small terminal which also serves to make electrical connection between the cover and a simple screen of copper which is placed under the coil. The result is therefore that when the coil is fitted into its socket and the cover is placed in position, the coil is practically completely surrounded by a metal case, and perfect screening results.

Completing the Screen

It was thought at first that it might be possible to omit the screen underneath the coil, in which case the coil would be screened at the sides, and at one end only, but experiments indicated that the amount of screening afforded by this arrangement was by no means complete, and that satisfactory results could not be obtained unless the metal case was completed by the addition of a screen across the bottom of the coil.

USING THE NEW SCREENED COILS
(Continued)

The arrangement as finally evolved is being made up by various manufacturers. The interpretation of the idea as produced by Messrs. Peto-Scott is illustrated in the photographs accompanying this article. The tubular cover can be seen to be completely removable, after which the coil itself may be removed from its socket, and either replaced by another coil or rewound or altered in any way required. In this particular instance, Messrs. Peto-Scott have provided a six-pin base which provides for practically all the ordinary types of circuit.

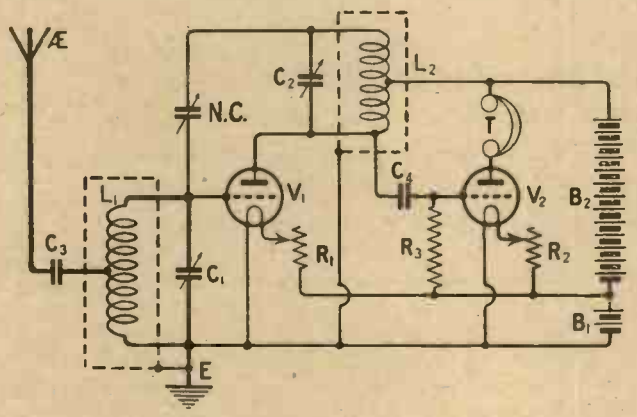


Fig. 3.—Provision is made in certain forms of the coil for centre-tapped arrangements.

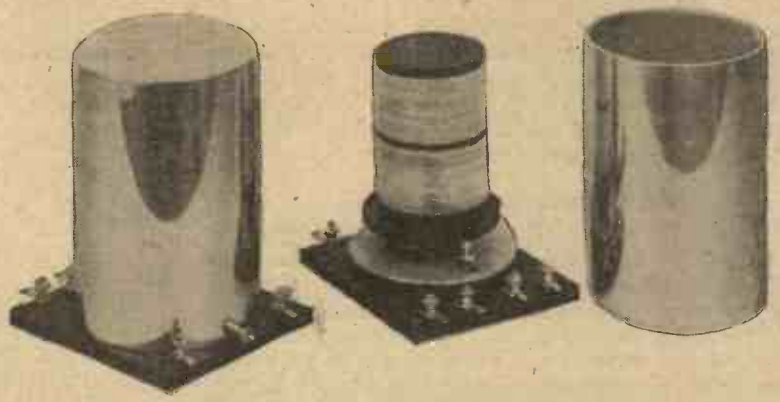
Flexibility

With such an arrangement it is possible to use tapped coils or transformers or any of the usual methods of connecting, and a centre-tapped circuit is that shown in Fig. 3. Here the first coil is centre tapped and the aerial is fed to the centre through a fixed condenser. The anode coil is also tapped, and the high-tension supply taken to the middle point. The remote end of the coil is then available for neutralising, a method which can be made use of with very satisfactory results. The screens themselves are connected to earth.

A Warning

A word of warning may be given in this connection, for certain secondary effects take place if more than one stage of high-frequency amplification is employed with the centre-tapped coil. This trouble was dealt with by Mr. Scott-Taggart in the last issue of *Wireless Weekly*, and the matter has been discussed in some detail in the last few issues of *Modern Wireless*, in which detailed methods of eliminating the troubles are given.

Any of the usual types of circuits may be employed with this coil, the chief benefit resulting from the absence of any stray magnetic couplings which are usually unavoidable in a wireless receiver. It might be thought, particularly where only two circuits were involved, that the elimination of the stray coupling was not material in producing any better results. This does not appear to be the case, however, since experiments indicated that selectivity is definitely better when screened coils are employed than when using an ordinary type of winding, so there would appear to be a definite loss of energy taking place with the ordinary types of coils, producing an appreciable lack of both selectivity and sensitivity.



This view shows how the coil is located inside the screen in the Peto-Scott form.

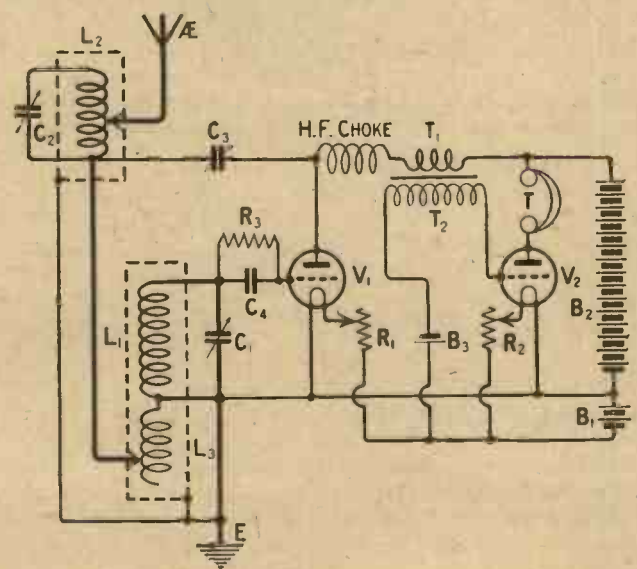
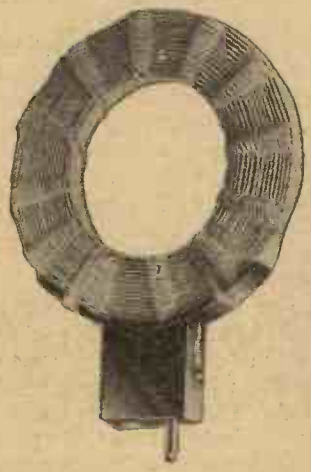


Fig. 4.— Screened coils possess important applications to wave-traps.

Wave-Traps

The coils are particularly useful in connection with wave-traps where, as is well known, any interaction between the trap coil and the tuning coils of the receiver produce peculiar effects, which may result either in the trap being ineffective or in the rejected station coming in at some other part of the dial. For example, if 2LO is cut out with a wave-trap, so that, at the normal position, the signal strength is practically negligible, then it may be found that under adverse conditions 2LO will tune-in again at some point on the dial quite remote from the normal.

(Continued on page 170.)



Why Do We Use Symbols?

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

The more experienced experimenter talks glibly of quantities such as "microhenries" and "microfarads," and uses symbols therefor which may at times puzzle the novice. Is it really necessary to use Greek letters and special signs? Mr. Barton-Chapple gives some very interesting notes on these points here.

I REMEMBER I once read a particularly interesting story about the origin of handwriting which ran somewhat on these lines. The chief of a barbaric race went out hunting one day, accompanied by his favourite daughter, and during the course of his adventures he had the misfortune to break his spear.

This was a calamity which bid fair to upset the whole day's sport, as he was far from his camp, but he espied approaching in the distance a member of a neighbouring tribe. On the inspiration of the moment the daughter obtained a piece of bark and with the aid of a sharp stone drew, in a very crude fashion, a picture of a broken spear with her father standing beside it and the stranger approaching.

An Unfortunate Episode

This was given to the other tribesman, and by signs he was made to understand that he was to take it to the village, the idea being that the chief expected a new spear to be despatched to replace his damaged one.

Unfortunately, the crude drawing was mistaken for a symbolical representation of hostilities, with the result that the unlucky messenger nearly lost his life before the real intention of the missive could be satisfactorily explained.

And the Moral

What moral can be drawn from this story? It should be quite plain that symbols have played an important part in the life of every nation when ordinary letters and words as we know them to-day had not been invented.

In spite of the progress of civilisation, however, symbols still have an important office to fulfil, and it is only their misrepresentation and lack of proper application that has led to the confusion that now unfortunately exists.

Lack of Uniformity

When perusing the various wireless journals and periodicals, one cannot help being struck with the apparent lack of uniformity on the question of nomenclature, terms and symbols as applied to the various factors which have almost come to be part of our daily life in the sphere of broadcasting. Why this should be so is at present somewhat difficult to comprehend, for in the other arts and sciences such a marked confusion does not appear to make its presence felt. If excuses are looked for, however, one of the foremost put forward is the fact that wireless has grown so rapidly that the symbol representation has failed to keep pace with the growth.

I remember on one occasion listening to an epoch-making paper at a well-known institution, where the author had made use of a set of symbols co-ordinated for the purpose of his exposition on the subject, and these differed from those approved by the International Electrotechnical Commission. During the course of the discussion this fact was deplored by some and supported by others, the remarks in the case of the latter being to the effect that "what was good enough for my grandfather was good enough for me." It was pointed

If one asked a salesman for a condenser of ".0005 μF," using the special symbol, confusion would probably result.

out that science had given rise to such a medley of symbols which had become more or less embedded in the language of that subject that although many had now lost their real significance, they would still be used.

A Curious Aversion

It is somewhat surprising how many people abhor the use of symbols in any shape or form, stating that their inclusion only tends to complicate matters. Why this should be so is hard to realise, for, when writing, or even in conversation, their use saves a great deal of time. If anyone has a bad memory, it may produce a certain amount of difficulty, but the number used in the application to wireless is relatively small. In the course of a discussion on the subject of symbols people with patriotic inclinations have deplored the fact that the

Why Do We Use Symbols ?

Continued

Greek alphabet is frequently resorted to for certain signs and symbols, but the reason for this is quite plain, however, for there are only twenty-six letters in the English alphabet, and there are more than twenty-six symbols required, so that objection is soon met.

Perhaps some readers who find it difficult to appreciate the use of signs and symbols constantly come across two or three letters which all purport to represent the same thing. It is possible to quote a good many examples, some of the most glaring being C for current, when the correct one is I, K for capacity instead of the accepted C, using ω for ohms and Ω for megohms, when up-to-date practice is Ω for ohms and MΩ for megohms.

When in Doubt

This practice, of course, is very confusing, and indicates that the authors of the particular articles are still wedded to old-fashioned ideas. It is far better, when doubt exists as to the correct symbol or sign, to write the word out in full and then readers will not be left wondering as to rights and wrongs of the situation. If resort is made to shortened expressions for the quantities, then trouble may again rise.

A Common Error

Another mistake often made is due to the failure to appreciate the difference between the symbol used to represent a certain quantity and the sign often substituted for the name of a particular unit. This perhaps can best be illustrated by one or two examples.

When referring to the passage of electrons along a conductor we say that a current I is flowing, but if we want to state the actual value of the current, then we say 1.5 amperes or using the correct sign 1.5A. Thus the whole information is conveyed in the simple form :—

$$I = 1.5A.$$

Now I am sure this expression appeals to many readers.

Further cases arise in many directions, as, for example, the resistance (R) of a current is equal to 45.3 ohms (Ω) or simply R = 45.3 Ω; the self-inductance of a coil (L) was measured and found to be 150 microhenries (μH), this becoming L = 150 μH, and so on.

Against Symbols

The opposers of signs and symbols bring forward another argument, which perhaps is admissible in present practice. Supposing a variable condenser is required, of maximum capacity, say .0005 μF, when requesting the dealer for same, all that is asked for is a three O's five variable condenser of such and such a make.

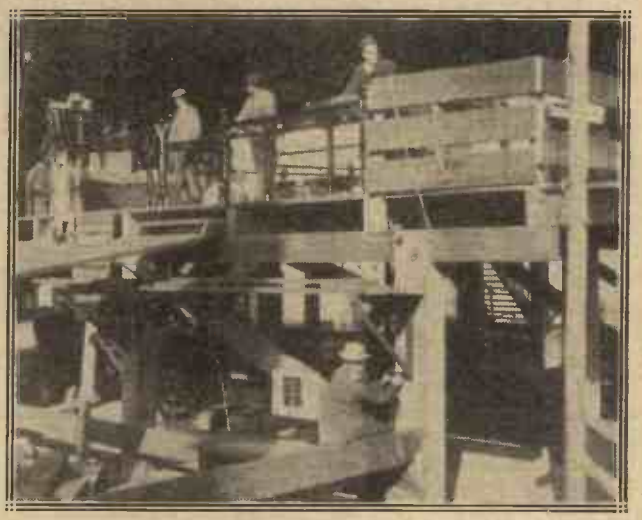
The dealer is not at a loss to know what his potential customer wants, but if he was asked for a three O's five μF (.0005 μF) variable condenser he would perhaps be excused if he thought that it was a new make of which he carried no stocks, and substitutes would be forthcoming.

Their Proper Sphere

In spite of the opposition, however, I feel that signs and symbols have their proper function to fulfil, and should be made use of in a judicious manner so as not to give the impression that mathematics is being introduced as a short cut to a verbal explanation.

With this object in view, and in order to avoid confusion in the future, a complete list of international symbols and signs, as recommended in a report by the International Electrotechnical Commission, is included in this article, and readers are advised to cut it out and keep it by so that it may be referred to as occasion demands.

The first table gives the name of the quantity and the symbol representing that quantity, only those quantities which have any direct reference to wireless being included. The second table has a column for the name of the unit, with an adjacent column indicating the particular sign which can be used in lieu of the complete name.



The launching ceremony of H.M.S. Cornwall was broadcast via the Plymouth station.

It should be borne in mind that the signs which are given must only be employed after numerical values, as shown in the typical examples quoted earlier in this article. To make this reference more complete the seven usual prefixes are also included with their correct meanings.

List of International Symbols

From a Report by the International Electrotechnical Commission.

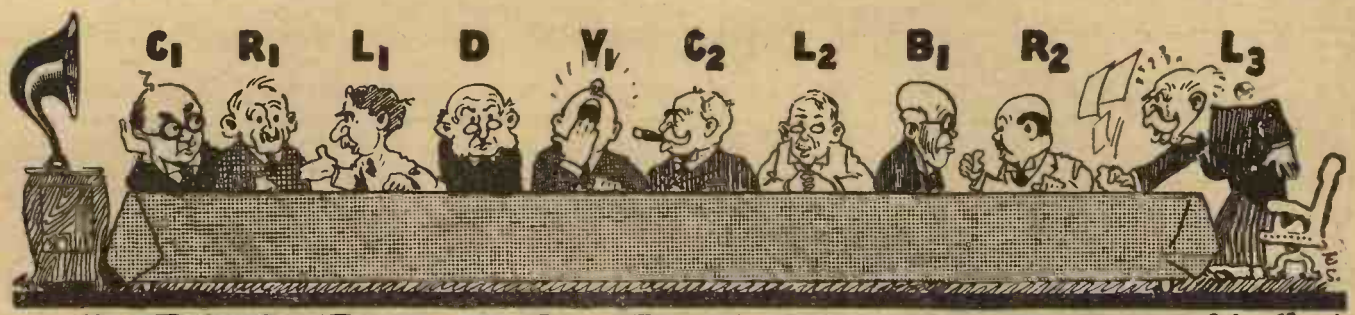
Name of Quantity.	Symbol	Name of Quantity.	Symbol
Energy	W	Resistivity	ρ
Power	P	Quantity of electricity	Q
$2\pi f$	ω	Capacity	C
Frequency	f	Dielectric constant	ε
Electromotive force	E	Self-inductance	L
Current	I	Mutual inductance	M
Resistance	R	Reactance	X
Magnetic flux	φ	Impedance	Z

Name of Unit.	Sign.	Name of Unit.	Sign.
Ampere	A	Volt-coulomb	VC
Volt	V	Watt-hour	Wh
Ohm	Ω	Volt-ampere	VA
Coulomb	C	Ampere-hour	Ah
Joule	J	Milliampere	mA
Watt	W	Kilowatt	kW
Farad	F	Kilovolt-ampere	kVA
Henry	H	Kilowatt-hour	kWh

The signs given above must only be employed after numerical values.

PREFIXES.

d = deci (1/10)	m = milli (1/1,000)
c = centi (1/100)	k = kilo (1,000)
h = hecto (100)	μ = micro (1/1,000,000)
	M = mega (1,000,000)



JOTTINGS BY THE WAY

By Wireless Wayfarer

THOUGH I am myself modest almost to a fault, I should have thought that there was no wireless enthusiast worthy of the epithet to whom the names of Professor Goop and myself were not as much household words as Messrs. Dogs' biscuits for pet sprats, Ma Sell's method of putting sine waves into straight hair, or Keating's toothpowder. I am, however, informed by my friend Mr. Hercy Parris (designer of the Flannelly Four and the Fan's Own Frantic Six) that there has lately been a vast influx of new readers, whose wireless education has been so neglected that they know little or nothing of the greatest names associated with the progress of radio in recent years.

Sad Reflections

Some of them have never heard of the Little Puddleton Club; others again have never heard even of Little Puddleton. A terrible business, is it not? Tears well up in my eyes when I realise that there are folk who know nothing of the Goop - Wayfarer Mosquitodyne Wavemeter, of the famous set employing the receiving felix and the natural catwhisker, of the world-

. . . I steer you to the first-class port hole . . .

shaking No. 761 circuit, which was published in serial form, of the widely-used Tune-No Tune switching arrangement which, with the aid of a gramophone in the adjacent room, has enabled many an experimenter to let his friends hear America from a set that would otherwise have been as silent as sets generally are when there is an audience.

Comforting

It was a sad blow to my pride to have information of this kind from Mr. Parris. I have comforted myself by the thought that many of the new readers in question know nothing of the books that his pen has produced, such as *Twelve Messed Up Wireless Sets;* they will never have read Mr. G. P. Bendall's *Tuning Coils But Never Mind Them*, or *Ten Thousand Wireless Answers Questioned,* of which he is part author; to them *Soldering Simplified, or Wireless Made Greasy* will be an unknown work, nor will they have even a nodding acquaintance with *Wireless Leaks And How to Dam Them* by Mr. Wallows.

In view of the fact that the new "Wireless Weekly" has gained a very large number of new readers, it is thought that some introduction of the various characters appearing in this feature will be desired. It is believed that the likenesses to be seen above, with the following key to the diagram, will serve to make known the peculiarities of the chief characters. The scene depicted is one of the historic meetings of the Little Puddleton Wireless Club.

LIST OF COMPONENTS.

C_1 Breadsnapp	C_2 Admiral
R_1 Snaggsby	L_2 Bumpleby Brown
L_1 Dippleswade	B_1 Professor Goop
D Gubbsworthy	R_2 Poddleby
V_1 Wayfarer	L_3 General

A Little Trip

The best thing that I can do, I think, is to take the new reader, figuratively speaking, by the hand, and to conduct him to Little Puddleton, in order that I may introduce him to the town itself, to its wireless club and to some of its leading lights.

As you, reader, are my guest, we will take a taxi, and when we reach the station you will have your first demonstration of my genius. I can claim to be one of the most expert fumblers living. What I mean to say is that I have brought the process of saying "No, no; this is mine," whilst vainly endeavouring to find my trouser pocket, to such a fine art that I have not had to pay a single taxi fare in the last five years. I steer you to the first-class port hole of the booking-office, and once again the fumbling process is triumphantly successful—at least, if it is not, I shall probably lose you in the crowd, considering you unworthy of my escort to Little Puddleton.

Speedy Travel

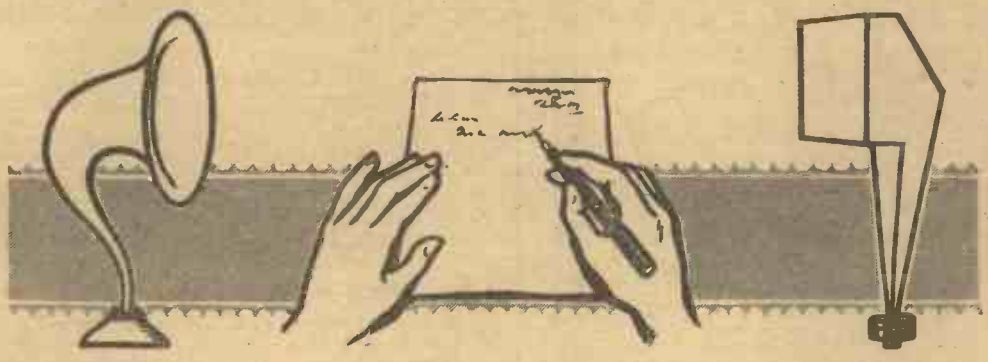
Should there be a restaurant car upon the train—as there will be, since I have selected that which shall have the honour of conveying us to our destination—I will stand you a royal lunch, and, curiously enough, it is probable that I shall have left my note-case on the piano before starting out. Our train being an express, we cover the twenty-five miles from London to Bilgewater Magna in a second or two under the two hours. There we change and proceed along the branch line to Little Puddleton.

We Arrive

As we approach what rude people call the village you are at once

. . . a kind of fox-tango-trot . . .

struck by the enormous number of aerials, which give the place something of the aspect of a forest that has been struck by lightning. In Aberdeen, owing to the recent raid upon the unlicensed as a result of



We want you to write to us

You could not have a better loud speaker than the one you can build with the "Lissenola". Put all the power you can through it—test it on speech or music and it will interpret perfectly every tone. Compare it in any way you like with the most expensive speakers on the market and if you find any inferiority of tone or volume, we ask you to let us know immediately. We definitely guarantee that every user of the "Lissenola", if he follows our instructions, will enjoy results equal to those you would expect with the most expensive loud speaker made. So exacting are the tests that every "Lissenola" must pass before it is released to the public that it is impossible for an instrument to leave our factory unless it is faultless and equal in every respect to our standard model. If, by any chance, you do not get from your "Lissenola" the results we claim, we want you to write to us.

The "Lissenola" is the essential sound-reproducing base which you convert yourself into a loud speaker of whatever type you please. It has been built to stand all the power you can put through it. The secret lies in the effective manner in which the electro-magnetic system is concentrated.

You can build the horn yourself.

With every "Lissenola" we give you full-size exact patterns and explicit instructions how, for a few pence, you can build a big horn of proved efficiency. It can be covered with fancy paper or painted as you will. In addition the "Lissenola" will fit the tone-arm of any gramophone, instantly converting it into a radio loud speaker. By using the Lissen Reed (sold separately for 1/-) the "Lissenola" will carry a cone or any other diaphragm working on the reed principle. You can quickly make a paper diaphragm yourself.

Your dealer will gladly demonstrate and supply—or send for the "Lissenola" post free by return, from the makers—price 13/6, or with Lissen Reed, 14/6.

THE LISSENOLA COSTS 13/6

and we stand behind it with an unconditional guarantee

Lissen Limited, 30-32, Friars Lane, Richmond, Surrey

'Phone: Richmond 2285 (4 lines) *'Grams: "Lissenium, 'Phone, London."*

JOTTINGS BY THE WAY
(Continued)

which aerials were hewn down right and left, there is now hardly a house whose garden contains a mast. In Little Puddleton every house has its aerial, and some have five or six. In some towns you will see gardens devoted to the growing of roses, honeysuckle, beehives and other vegetables. In Little Puddleton we understand what gardens are for. To us they are aerial supports and earths.

Poddleby

As the train begins to pull up at Little Puddleton station, I leap brightly from the opened door of the carriage, and collide rather violently with a stout passenger who has done the same thing a second or so previously from the carriage in front. We do a kind of fox-tango-trot down the platform, which includes some up-to-date musical effects owing to our collision with a row of empty milk-cans. We pick ourselves up, and when mutual recriminations have ceased I introduce you to Mr. Jehoshaphat Poddleby, the secretary of the Little Puddleton Wireless Club. From him you will receive a pressing invitation to attend that very evening, as ever is, a meeting of this august body.

Snaggsby

Having accepted the invitation on your behalf, I explain that my own household is so disorganised by spring-cleaning activities that it is impossible to ask you to dine at my little abode. For the same reason I propose that we spend what remains of the afternoon in the wireless den of my friend Snaggsby, who has contributed in the past not a little to the inventions of Professor Goop and myself by providing, usually quite unwittingly, many of the components for our epoch-making circuits.

I notice with pain, and you, if you are a gentleman, pretend not to notice, that Snaggsby hastily sweeps all the gadgets that are lying about into a drawer, and locks them up the moment that we are ushered into his wireless den. He is really a very good fellow, is Snaggsby, when you get to know him, but he has never quite realised the truth of the old maxim that it is much more blessed to lend components than to own them.

A Demonstration

Egged on by myself, Snaggsby consents to show us what his new umpteen-valve superheterodyne can do in the way of running round the afternoon transmissions of foreign stations. He lets us hear Rome (if only he was working), a thunderstorm in Madrid, and what he calls Oslo, which sounds much more

. . . *hastily sweeps all gadgets into a drawer* . . .

like a railway terminus in which two dozen locomotives are all whistling simultaneously. He then explains that the results up to this point have not been better because he ought to have more H.T. on the medium-frequency amplifier.

He does juggling tricks with various leads, as a result of which the medium-frequency amplifiers get so much H.T. in the wrong place that they all go up in blue flames. I nudge you gently in the ribs, and we steal silently away, leaving Snaggsby to bite pieces out of the hearthrug in his chagrin.

Our Warriors

I conduct you to the Duck and Gluepot, our local hostelry, where you are to be my guest for dinner. On entering the coffee room we observe sitting by a table in solitary state a white-moustached, red-faced personage who is shouting to the waiter for further supplies of cayenne pepper. I lead you across and present you to General Blood Thunderby, the world-famous presi-

. . . *concerning the dielectric constant of the cutlets* . . .

dent of the Little Puddleton wireless club. As my notecase still reposes upon its original piano I now give you a demonstration of real tact, the outcome of which is that the General invites both of us to dine with him.

Arrival of the Admiral

Hardly have we taken our seats than his dearest crony, and bitterest foe where wireless is concerned, Admiral Whiskerton Cuttle, enters and is invited to join us. Our meal is enlivened by a violent argument in which the General, the Admiral, and the waiter are involved concerning the insulating properties and the dielectric constant of the cutlets, which the General declares to be of leather, whilst the Admiral maintains that they are of ebonite, and the waiter protests that he is certain they are mutton, since the sheep that provided them had been known to him since the days of his boyhood.

The Professor and Others

The meal over, we make our way to the meeting of the club where many treats are in store for you. I introduce you first of all to no less a person than Professor Goop himself, who hangs his hat upon your outstretched hand and shakes hands warmly with a hatpeg. You notice that the Professor is wearing one black and one brown boot, whilst a pair of socks is keeping his hands warm. Such things are the outward signs of true genius. I present you next to Breadsnapp, Dippleswade, and Bumpleby Brown, all of whom unwittingly (and usually unwillingly) supply all the necessary components to the Professor and myself.

The Lecture

And then the real business of the evening begins. We listen to a paper by Professor Goop upon "The Prevention of Gamping in Umbrella Aerials." To say that we are thrilled at his masterly exposition of the subject is to put it mildly. Thanks to his wonderful command of words everything becomes as clear as mud as he unfolds his thesis, and by the time that I have beaten you in ten successive games of noughts and crosses he takes his seat amidst thunders of applause, having held the attention of the meeting for what seems like three hours, but is really less than one.

The Discussion

Member after member rises to his feet to put a question to the lecturer. Breadsnapp wants to know how to increase the selectivity of his receiving set which at present will not separate 2LO from 5XX, whilst Gubbsworthy desires the Professor to help him to solve a problem that is puzzling him at the moment: How many microvolts make a megohm? The lecturer himself, however, has completely forgotten what his original subject was.

WIRELESS WAYFARER.

The Committee's Report

A document which will have a profound and far-reaching influence upon the future of broadcasting in Britain is to be found in the newly published Report of the Broadcasting Committee.

The Committee conducted a long and thorough investigation into the problems of the control of broadcasting, under the chairmanship of the Earl of Crawford and Balcarres, whose portrait appears above.

THE eagerly-awaited Report of the Broadcasting Committee was published on March 5, and the reader will find hereunder a summary giving the main contents in a concise form.

The Committee, which received evidence from 22 individuals or groups and considered also various memoranda, opens the report by paying a tribute to the work so far accomplished by the British Broadcasting Company.

Reorganisation Necessary

" Broadcasting," the report goes on, " has become so widespread, concerns so many people, and is fraught with such far-reaching possibilities, that the organisation laid down for the British Broadcasting Company no longer corresponds to national requirements or responsibility. Notwithstanding the progress which we readily acknowledge, and to the credit of which the Company is largely entitled, we are impelled to the conclusion that no company or body constituted on trade lines for the profit, direct or indirect, of those composing it can be regarded as adequate in view of the broader considerations now beginning to emerge.

British Broadcasting Commission

" We do not recommend a prolongation of the licence of the British Broadcasting Company, or the establishment of any similar body composed of persons who represent particular interests. We think a public corporation the most appropriate organisation. The authority can be set up by Statute or under the Companies Acts. However established, it would hold the licence of the Postmaster-General, and in view of the scale, significance and potentialities of broadcasting, the proposed corporation should be invested with full authority. Its status and duties should correspond with those of a public service, and its directorate should be appointed with the sole object of promoting the utmost utility and development of the enterprise. We think the ' British Broadcasting Commission ' would be a suitable title for the new authority."

Continuity of the Service

It is urged by the Committee that it is most important that there should be no break in the service of broadcasting when the change recommended takes place. To this end the new authority must be constituted by December 31, 1926, contracts must be taken over and arrangements made for future programmes. It is recommended that the existing staff of the British Broadcasting Company be taken over by the Commission, adequate compensation being paid to individuals if it is necessary at a subsequent date to dispense with their services.

The Commissioners

On the subject of the Commissioners themselves, the Report continues, " We hold that the actual Commissioners should be persons of judgment and independence, free of commitments, and that they will inspire confidence by having no other interests to promote than those of the public service. We hope they will be men and women of business acumen and experienced in affairs. In numbers they should not exceed seven or be less than five, and we recommend that they should be nominated by the Crown. In the interests alike of continuity and independence the Commissioners first appointed should hold office for five years. Thereafter, one should in every year retire by rotation, being, however, eligible for re-appointment. All vacancies on the Commission, casual or otherwise, should be filled by the Crown.

" The Commissioners will require Advisory Committees, of which a considerable number can be appointed; these may frankly comprise advocates, as their duty will be to ensure due consideration for particular phases of broadcasting, in relation both to programmes and to scientific progress and research."

Finance

The Committee is of opinion that the overhead and administrative charges of the new authority will rise. The Commission must be self-supporting and can expect no grant from public funds. Expenditure will govern progress, and outlay on bold experiment should not be meagre. All witnesses seem to agree that improvement of the service will increase the number of licencees.

The Licence Fee

The present licence fee of 10s. the Committee does not consider excessive, and calculations for the future may well be based on the assumption that this licence fee will be maintained. The Postmaster-General must

The Committee's Report—*continued*

be indemnified against the cost of collecting fees, and against all other expenditure incurred by him in relation to the service.

Subject to these provisions, it will be the duty of the Postmaster-General to pay to the Commissioners from the licence fees an income thoroughly adequate to enable them to ensure the full and efficient maintenance and development of the service.

Surplus Funds

On these conditions, and when the adequate service has been assured, but not until then, it is expedient that the surplus should be retained by the State. It must be remembered that the State is authorising individuals at their free will to use a monopoly vested by Statute in the whole Community. Moreover, the State safeguards the listener against exploitation, takes steps to maintain the efficiency of the service, and also exercises its regulative powers without which broadcasting would be thrown into chaos.

It is recommended that the licence of the new Commission should run for not less than ten years, and be renewable.

Copyright

During the hearing of evidence by the Committee conflicting statements were made by various individuals and groups with regard to the position of broadcasting as a public service. Apprehension was expressed lest broadcasting should supplant existing agencies, professions or pursuits. In the opinion of the Committee " Broadcasting will become the handmaiden rather than the usurping rival of literature and the arts; in fact, we feel justified in our opinion that in the long run art will not be injured by science, and that the printed page will not be displaced by the spoken word. Nor indeed can scientific ingenuity, which satisfies a laudable demand for recreation and study, be permanently withheld from the public, for broadcasting is not only an institution, but has become a necessity throughout the civilised world. This country cannot withhold privileges so widely enjoyed without restriction elsewhere.

" At the same time, we should deprecate any cause for grievance amongst those who supply the raw material of broadcasting, and we feel that services rendered to the Commissioners should be adequately rewarded. We hope the Commissioners will maintain and improve their service by allocating ample funds for meeting copyright royalties and for the adequate payment of performers.

High Standard of Service

" Every effort must be made to raise the standard of style and performance. We are assured by musicians, eminent in their art and versed in this very problem, that the gradual infusion of improved standards will be welcomed by listeners—unconsciously at first, but with growing appreciation amongst those who will instinctively learn to desire better performances.

" Special wavelengths or alternative services may provide an escape from the programme dilemma, but we trust they will never be used to cater for groups of listeners, however large, who press for trite and commonplace performances. The new authority, steadily, but with great patience, must try to improve the standard in each sphere of its activity, especially in music."

Various suggestions, made to the Committee by witnesses, relate to subjects which are left to the future consideration of the Commissioners. Among such subjects are :—

Oscillation and jamming.

International broadcasting.

Advertising.

Reservation of certain periods for unofficial experimenters.

The report pays a high tribute to the work of the B.B.C. under the direction of Mr. J. C. W. Reith.

Recommendations

In the summary with which the Report closes, the following recommendations are made :—

That the entire property and undertaking of the British Broadcasting Company as a going concern should be vested in the Commission on January 1, 1927; that all existing contracts and staff of the British Broadcasting Company should be taken over by the new Commission.

That the provision for experiment and research should be generous.

That so soon as the licence expires or is withdrawn the Commission, on due provision being made for the discharge of all debts and liabilities, should be bound to transfer or dispose of its whole undertaking in such manner as the Postmaster-General may direct.

That a moderate amount of controversial matter should be broadcast, provided the material is of high quality and distributed with scrupulous fairness, and that the discretion of the Commissioners in this connection should be upheld.

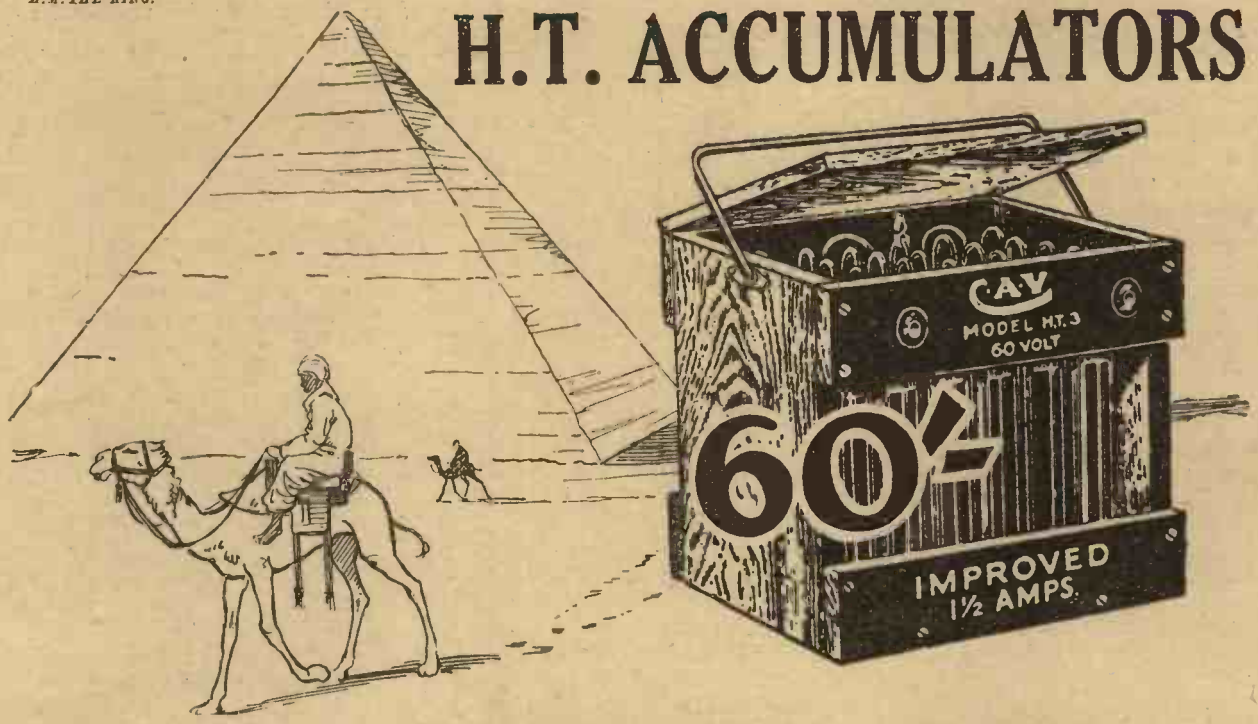
That licences should be granted to blind persons free.

That the Commissioners should present an annual report to Parliament.

Built to last C.A.V.

Our Equipment Manufacturers by Appointment to H.M. THE KING.

H.T. ACCUMULATORS



ACCUMULATOR claims are numerous, but C.A.V. claims 33 years' manufacturing experience. The C.A.V. H.T3 was designed with that experience behind it and is constructed to work with the average broadcast receiver. It is electrically efficient and all that can be desired for really reliable radio reception. OVER 10,000 SATISFIED USERS. Moreover, it is exclusively used by those who know, namely:—

Mr. W. K. Alford, radio 2 DX;

Mr. V.E.M. Oliver, B.A., A.M.I.E.E., radio 6 BV;

Mr. J. A. Partridge, radio 2 KF;

Mr. E. J. Simmonds, M.I.R.E. F.R.S.A., radio 2 OD;

and others who find them essential when setting up wonderful records in reception throughout the world.

For your L.T. supply, "Acton" Accumulators in celluloid or glass.

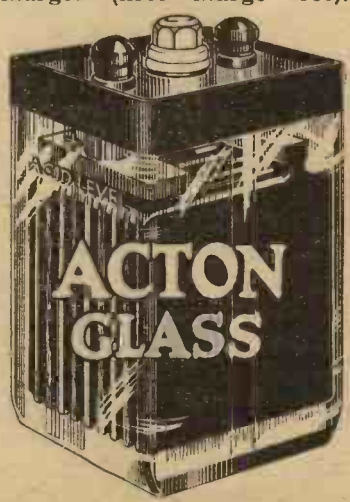
Write for a copy of our complete Radio Catalogue.

Supplied at 1/- per volt.

H.T.3. 60 volts .. 60/-

H.T.4. 30 volts .. 30/-

ALL C.A.V. H.T. ACCUMULATORS are supplied fully charged (first charge free).



C.A. Vandervell & Co. Ltd.
WARPLE WAY, ACTON, LONDON, W.3

Wireless News in Brief.

From the Programmes. Sunday, March 21.—London: 9.15 p.m., Chamber Concert, J. H. Squire, Celeste Octet. Manchester: 9.20 p.m., Band Music and Songs.

Monday, March 22.—London: 8.57 p.m., Act 3 of "Hugh the Drover" (R. Vaughan Williams), performed by the B.N.O.C., and relayed from Bradford. Bournemouth: Winter Garden Night.

Tuesday, March 23.—London: 9 p.m., The Savoy Symphonic Augmented Orchestra. Manchester: First performance by the Station Concert Party.

Wednesday, March 24.—Separate programmes from all stations.

Friday, March 26. — Bournemouth: Grand Opera. Glasgow: Variety. Newcastle: Beethoven Programme.

Saturday, March 27.—London, 8 p.m., 3rd edition of "Listening Time." Birmingham: 7.30 p.m., Concert from the Town Hall, The Birmingham City Choir. Manchester: Popular Orchestral Programme.

* * *

B.B.C. News. The B.B.C. is organising music competitions to encourage new and little-known British composers. Prizes will be awarded for symphonic and choral works, and a musical festival will be held in October at Covent Garden Opera House, when the prize-winning compositions will be performed and broadcast to all stations.

* * *

An excerpt from "The Student Prince," now playing at His Majesty's Theatre, will be broadcast on March 26, commencing at about 8.45 p.m.

On the same date the speech made by the Rt. Hon. J. H. Thomas at the annual dinner of the Glasgow Publicity Club will be broadcast from the Glasgow Station at 9 p.m.

Broadcasting of Parliament. In reply to a question put by Captain Fraser, the Prime Minister said that the broadcasting of speeches in Parliament was a matter on which Parliament should be consulted. He stated further that he proposed to consult the leaders of the parties in the House, in order to ascertain how best to attain the object in view.

* * *

Wavelength Change. A few days ago the Dundee and Liverpool stations interchanged their wavelengths. The Dundee station now operates on 311 metres,

A view of the transmitter at the Ecole Superieure broadcasting station, Paris.

while Liverpool is using 331 metres, so that the latter station will be further removed from the shipping wavelength of 300 metres.

* * *

The Broadcasting Committee. Two recommendations made in the Report of the Broadcasting Committee, an abstract of which will be found on another page in this issue, are that the development of high-power transmitting stations should be encouraged, and that free licences should be provided for blind people.

* * *

Transatlantic Telephone Conversation. On March 7 a conversation was carried on between London and New York via the new Rugby station and the Radio Corporation station on Long Island. The receiving stations used were at Wroughton, near Swindon, and at Houlton, Maine, U.S.A., landlines being used to complete the links between London and New York. The atmospheric conditions were favourable, and perfectly clear speech was obtained at each end. The main problem in the establishment of a continuous telephone service is maintenance of reliable communication when atmospheric conditions are adverse.

* * *

Wireless Licences. The number of persons licensed to use wireless apparatus is steadily increasing, and it should not be long now before the two million mark is passed. The number of licences in force on February 28 this year was 1,906,000, as compared with 1,258,000 a year ago.

* * *

The Aurora Borealis. On the evening of March 9 the Aurora Borealis was visible in London between 7 and 8 p.m. It is unusual to see this phenomenon so far south. An official at Marconi's stated that no interference with reception was observed there. On the higher frequencies, however, atmospheric disturbances were prominent, though both European and American amateurs came in at good strength on the 6,667-kilocycle band and above.

SELECTIVIT

H.F. S

By L. H.

In the search for selectiv
secondary" reaction circu
tion. In this effective two
selectivity is obtained

There are only two tuning controls, and the reaction is adjusted by means of a slow-motion coil-holder. All the battery terminals are at the back of the receiver.

ALTHOUGH the "split-secondary" type of receiver possesses several great advantages over the type having both the reaction coil and the primary coil coupled to the secondary, it does not seem to have met with anything like the popularity it deserves. The receiver described in this article has been designed with the object of "setting-off" some of these advantages, and also to show the application of the theory of this type of receiver to practice.

Tuning Difficulties

Most of my readers will probably have had some experience of the type of receiver employing a three-coil holder, the secondary plugging into the fixed socket, with the primary on one side and the reaction on the other; they will also probably be quite familiar with some of the exasperating phenomena experienced on trying to tune-in a station with this kind of receiver.

The two worst points are: (1) that on loosening the reaction coupling in order to stop oscillating the frequency changes, owing to the variation in the tuning of the secondary circuit; (2) on loosening the coupling between the primary and secondary the set suddenly starts oscillating, on account of the reduction of the damping effect of the aerial.

A Remedy

Both these annoying effects can be reduced to a minimum, if not completely abolished, by using a "split secondary," which is arranged as follows: the ordinary single secondary coil is replaced by two separate coils, preferably arranged at right-angles to one another, and wired in series. The reaction coil is coupled to the smaller of these, and the primary coil to the other.

Now it will be seen at once that the reaction coil will no longer have any noticeable effect on the tuning of the *primary* circuit; further, since it is only coupled to a small portion of the secondary, the loosening of the coupling between these two coils will have hardly any appreciable effect on the tuning of the *whole* of the secondary circuit. Also, since the aerial is coupled only to part of the secondary, there is no need to make provision for very great or frequent variations of this coupling, as the receiver will normally be considerably more selective than the more usual type.

A Practical Example

In the actual receiver shown in the diagrams and photographs, the coupling between the primary and secondary coils may be varied coarsely, provision for this having been made by mounting these coils in the standard type of baseboard

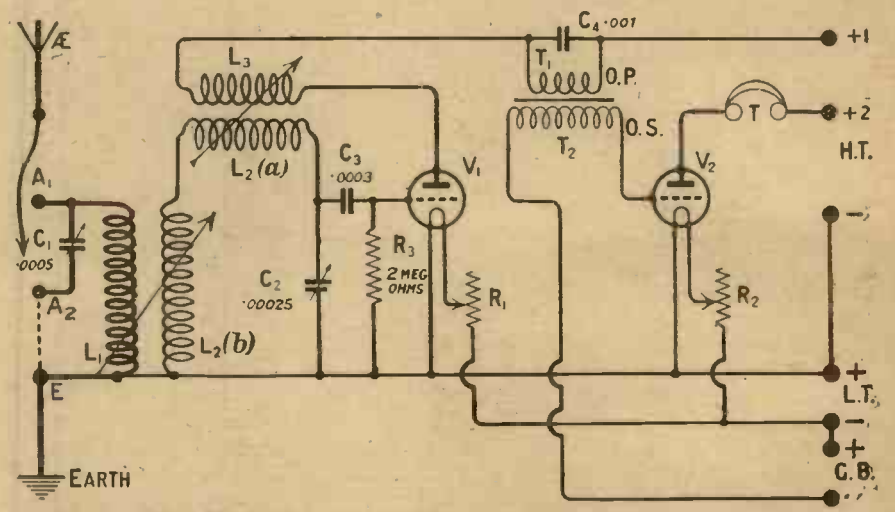
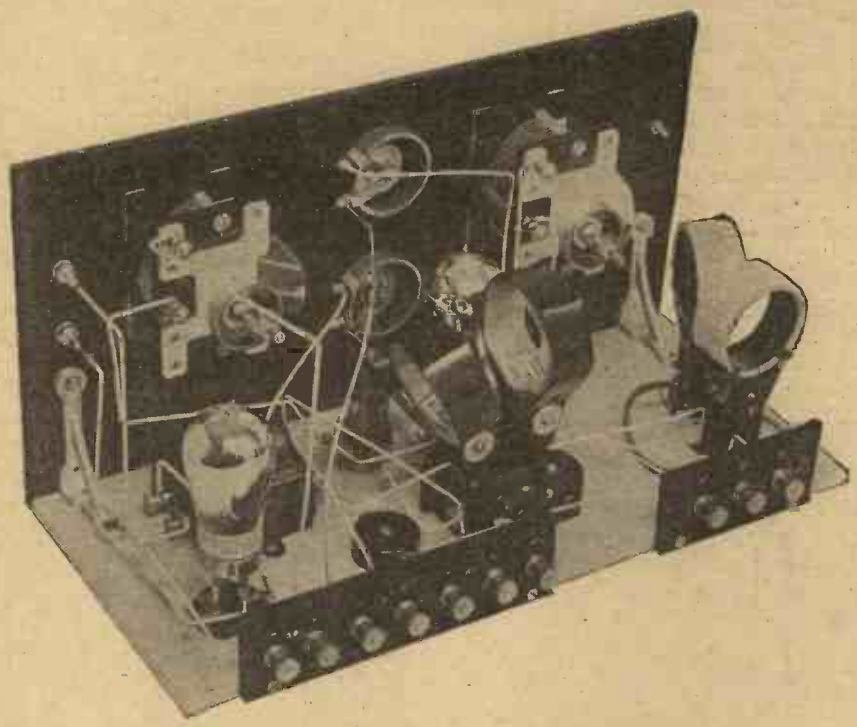


Fig. 1.—The circuit is quite a typical "split-secondary" arrangement. The aerial condenser may be used in series or parallel.

WITHOUT AGES

OMAS.

e virtues of the " split- e worthy of considera- e set a good measure of very simple way.



The aerial and secondary coupling coils are adjusted in position by swivelling their mounts.

coil-mounts, one of these having been fixed with a single screw only, so that it may be rotated towards or away from the plane of the fixed coil. The coupling between the smaller part of the secondary and the reaction coil is capable of fine adjustment; this is the only means of controlling reaction that is provided on the receiver, a good geared coil-holder having been employed.

Apart from the splitting of the secondary coil into two sections, as described above, the circuit arrangement of the receiver is perfectly straight. Preliminary experiments with the circuit gave evidence of such excellent selectivity that it was thought that, as it was obviously possible to cut out the local station and listen to distant stations, it would be worth while to add a stage of L.F. amplification, to make " DX " reception really interesting.

Constructional Details

The arrangement of the components on the panel is very simple, and permits the use of fairly short leads throughout. The condenser on the left may be used either in series or in parallel with the primary coil, the change being effected by altering two connections to terminals on the back of the receiver. That on the right is permanently connected across the whole of the secondary coil; the tuning of this circuit was found to be extremely sharp, so that quite a small value (.00025) was used in this position. The primary tuning condenser has a maximum capacity of .0005. Both of these condensers are of the slow-motion type, and, unless a type similar to those actually incorporated in this set is employed by the reader, he will probably find tuning quite difficult.

Coupling Arrangements

The two mounts for the primary coil and the portion of the secondary to which it is coupled are kept on the left of the receiver, and as well separated from the other components as possible. The reaction coil and the other part of the secondary are mounted in a geared two-way coil-holder, the coupling being varied by means of a long handle which protrudes through the panel.

The only terminals on the panel are those to which the telephones are connected, all the battery terminals, as well as the three for the aerial and earth connections, being mounted on strips at the rear of the receiver, holes having been cut in the back of the cabinet to facilitate easy connections to these terminals.

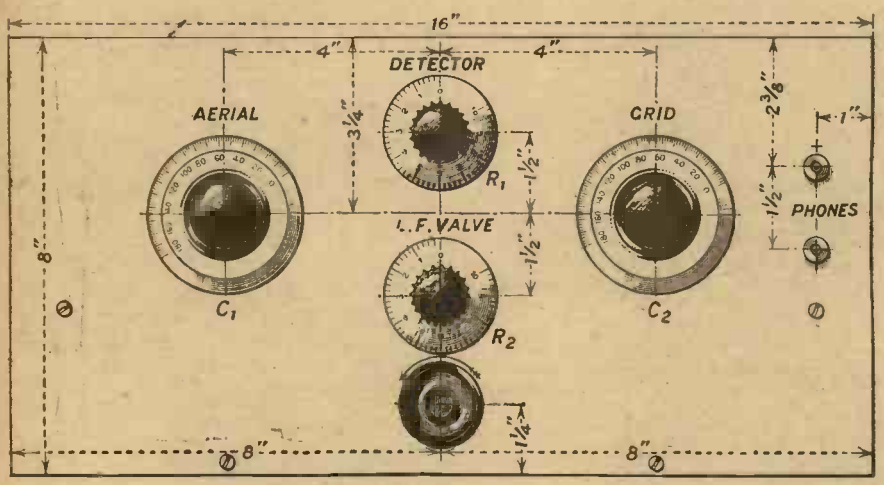


Fig. 2.—In laying out the panel the positions of the bracket screws will depend on the make of bracket used.

Components

For the guidance of those readers who wish to copy this set in every detail, a list of the actual components used, with the manufacturers' names or trade-marks, is given here.

One ebonite panel, 16 in. by 8 in. by ¼ in.

One cabinet for the above ("All-Concert" type), with loose baseboard.

One 7-terminal strip, and one 3-terminal strip. (All supplied by the Peto-Scott Co.)

One .0005 low-loss slow-motion condenser. (Ormond Engineering Co.)

One .00025 low-loss slow-motion condenser. (Ormond Engineering Co.)

Two "De Luxe" type Peerless rheostats, of resistance to suit the type of valve in use. (Bedford Electrical and Radio Co.)

One two-way coil-holder, with long handle. ("Lotus," by Garnett, Whiteley & Co.)

Two baseboard mounting coil sockets. (Burne-Jones & Co., Ltd.)

Two No. 2 panel brackets. (Burne-Jones & Co., Ltd.)

One general-purpose L.F. transformer. (C. A. Vandervell.)

One .0003 fixed condenser, with clips for grid-leak. ("Dorwood," H. Bowyer & Co.)

One .001 shunting condenser for transformer. (A. J. Stevens & Co., Ltd.)

One 2-megohm grid-leak. (Dubilier Condenser Co.)

SELECTIVITY WITHOUT H.F. STAGES

(Continued)

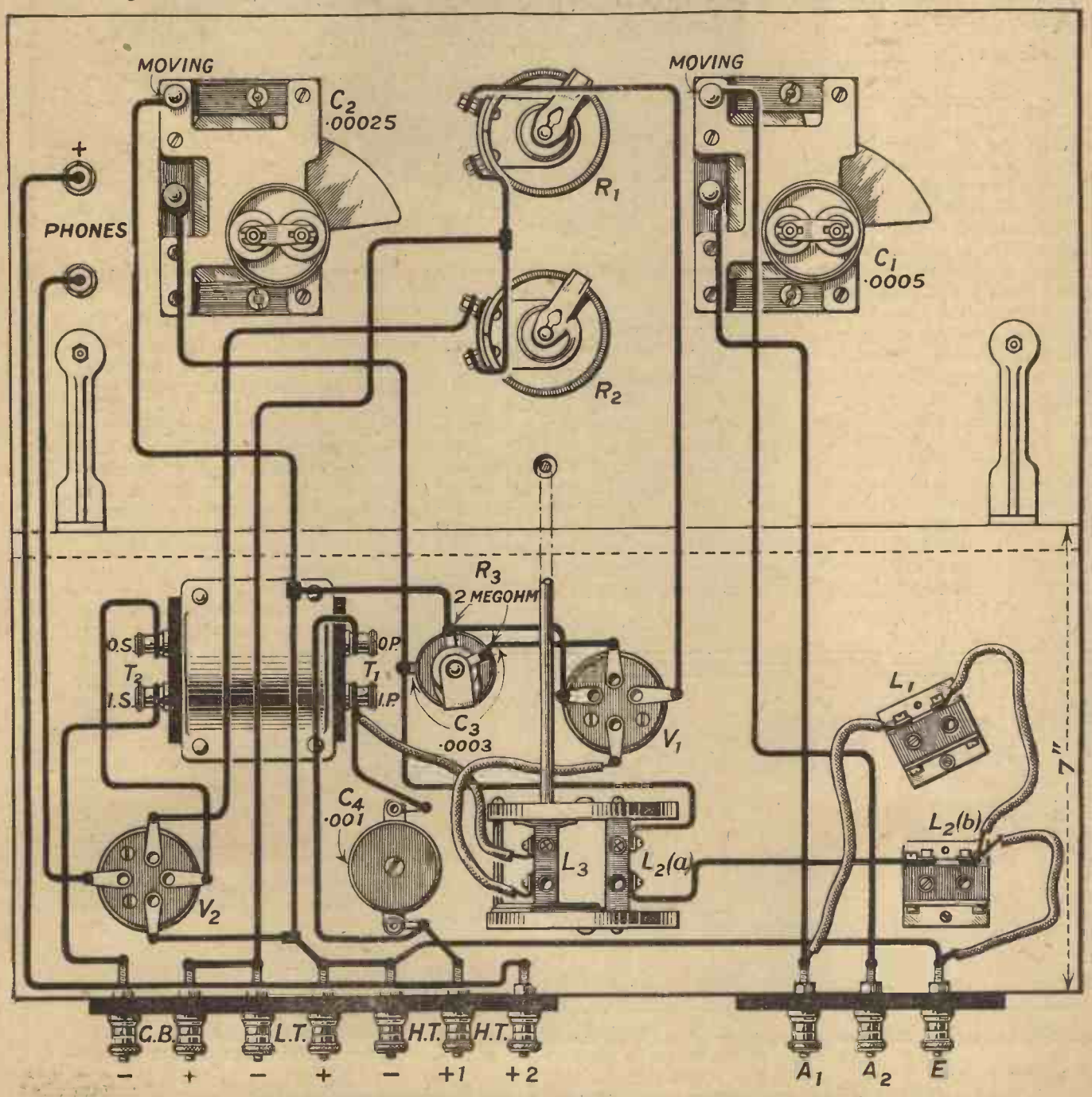


Fig. 3.—In carrying out the wiring it is advisable to use flex for the connections to the moving coil sockets.

Heat
—the biggest thief in your Receiving Set

THERE'S a thief in your Receiving Set! The moment you close the filament switch he starts his deadly work. His name is Heat. Sometimes he works quickly and sometimes he works slowly. But all the time he is planning the destruction of your valves and stealing valuable hours of usefulness from their lives. For years science has been waging a stiff fight against his nefarious practices, and for years little or no impression could be made upon him. But at last there came a valve with a filament which made use of new principles—a valve which at one stroke definitely got to grips with this crippling influence —the Wuncell Dull Emitter.

Let's investigate further. The old bright emitter possessed a tungsten filament which required a very high temperature—as much as 2000°—in order to create the necessary stream of electrons. Such a temperature—coupled with the constant expansion and contraction of the filament—rapidly caused brittleness and disintegration. In other words, the intense heat—while necessary for the prolific production of electrons—robs the filament of many hours of usefulness. But if the temperature is reduced—then the electron stream is impoverished, too.

So other means had to be sought. Instead of tungsten, the Wuncell uses a filament which is built up layer upon layer under a secret process known only to Cossor. This external covering emits a copious supply of electrons at an extraordinarily low temperature. In fact, at 800° the Wuncell produces more electrons than a bright emitter valve does at 2000°. The Wuncell goes a long way towards banishing heat from the valve altogether—at all events 800° is no more than a dull red glow practically invisible in daylight. When you choose the Wuncell for your set, therefore, you get a valve which has the longest life of any because it is the only valve which so effectively reduces the ruinous influence of heat.

The Wuncell Dull Emitter
Voltage 1·8 volts. Consumption ·3 amp.
•W1 for Detector and L.F. 14/-
•W2 for H.F. amplification 14/-

The Cossor Loud Speaker Valve W3
Voltage 1·8 volts. Consumption ·5 amp.
Price 18/6

•Also in WR Series, with special switch and resistance in base to enable Valve being used with 2- 4- or 6-volt Accumulator:
WR1 for Detector and L.F. 16/-
WR2 for H.F. amplification 16/-

Cossor

Gilbert Ad. 4829.

Two baseboard-mounting valve-holders. (Burwood.)

Sundry bolts, terminals, wood-screws, etc.

Quantity of "Glazite" for wiring-up.

"Radio Press" panel transfers.

Wiring

The method of assembly and wiring should be quite clear from the photographs and wiring diagram, but it might be mentioned that the first connections to be soldered should be those to the "Dorwood" grid condenser and those to the primary of the L.F. transformer. If left to the last these may be found very difficult to get at. Care should also be taken about the wiring-up of the former of these components. The bottom connection should go to the top of the secondary coil, the top one to the grid of the valve, and the middle one to the positive L.T. terminal.

Coil-Holder Connections

Connections to the primary coil and the part of the secondary coupled to it are made by means of flex, to facilitate occasional adjustment of the coupling between them. This portion of the secondary coil is the lower part, one end of it going to earth, and the other to the coil-holder proper, where it joins the other section of the secondary.

The secondary tuning condenser is connected from the positive L.T. terminal to the side of the grid condenser remote from the grid. There are some who prefer to tune only the portion of the secondary coil that is coupled to the primary, but the writer, after some experimenting with both methods, decided on tuning the whole coil.

The Circuit

Reference to the theoretical circuit diagram, Fig. 1, will make the arrangement quite clear. Separate filament control and H.T. voltages have been provided for each valve, and two grid-bias terminals for the note-magnifier are provided on the terminal strip at the rear.

Series or parallel tuning of the primary is arranged as follows:—Three terminals, on the strip at the back left-hand corner of the baseboard, are marked A1, A2, and E. One end of the secondary and one end of the primary are both connected to the "E" terminal. To A2 is connected one side of the condenser C1 (the moving plates), the other side being connected to A1, together with the other end of

SELECTIVITY WITHOUT H.F. STAGES

(Continued)

the primary coil. If now the aerial is connected to A2, and the earth to "E," the condenser C1 is in series with the primary coil L1. To use parallel tuning proceed as follows:—Leaving the earth on "E," connect this terminal also to A2 by means of a short brass strip, or some similar device, the aerial then being connected to A1.

Operation

On testing the set for the first time, the following procedure should be carried out. First connect the low-tension battery across its appropriate terminals, and, slowly turning on the rheostats, note whether the valves are glowing at their normal brilliancy. Then apply a low value of H.T. (not more than about 6 volts) across first H.T.– and H.T.+1, then across H.T.– and H.T.+2. If the filaments of the valves do not appear to glow more brilliantly when either of these tests is carried out, it may be considered safe to apply the full H.T. voltage.

Coil Sizes

For reception of the local station, which will almost certainly be the first test to which the receiver is subjected, plug in a No. 35 coil in the reaction socket and a No. 50 in the other socket of that coil-holder. Short-circuit the socket for the other part of the secondary coil, and make sure that the set will oscillate, afterwards replacing the No. 50 with a No. 25. This having been done, remove the shorting-plug and insert in its place about a No. 50 coil and in the aerial socket a No. 25 or 35. (It is, of course, understood that any of the well-known makes of coil can be used, the above figures referring to the approximate number of turns.) The coupling between primary and secondary should at first be fairly loose.

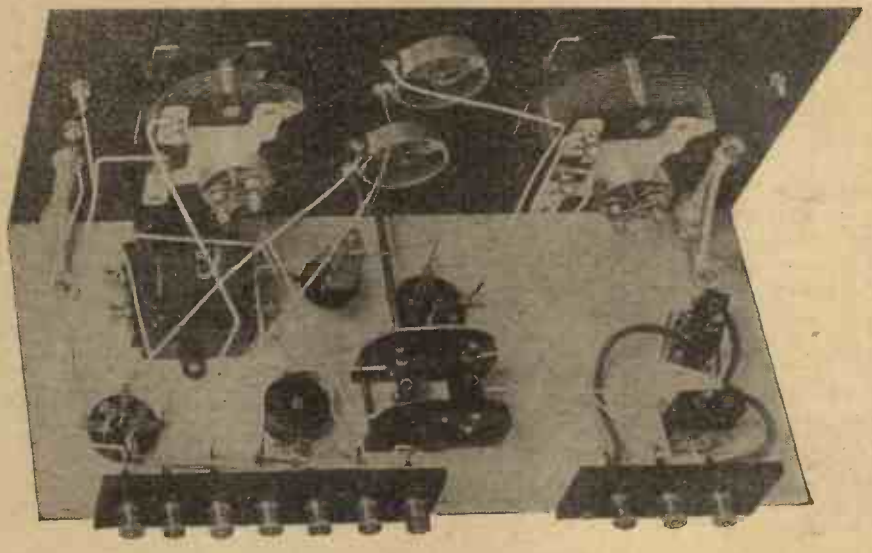
Searching

With the receiver well off the oscillation point and this loose coupling, search for the local station by rotating the dial of C2. When it has been found (signals probably being rather weak), adjust the primary tuning condenser C1 to the position that gives the best result. It will probably be necessary to try this both in series and parallel. Then try tightening the coupling. Selectivity will most probably not be so good, but signal strength may be found to have increased slightly. A great deal, of course, depends on the type of aerial on which the set is being tested, also the length of the earth lead, etc.

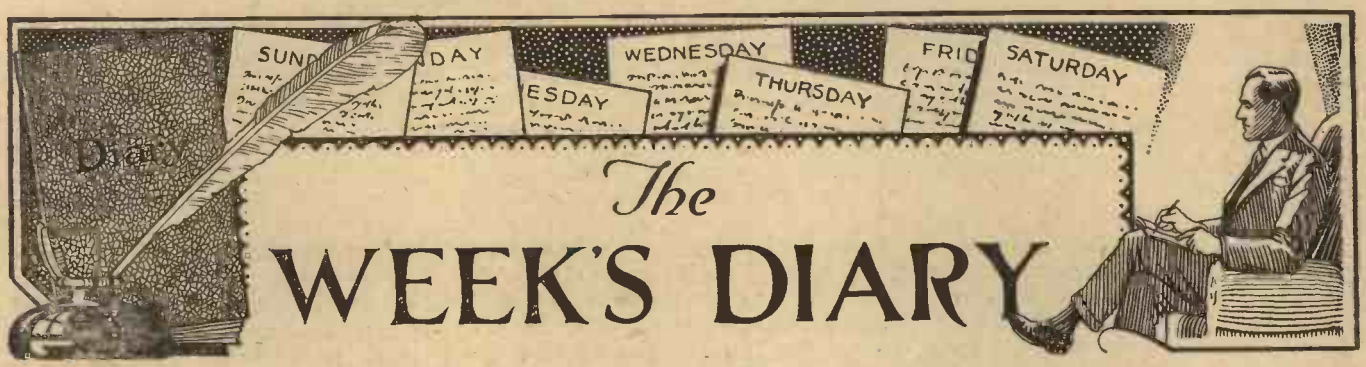
Reaction Control

The sizes of coils mentioned should allow of easy oscillation over practically the whole broadcast

(*Continued on page* 166)



The coil-holder is of the long-handle variety, the knob appearing on the front of the panel.



The WEEK'S DIARY

WALKING along a well-known thoroughfare the other day, I narrowly missed being knocked over by Captain Eckersley in his new car. The gallant and dashing Captain (I am sure you would agree with me that "dashing" is the correct word if you saw him speeding off to Daventry) is a very ardent motorist, and the frequent use of his car enables him to crowd into the day an amount of work which few people would credit.

* * *

THERE will be sad little hearts in many homes with the curtailment of the birthday greetings during the Children's Hour. I appreciate the difficulty the B.B.C. must have, and for a long time past it has been necessary to read the list of names very rapidly, with only a brief word to each, but it must not be forgotten that even this brief message brings a wonderful thrill to the children, even if the grown-ups are rather bored. While writing may I suggest there is a little too much sophisticated back-chat between Uncles and Aunts in some of the stations. I really do think that the Children's Hour should be kept purely for the children. This may seem a platitude, but some station directors do not always bear it in mind. Now that so many hospitals are fitted with wireless, it would be interesting to take a vote in some of the children's wards. I fancy Aunt Priscilla would come quite high in the list of favourites!

* * *

PERHAPS the most priceless example of unconscious wit in writing of wireless occurred in an evening paper recently, when some facile writer explained that too good an earth was sometimes the cause of bad signals. According to his delightful theory, such an earth drains away energy which is really needed in the set. This idea seems worth following up. That baby's bath you purloined when you first started listening in, and which lies buried beneath the front flower bed, is it yet full of music, I wonder? Has it drained away too much John Henry or not enough of the Savoy? Is the ground yet sodden with symphonies, and will it overflow one day and soak you with sound?

* * *

OUR American friends who listened for Europe in the Tests week last January are nothing if not enthusiastic over long-distance reception. Their optimism leads

Many of the continental stations are remarkably simple in their lay-out, as this view at Zurich indicates.

them into unconscious humour at times, though perhaps some of them write with their tongue in their cheek. One listener, after commenting on the newspaper reports of weak reception, writes: "It was amusing to read the letters written by various readers of the daily Press. Some thought they made connection with Mars." So far, so good. Then he goes on to say that on the night of January 28 he got faint reception on a five-tube set, which appeared to be coming from station . . . . Five of these letters were sent, each to a different B.B.C. station!

* * *

IN the home of "tall stories" there are some who have been accused by their friends of what in Parliamentary language is called a "terminological inexactitude." They write imploring us to verify their reception, so that they can look their neighbour straight in the eye, and tell him that they really did hear a programme from across the pond. Such a wealth of detail of what was heard is given in many of the letters that the fake transmission in Omaha cannot have been the only one.

* * *

WELL, we've got the Commission's report at last! I do not know what *you* think of it, but to my mind there is too strong a "Government" flavour about the recommendations to be really healthy. It is good to hear the recommendation that the proposed organisation should have a reasonably lengthy run so as to assure stability and ordered progress, but personally I feel that there is something radically wrong with the idea of collecting a number of people for such a long period as that suggested as controllers of broadcasting. Commander Kenworthy, with whom I was discussing the matter the other day, has very strong views on the subject, and expressed the opinion that a seat on the broadcasting commission would be a good way of getting rid of some of the political personages whom the Government of the time thought it desirable to pacify!

* * *

I HAVE no doubt it would suit the Post Office very well to get a much fuller control of broadcasting, but whether or not it would be good for the nation to have

State-regulated humour and music is certainly open to discussion. Somehow, I cannot think of Capt. Eckersley as a Civil Servant or John Henry explaining to a Government department (on form AM/1964/32967 A2) that his joke on Thursday, the 4th ultimo, had no political significance, and that he had the honour to be, etc. !

* * *

A SCOTCH friend tells me that communal aerials are "catching on" rapidly north of the Tweed. Perhaps it would be more correct to refer to them as communal aerial "poles," for the idea seems to be for a group of neighbours to join in erecting a single pole from which a number of aerials are suspended. Where a number of gardens are adjacent this scheme often works quite well, and unless one of the owners happens to be an oscillator quite satisfactory results are obtained.

Speaking of aerials reminds me that the promoters of a new garden city have recently given very careful consideration to the whole question of aerial poles, and, indeed, propose to erect one at the foot of each garden, on the assumption that the future residents will all have wireless sets. By doing this they are assuring themselves of a reasonably satisfactory appearance, and are guarding against the appearance of such monstrosities as often disfigure the skyline in suburban districts.

From the broadcasting of the sounds of a film studio scene to the transmission of the scene itself may not be such a far cry as some people imagine.

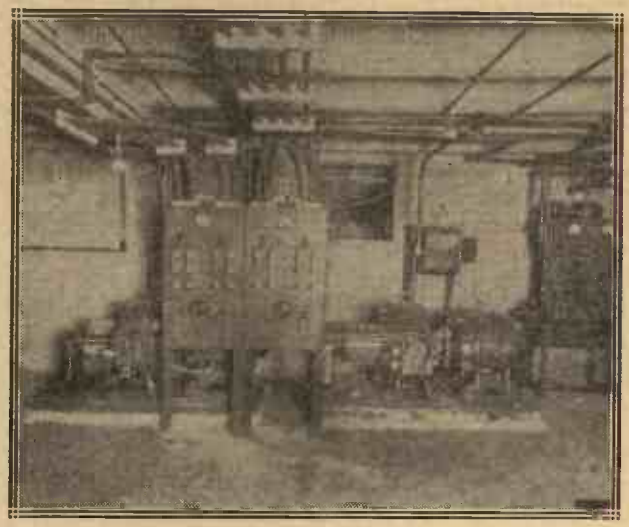
* * *

I WONDER how many listeners who complain of interference from ships' signals in the Channel and other places are sufficiently skilled to read the actual Morse code signals which so frequently spoil their reception? Prior to the advent of broadcasting, almost every wireless experimenter had a working knowledge of the code, and, owing to the high power used by many commercial stations and the good carrying power of Morse signals as against telephony, some wonderful reception records were made. With quite an average three-valve set, American high-power stations could be read at any hour of the day or night, while, after dark, Panama, the East Indies, and even the Pacific coast of the United States were well within receiving range. A well-designed crystal receiver would bring in, after dark, good, clear signals from ships and coast stations in the Mediterranean.

* * *

NOWADAYS, of course, no one ever troubles about anything but telephony. I suppose in a year or two's time we shall all be hunting for wireless pictures ! I can imagine an ardent experimenter adjusting this and touching that, and turning this knob ever so carefully, in an agonised endeavour to make a picture from, say, Constantinople clear enough to recognise what is going on. You may laugh, but such a day is not very far distant.

I believe even now the engineers of a famous American company are working in their laboratories upon wireless vision apparatus which has reached a most promising stage of development, and, as Rugby has already succeeded in linking up the United States for wireless speech, perhaps it will be the station through which transatlantic wireless pictures will first be transmitted and seen.



Special pains were taken in building the short-wave transmitter at KDKA to get all masses of metal away from the high-frequency apparatus. The power plant, etc., is placed underground.

AN APPRECIATION

SIR,—Please accept my most hearty congratulations on the new *Wireless Weekly*, and particularly on your new feature, "The Week's Diary."

It seems to me that a weekly review of such a *personal* type will have a very good effect, and that the persons likely to be mentioned in it will, to some slight extent, be careful not to put themselves "within the reach of the writer" by committing indiscretions of any kind.

It will be, in short, a restraining influence.—Yours faithfully,

R. L. BRONSON.

Shepperton.

NEXT WEEK.

Look out for the special set by Mr. Reyner incorporating the new screened coils. Remarkable results are being obtained with this receiver.

Operating the "Split-Coil" Set

By STANLEY G. RATTEE, M.I.R.E.

In these notes the author gives further hints and detailed instructions for working the interesting single-valve set described last week.

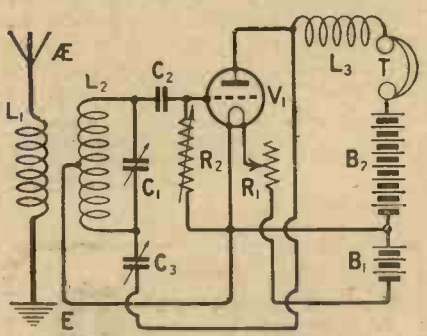
BEFORE attempting any distance work with a receiver of this type it is necessary to pay considerable attention to those adjustments which make for smooth reaction control. If it is found, for instance, that when adjusting the receiver to its most sensitive condition by means of the reaction condenser, a strong pop is heard in the telephones when the set is made to oscillate, and another pop is heard when adjustments are made to stop it, it will be extremely difficult to receive any but the local station, or the nearest of the more distant ones.

The Ideal

The ideal condition, and one which should be the ambition of all who make this set, is to so adjust the filament current and anode voltage until a suitable value for each is found where the reaction control results in the desired "sliding" effect. That is to say, reaction may be increased until the operator is almost unaware of the fact that he has passed the danger mark; during reception of broadcasting this fact would, of course, make itself manifest by distorted speech or music.

Voltages and Reaction Control

With a suitable valve inserted in the socket, such a valve being of the D.F.A.4, D.E.5B, etc., type for this particular receiver, apply, say, 60 volts high tension and light the valve. With these adjustments made it will probably be found that the reaction control, as stated above, is "floppy," as it is called. By reducing the value of the high-tension voltage, say, 3 or 6 volts at a time, the loudness of the pop will be reduced until a value of high tension is reached where the set will not oscillate at all. Between this value, therefore, and the original of 60 volts will be found the best voltage to allow of smooth control. In practice this value will be nearer to the lower reading.



The circuit of the receiver is reproduced for reference. It will be seen that a very simple reaction scheme is used.

Assuming that the best anode voltage has been found without in any way varying the filament current, a slight reduction in this also will bring about the desired effect of making the passage into oscillation almost inaudible in the telephones. Reducing the filament current too far will, of course, render the receiver insensitive and of little use for long-distance work.

Long Distance Hints

With the reaction control satisfactorily adjusted, so far as smoothness is concerned, throughout the full range of the grid tuning condenser, attention may then be given to the reception of distant stations.

It should be remembered that the smaller the plug-in coil in the aerial circuit the greater will be the selectivity of the set. At the same time, making the coil too small will result in a reduction of signal strength; the objective, therefore, is to find a size of coil which will bring about the desired degree of selectivity without unduly reducing the signal strength of the desired station.

The Aerial Coil

Probably the best way of determining the right size of coil to use is to start with a No. 35 coil, tune in the local station, noting the number of degrees of the grid-tuning condenser, over which signals may be heard. Replace the No. 35 coil with either a No. 30 or 25, observing that the local station may be heard over a narrower band on the grid-tuning condenser.

At this stage extreme care should be observed in noting whether there has occurred any serious reduction in signal strength when compared with that obtained when using the No. 35 coil. Should there be any doubt upon this point then the set should be tuned for a more distant station, when the difference in signal strength, if any, will be more noticeable.

The question of coil size, of course, cannot be settled for the whole tuning range: it will depend to some extent upon the frequency of the station to be received.

A Personal Case

On my own aerial, and upon another at Ealing, the desired amount of selectivity required to cut out London and receive Bournemouth is obtained when using a No. 30 coil, but since different aerial systems, different localities or different frequencies may require a different coil it is advisable to determine its size by experiments in order to obtain the best results.

When tuning, the movement of the grid-tuning condenser should be

(Continued on page 172.)

Peto-Scott's

introduce yet another revolutionary improvement

FOLLOWING hard upon the heels of the famous Peto-Scott Low-Loss H.F. Transformer used in the "Modern Wireless" Special Five and other well-known Receivers comes the new idea of copper shielded plug-in and interchangeable coils, developed by Mr. Reyner.

Cōpex Coils

(Pat. applied for)

can be used in aerial and h.f. circuits. Being fully shielded and earthed there can be no inter-action between coils neither can outside interference be picked up. Consequently the Set is wonderfully stable, infinitely more selective and capable of superior tone with a complete absence of mush. See this issue of "Wireless Weekly" for a technical explanation of the advantages of such coils. All coils are interchangeable on a standard five pin base. Copper unit and base 15/-. Plug-in low loss coils from 3/6 upwards according to wavelength. Write for full particulars.

PETO-SCOTT CO. LTD.

Head Office and Mail Order : 77, CITY ROAD, LONDON, E.C.1

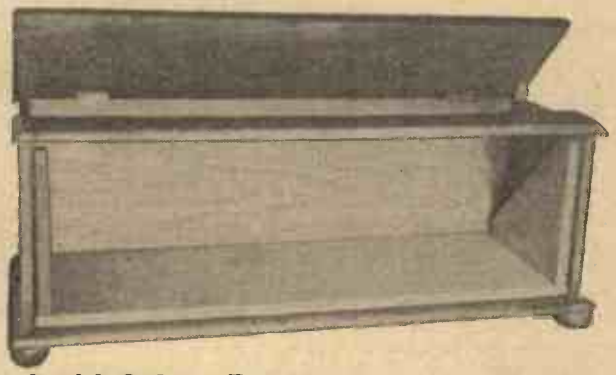
Branches :

LONDON : 62, High Holborn, W.C.1
WALTHAMSTOW : 230, Wood Street.
PLYMOUTH : 4, Bank of England Place.
LIVERPOOL : 4, Manchester Street.

P.S. 4846

CAXTON 4-VALVE CABINET

Made for Editor of Wireless Magazine for Set "As good as money can buy" described in issue February, 1925.



Cash with Order. Fumed Oak ... **£1 5 0**

or Real Mahogany polished **£1 14 0**

With detachable recess fitted Base Board to mount 21 in. by 7 in. panel to slide out of Cabinet front.

Extra 10/- with two beaded front doors totally enclosing fitted panel.

Cabinet overall length 22½ ins. Width 8½ ins. Height 9 ins.

Polished with the new enamel that gives a glass hard surface that cannot be soiled or scratched.

SENT FREE.—Catalogue of standard Wireless Cabinets in various sizes and woods. Special Cabinets made to customer's orders.

PACKED AND DELIVERED FREE IN U.K.

CAXTON WOOD TURNERY CO., Market Harborough

Britain's first Wireless Loud Speaker still leads

H1

THE success of the Brown runs parallel with the rapid growth of Broadcasting. Each year has seen the Brown more firmly established in public favour. Its long lead—for the Brown was the first Loud Speaker ever built in this country for wireless use—has never been seriously challenged.

Its unique internal construction makes possible a tonal purity and mellowness which must be heard to be fully appreciated.

Your Dealer will be pleased to demonstrate the Brown for you.

There are Eight Types of Brown Loud Speakers

Type H.1. 21 ins. high. 120 ohms £5 5 0 — 2,000 ohms £5 8 0 — 4,000 ohms £5 10 0

Type H.2. Height 12ins. 120 ohms £2 5 0 — 2,000 ohms £2 8 0 — 4,000 ohms £2 10 0

Type H.3. 15 ins. in height and in resistances of 2,000 or 4,000 ohms. £3 0 0

Type H.4. The smallest Brown Loud Speaker. Only 10 ins. high. 2,000 or 4,000 ohms £1 10 0

H2

Type H.Q. 20 in. high. Resistance : 2,000 or 4,000 ohms. £6 0 0

Type Q. 23 ins. high. In resistances of 120, 2,000, or 4,000 ohms £15 15 0

Cabinet Type In Mahogany or Oak Cabinet, 2,000 or 4,000 ohms £6 6 0

Crystavox The only Loud Speaker which works from a Crystal Set £6 0 0

HQ

—three types of Headphones

Type A. As used by the Admiralty 120, 2,000 or 4,000 ohms £2 10 0 — 8,000 ohms £3 0 0

Type F. Popular Broadcast type. Weight only 6 ozs. 2,000 ohms £1 0 0

Type A.2. The New reed-type, unequalled for sensitiveness. 2,000 ohms £1 10 0

and two Gramophone Adaptors

For converting your Gramophone into a Loud Speaker.

H.1 (2,000 ohms) £4 10
H.2 (2,000 ohms) £2 0

¶ If the Trade have difficulty in obtaining Brown Wireless Instruments they should write to us without delay.

H3

S. G. Brown Ltd., Western Avenue, N. Acton, W.3

Retail Showrooms :
19, Mortimer Street, W.1.
15, Moorfields, Liverpool.
67, High Street, Southampton.

Depots (Wholesale Only) :
13, Bushy Hill Road, Bristol.
Cross House, Westgate Road, Newcastle.

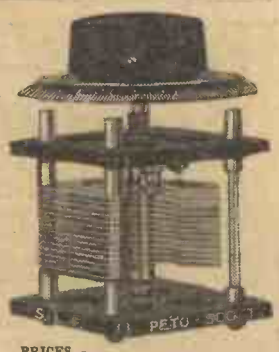
Scottish Depot :
120, Wellington Street, Glasgow.

Brown

Gilbert Ad. 4841

Be up to date!

—your old-fashioned and difficult-to-tune Set can be easily brought up to date by using these new Straight Line Frequency Condensers.



WITH ordinary Condensers you get the lower wavelengths crowded together in one section of the dial. Peto-Scott S.L.F. Condensers will space them out and enable you to log the difficult ones. Among their many excellent features are special low-loss ebonite end-plates, spiral contact, eliminating all noise, thick felt friction pads and 4 in. dial, to facilitate tuning. Fit these Condensers to your Set to-day—they take up no more room than your present type.

PRICES—
With helical 2 to 1 gearing and 0 to 360 degrees dial. .0005, 19/6 : .0003, 18/6. With direct drive, .0005, 15/-; .0003, 14/-

"Pilot Parts for the "Specially Selective" 2-Valve Set described in this issue

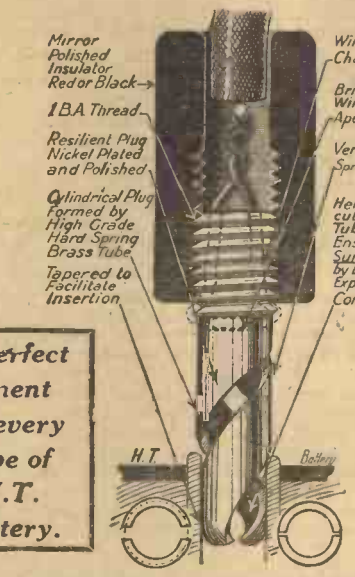
"Pilot" Type "B" Kit of Components comprise the following :—

1 each Peto-Scott Low Loss Square Law Condensers with 10—1 reduction gear, .0005 and .00025 mfd. respectively ..	£1	14	6
2 Peto-Scott Rheostats, 30 ohms	0	6	0
1 Back of Panel 2-coil holder, with long handle.. ..	0	6	0
1 Max. Amp. Blue Band L.F. Transformer	0	19	6
2 Benjamin Antimicrophonic Valve Holders	0	5	6
1 Dubilier 2 meg. grid leak and .0003 mfd. fixed condenser	0	5	0
2 B.M. Single Coil Holders ..	0	2	6
1 Dubilier Fixed Condenser, .001 mfd.	£0	3	0
1 Pair Aluminium Angle Brackets	0	2	6
1 Seven Terminal Strip with nickel terminals fitted ..	0	4	0
1 Three Terminal Strip with nickel terminals fitted ..	0	1	6
	£4	10	0
"Pilot" Panel, 16 by 8 by ¼ in., matted and drilled ..	0	10	6
Engraving extra, if required ..	0	3	0
Polished Mahogany Cabinet and baseboard ..	1	7	6

PETO-SCOTT Co. Ltd.
77, City Road, E.C.1.

Also 62, High Holborn, London, W.C.1.
Walthamstow : 230, Wood Street.
Plymouth : 4, Bank of England Place.
Liverpool : 4, Manchester Street.
P.S. 4846

CLIX
REG? TRADE MARK.
WANDER-PLUGS
(NON-MICROPHONIC)



A perfect fitment for every type of H.T. Battery.

PRICE: 2D. EACH

The diametrical expansion and compression of the CLIX WANDER-PLUG ensures rigid full-length, full-surface contact, with 90% of the efficiency of a soldered joint.

For all other connections use CLIX Plugsockets and adapters.
From all traders or direct from:
AUTOVEYORS LTD., 84 VICTORIA ST., LONDON, S.W.1

MAXIMUM Efficiency — Strength

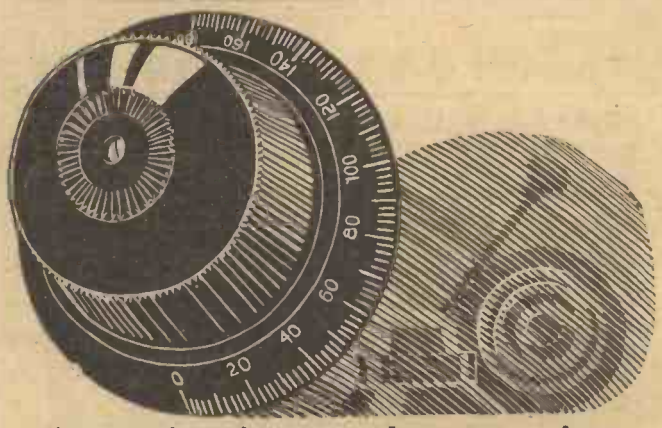
MINIMUM Capacity Damping Effects Resistance

Ask your dealer for one of these coils for test, or write direct to us if he does not stock them and you will find them as good as, if not better than, the most expensive coils on the market.

NOTE.—Special Short Wave Coils at bottom of List.

Coil	Wave Length using .001 Variable Condenser in Parallel MAXIMUM	MINIMUM	PRICE
25	395	190	2/4
30	435	240	2/4
35	515	360	2/6
40	680	370	2/8
50	835	485	3/-
75	1250	600	3/4
100	1820	815	3/10
150	2300	960	4/8
200	3100	1870	5/4
250	3750	2200	5/8
300	4500	2300	6/-
400	4950	2500	6/6
3	154	75	2/6
10	195	105	
13	225	125	

Manufactured by
THE
HAWK COIL CO., Ltd.
St. Mary's Rd. Surbiton, SURREY.



Among experimenters there are various shades of opinion on the best method of obtaining micro-selective tuning.

In advertising to readers of this publication the Pelican Univernier control we are confident that they will fully appreciate the value and efficiency of apparatus that is designed and constructed only after exhaustive experimental work and practical tests, and for these reasons we ask you to replace your present control dials with

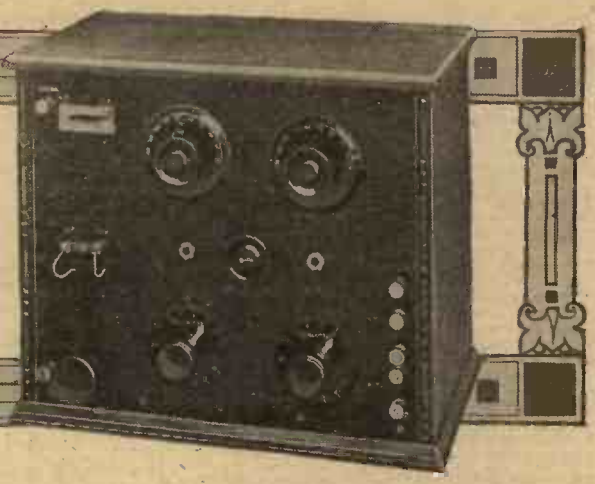
THE PELICAN UNIVERNIER

The Pelican Univernier does provide that super-fine adjustment essential to truly selective tuning

The price is 6/- and they can be obtained from all dealers, or if more convenient from

CAHILL & CO., LTD., 64, NEWMAN STREET, LONDON ——— W.1.

HF 26



Working Your Set

Reinartz reaction and tuning—A tuned-anode peculiarity — Neutralising a set — Alternative neutralising adjustments—Constancy of the neutrodyne setting

IT is fairly well known that the Reinartz method of capacity-controlled reaction has the advantage that the setting of the reaction condenser has very little effect upon the tuning of the grid circuit. When the capacity of the reaction condenser is increased, however, the frequency of the grid circuit *does* drop slightly, and a certain amount of care must be used for the efficient tuning-in of telephony.

Probably the best method is to tune the grid circuit, when the set is not oscillating, to a frequency slightly *higher* than that of the desired signal, then "bringing up" the reaction control till the set almost, but, of course, not quite, oscillates, when the tuning will be accurate. The amount of de-tuning necessary to compensate for this change will soon be performed automatically.

A Tuned Anode Point

A curious phenomenon is sometimes noticed in operating a tuned anode receiver, which is apt to prove rather puzzling at first. What happens is something like this: one tunes in a distant station and notices that the settings upon the two dials, namely, the aerial and the anode tuning condenser dials, are, perhaps, 28 deg. and 40 deg. for the best results. Now, it may be noticed that if the first dial is set to 30 deg. and the second one to 38 deg., the signals of the same station will come in again, at somewhat reduced strength, but, nevertheless, quite audibly.

Further, it may be discovered that one appears to have struck an actual position of "maximum signals" upon each of the dials, and it is only on gradually reverting to the other pair of settings that one finds an improvement in signal strength. It is quite a common thing to find a number of pairs of readings like this, other than the correct ones, which are capable of giving reception of a sort from the desired station.

A Troublesome Effect

The effect is more pronounced in some sets than others, and it may even become something of a nuisance when one is searching for a distant station. It becomes quite disconcerting to discover that one can pick up a distant station, receive it at fair strength, and then discover that another pair of settings for the two dials will give very much better results.

"Increase the reading of the aerial condenser in steps."

Probably the best procedure to adopt when it is found that this effect is present to a troublesome extent is the following one: having discovered a pair of readings which give audible signals from the desired station, decrease that of the aerial tuning condenser by, say, 2 deg., and then proceed to revolve the anode tuning condenser until another position is found which gives the same signals once more. If they are now heard more strongly, make a further alteration in the same direction upon the aerial condenser, again retune upon the anode condenser, and note whether improvement is again the result. Proceed in this way until a point of maximum signal strength is discovered, which begins to fall off once more as the alteration in dial settings is carried further.

A Test

If it is found that signal strength diminishes as soon as any alteration is made in the way indicated, reverse the proceedings; that is to say, *increase* the reading of the aerial condenser in steps, and note whether improvement now takes place. If a reduction is again apparent, it is probable that the original settings were the correct ones, and evidently no alteration is needed.

Neutrodyne Performance

The ideal neutrodyne receiver is one in which the adjustment of the neutralising or stabilising condensers holds good over the whole of the tuning range of the set, and this is a state of affairs which is closely approached by a really good set. In even the best sets, however, there are variations of performance according to the methods adopted in carrying out the initial neutralising, and there are certain points which deserve consideration in this connection.

In very many neutrodyne receivers it will be observed in carrying out the neutralising operation that there are two possible settings for the neutralising condensers. What happens is something like this: upon setting the neutralising condenser or condensers to their minimum position, the set probably oscillates fairly strongly. Upon now increasing the capacity of the neutralising condenser, the oscillation becomes weaker, and finally, at a certain capacity, stops.

Over-Neutrodyning

If this adjustment is found to hold over the complete tuning

WORKING YOUR SET
(Continued)

range, one may regard the set as satisfactorily stabilised, and proceed to operate it. If, however, out of curiosity, the increase of capacity on the neutralising condenser is continued still further, it is quite possible that it will be discovered that beyond a certain point the set commences to oscillate once more, and oscillates more and more strongly as the capacity of the condenser is increased. This is the condition referred to as "over-neutralising," and it at once opens up the possibility of a second position for the neutralising adjustment; that is to say, one can set the neutralising condenser to a capacity just short of that at which the set once more commences to oscillate.

A Useful Point

This point is one which is worth investigating in any given neutrodyne circuit in which it is found to be present, since the two possible neutralised points are often possessed of different characteristics. For example, in one set in which the test was recently made by the writer of these notes, it was observed that when the set was adjusted to the point just short of over-neutralising—that is to say, to the point at which oscillation was just about to commence once more—the adjustment was much more constant over the tuning range than the alternative one.

As a matter of fact, the set in question was not a particularly satisfactory one, and did not hold its neutrodyne adjustment at all well with the normal adjustments. With the second method of neutralising, however, it behaved quite reasonably well.

SELECTIVITY WITHOUT H.F. STAGES
(Continued from page 161)

band; should any trace of "overlap" be present, assuming that the correct H.T. and L.T. voltages are in use, and also the correct value of grid-leak, the reaction coil is probably too large. A 35-turn coil was found by the writer to be quite large enough.

Of course, the smaller the size of the portion of the secondary coil that is coupled to the reaction coil, the greater will the ease of adjustment be.

Conversely, the smaller the amount of the secondary coil coupled to the aerial, the greater will be the selectivity. This is, however, normally controlled by the coupling between the two coils on the left of the receiver, so that it is wise to couple as little of the secondary coil to the reaction coil as is possible to ensure easy control, and to depend on angular adjustment in the other case.

Refinements

Having now got the set to function properly, a further increase in selectivity may be obtained by auto-coupling the aerial to the primary coil. This may be done by means of a Lissen "X" coil, or by one of the many centre tapped coils now available, if a small series fixed condenser (.0001) is placed in the aerial lead to the set. Alternatively, this separate primary may be dispensed with altogether, and an "X" coil may be used for that portion of the secondary that is not coupled to the reaction coil.

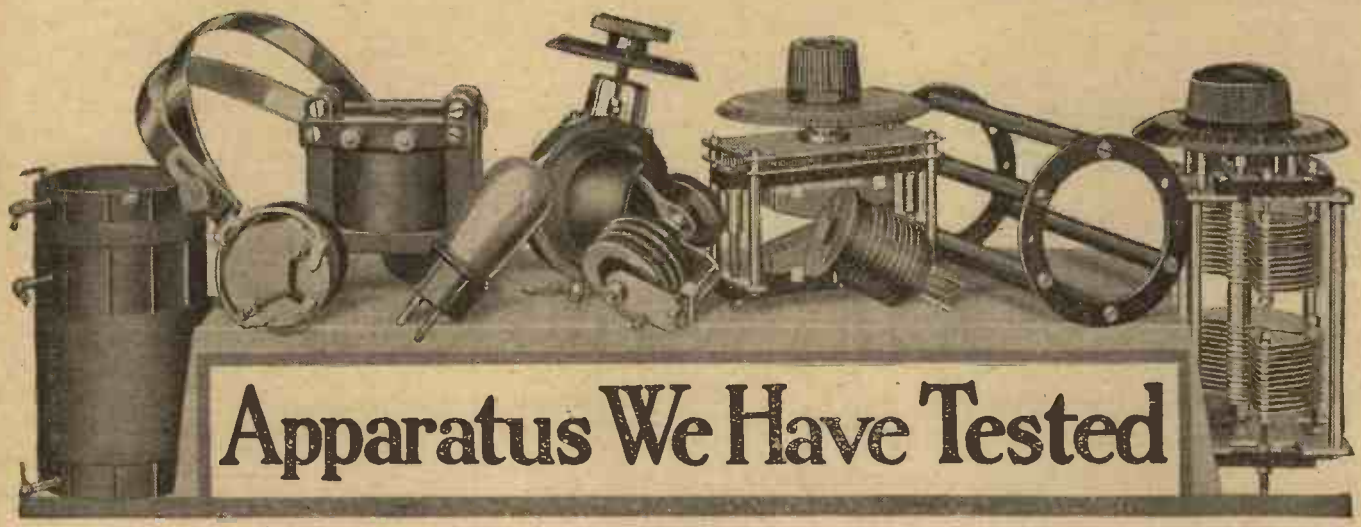
Valves and Voltages Used

In view of the comparative absence of the usual damping effect of the aerial upon the secondary circuit as a whole, it will usually be found extremely easy to make this receiver oscillate. For this reason the writer usually employs dull-emitter valves of the .06-ampere type, with a fairly low H.T. voltage on the detector. On the actual tests 22½ volts was employed as the anode potential for the detector, with about 100 volts on the L.F. valve. About 4½ volts negative were applied to the grid of the amplifier.

Results

In use under these conditions, the receiver gave good headphone strength on Bournemouth, Manchester and Glasgow, with only the merest trace of 2LO in the background, the angle of coupling between the primary and its portion of the secondary being about 45 degrees. The coils then in use were as mentioned earlier in the article. Several foreign stations were also received on headphones, while very good loud-speaker strength was obtained from 2LO, the writer's distance from the latter station being about six miles.

(Further operating notes, results, and the test report of the *Wireless Weekly* laboratories will be given next week.)



Apparatus We Have Tested

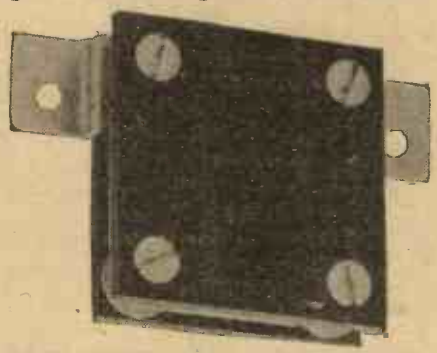
Conducted by the Radio Press Laboratories, Elstree.

Fixed Air Condenser

We have received from Messrs. The Baltic Radio Co., Ltd., one of their fixed air condensers. The plates of this condenser are of stout brass sheet, and solid lugs are provided for connecting. It is mounted between two ebonite end plates, the size of the component being 1¼ in. square and less than ½ in. thick. Its rated capacity is 50 micro-micro-farads, and on test its actual capacity was found to be 47. Its losses are negligible, and it is a neat and compact component which would appear to be suitable for short-wave work.

Repaired Valves

We have received for test from Messrs. Radion Valves Co., Ltd., a valve repaired by their special process. No rating was given for this valve. It was tested at a filament potential of 3.8 volts, under which conditions it passed a current of .6 amps. With an anode potential of 80 volts, an impedance of 50,000 ohms was obtained with an amplification ratio of 11.5. It was noted, however, that a positive potential of 1 volt had to be applied to the grid in order to get on to the centre point of the straight part of the characteristic.



Messrs. The Baltic Radio Co., Ltd., produce a fixed air condenser.

When placed in a test set it was found to function satisfactorily as H.F. amplifier and detector, but results as an L.F. amplifier were distinctly bad, as would be expected from the results obtained above.

A repaired valve submitted by Messrs. Radion Valves Co., Ltd.

Double-Grid Valves

We have received samples of their double-grid valves from Messrs Radio Valves, Ltd. These are of the bright-emitter type passing .47 amps. with a filament potential of 3.5 volts. They are intended for general-purpose work, the function of the inner grid being to reduce the space charge, thus allowing a considerably lower plate potential to be used. Although there are no data accompanying these valves, it is usual for them to be employed with 10 to 12 volts on the inner grid, and 10 to 12 volts on the plate for amplification work, lower voltages being used when the valve is being used as a detector.

The samples submitted did not show very great uniformity, although one gave an impedance of 11,000 ohms and the other 9,100 ohms. The amplification ratio in the first case was only 3.7, while in the second case the figure obtained was 5.5.

When tried out in a test set, these valves were found to function satisfactorily as detectors with inner grid and plate connected to L.T. positive, no external positive potential being applied. With 6 volts on the plate and inner grid quite fair results were obtained in an H.F. amplifier, an excellent silent background being obtained. The set, however, was not found to be so selective as with other valves. With only 6 volts on the plate and inner grid results on the L.F. side

This double-grid valve, which is a product of Messrs. Radio Valves, Ltd., employs a terminal on the metal cap for connection to the inner grid.

APPARATUS WE HAVE TESTED—(*Continued*)

were not found to be too good, but with 12 volts on inner grid and plate, and a suitable negative potential on the outer grid, quite good results were obtained when compared with general purpose R type bright-emitter valves.

It was noticed that the valve pins badly needed opening out, and that even then they were not a very good fit in the valve holder. The usual type of four-pin mounting was employed, the inner grid being carried to a terminal on the metal cap of the valve, so that these valves can be used in existing sets without alteration.

Low Loss Coils

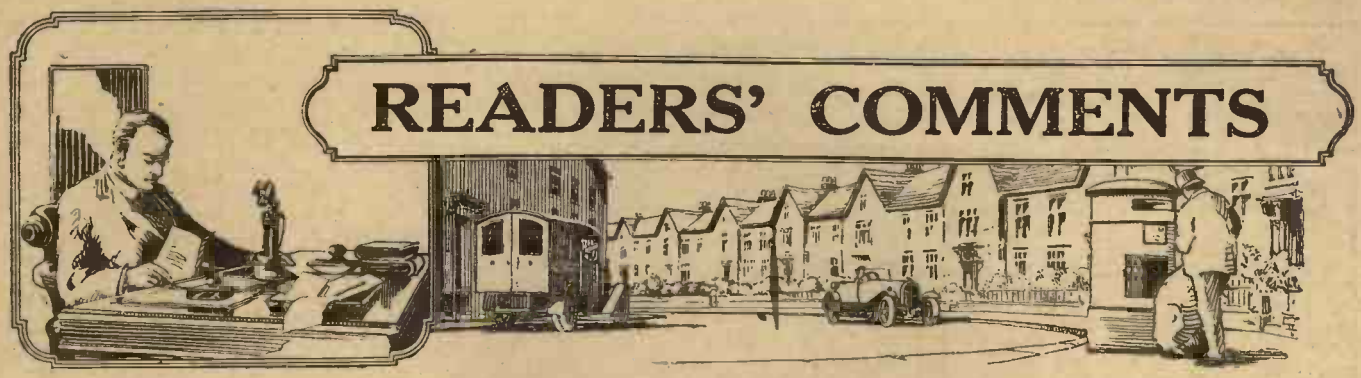
We have received from Messrs. The Norman Radio Co., Ltd., several of their low-loss coils.

These are of the pancake type, being wound on special slotted X formers

The Norman Radio coil possesses a low-capacity mounting.

made of black insulating material. They have special low-capacity mountings, but adapters are provided by which they may be inserted in the usual coil holder. The largest of the coils submitted consists of four of these pancake coils connected in series, and is wound to cover a range of frequencies from 857 to 577 kc. (350 to 520 metres) in the aerial circuit.

The high-frequency resistance of these coils is satisfactorily low, and they certainly provide an efficient coil for the broadcast band. They are specially suitable, however, for the shorter waves, owing to the absence of dielectric, and the special low-capacity mounting is also an advantage in this case.



READERS' COMMENTS

"Press Stunts"

SIR,—Under the heading of "Press Stunts" in the issue of your journal for March 10, one of your correspondents gives one the impression that owing to the existence of the technical wireless Press he is enabled to keep cool and "see through" the scares published by the daily papers.

I venture to suggest that there are a great many people in this country who treat wireless as part of their daily life, and a great many more who are contemplating the installation of receivers as permanencies in their homes, and that these people would be quite right in resenting the name of "radio-fan" as applied to them.

Even if all the owners of wireless sets are subscribers to one or more of the technical journals—a supposition which is doubtful in the extreme—the psychological effect of scare headlines in the morning paper is quite sufficient at least to make them feel uneasy.

My main point is that this uneasiness must inevitably react on the wireless trade. People will not buy sets or even parts for them if they are led to imagine that the period of usefulness of such apparatus is likely to be limited. For this reason alone, particularly at the present time, I am fully in support of Mr. Henson's contention that these Press stunts can do a great deal of harm.—Yours faithfully,

J. LOWINSON.

Kettering.

Series Tuning and H.F. Resistance

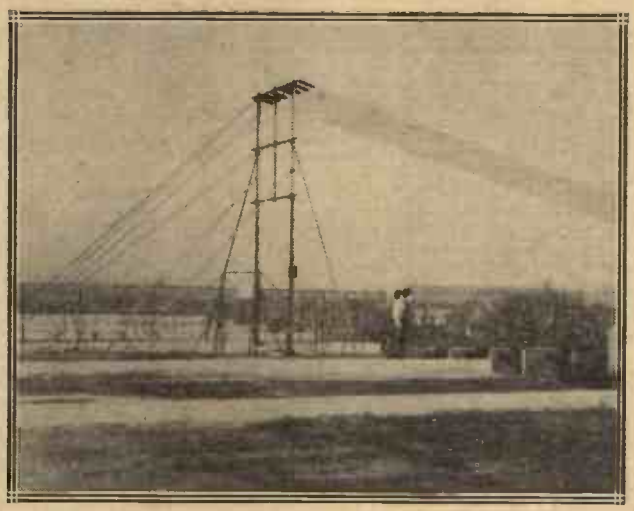
SIR,—In your "Notes on Practical Matters" on page 126 of the March 10 issue of *Wireless Weekly* you make a statement about series aerial tuning condensers which I fail to follow. In advising experimenters not to use a variable series condenser below about 20 or 30 deg. on the dial scale, owing to the consequent weak signal strength, you give as the reason the fact that the H.F. resistance of a variable condenser increases seriously on the lower scale readings.

Now, surely in this case you are neglecting the combined effect of the capacity and inductance in series. When a capacity and an inductance are connected in series, the impedance of the combination is lower than that of the inductance alone, and the impedance is directly proportional to the value of the series capacity. It appears to me, therefore, that at low readings of a series condenser, in the case under discussion the impedance of the aerial circuit will be lowered, with a consequent increase in the efficiency of the circuit. The fact that this is not borne out in practice does not help to explain to me the apparent conflict of theories.—Yours faithfully,

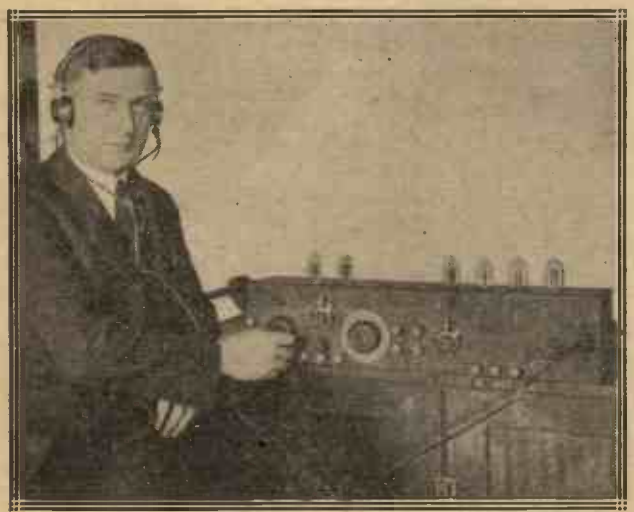
G. C. MORTON.

Bath.

[EDITORIAL NOTE: Our correspondent is confusing H.F. resistance and such factors as impedance and reactance. Every condenser can be regarded as an equivalent resistance, the value of which is fixed by the condenser losses. It has been shown that at low dial settings the H.F. resistance rises to an abnormally high value, and this effect is independent of such matters as tuning.]



A view of the aerial of the well-known French broadcasting station, "Ecole Superieure," which is noted for its dramatic broadcasts.



The original superheterodyne receiver invented and built by Major E. H. Armstrong in the Signal Corps Research Laboratory at Paris during the War, is still in use at Washington. Major J. O. Mauborgne is here seen operating the set.

USING THE NEW SCREENED COILS

(*Continued from page 149*)

Thus the only effect of the insertion of the wave-trap has been to remove the trouble to a different position. The circuit in Fig. 4 illustrates a simple receiver employing Reinartz reaction with a wave-trap inserted in the aerial circuit. The new type of screened coil may be satisfactorily employed in a case like this, and good results are obtained.

Wiring Couplings

A point which has been brought out in the preliminary experiments so far conducted in this direction is one of considerable interest. A test receiver was made up, employing a high-frequency amplifying valve, a detector, and a note magnifier, the two tuned circuits incorporating screened coils such as those described. Although the screening improved the selectivity to an appreciable extent, it was thought that there was something lacking, and that the results were not quite up to the theoretical expectations.

Further investigations showed that this was due to stray couplings between the various portions of the wiring and also to a certain direct action of the incoming signal on the circuit. The total effect was that there was a residuum of 2LO left, even when the condenser was mistuned to an appreciable extent, so that, although the actual tuning to the maximum signal was very sharp, it was not possible to eliminate the interference of the local station quite as easily as the sharp tuning led one to suppose.

An Important Point

This is a very important point, which illustrates that selectivity is not necessarily a matter simply of obtaining low-loss tuning coils and tuning circuits generally, but it is also very much a question of getting rid of residual effects which have just been described, and experiments are proceeding in this direction at the present time. It is not until one employs the screened coil that such effects as this become noticeable, because with the ordinary type of coil there is sufficient magnetic coupling between the various parts of the circuit to give rise to all kinds of peculiar effects such as this.

Marked Improvement

With a screened coil, on the other hand, the coupling between the two circuits is negligible if the wiring is carried out in a correct manner, so that it becomes comparatively easy to locate the trouble definitely, after which the remedy is soon forthcoming. It should not be forgotten that the use of an earthed screen such as that described also eliminates the electrostatic coupling between the coils themselves, so that the only coupling left is that due to the valves, the wiring and other components in proximity.

It will be obvious that the use of these screened coils is increasingly valuable as the number of valves in the circuit is increased. Thus for a receiver employing two stages of high-frequency amplification, the improvement due to the elimination of all external magnetic fields becomes very marked.

Possible Variations

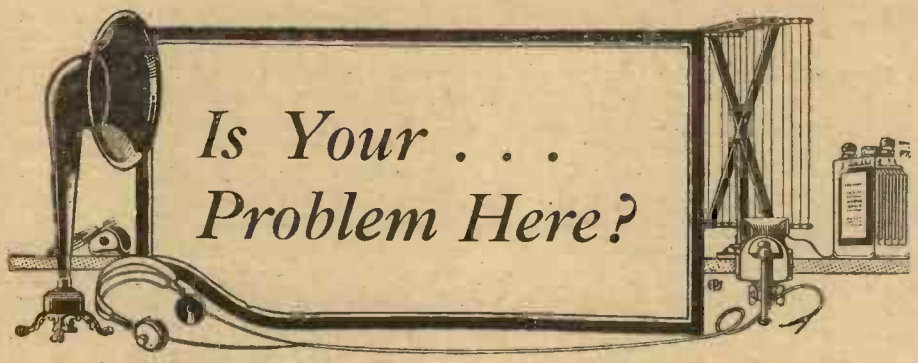
As has previously been indicated, these circuits are not the only ones that can be used, and there are a very large number of different types of circuits which can always be employed with the screened arrangement, because it is possible by simply removing the screen to change or alter the coil in any way desired.

In the next issue I hope to describe a receiver which has been made up at the Elstree Laboratories incorporating two of these new screened units, which is giving very remarkable results, while the question of the elimination of the residual effects when eliminating the local station is one which is receiving consideration, and will shortly be discussed in greater detail.

Apparatus Received for Test

"Rectalloy" Battery Charger

We have received for test from Rectalloy, Ltd., a sample of the "Rectalloy" battery charger. This instrument is designed for the charging of accumulators from alternating current mains. A low charging rate is employed, so that if the accumulator is used for running the receiver during one evening it is claimed that it can then be placed on charge and safely left till the following evening, by which time it will be once more ready for service. It is further stated by the manufacturers that the cost of charging is very low. (A cost of 3d. a day was quoted erroneously in an advertisement in *Wireless Weekly* for March 3, whereas this should have been 3d. a week.) A test report of the "Rectalloy" charger will appear in a future issue.



A Wiring Point

"I have frequently heard people say that the use of square section wire results in serious losses. On the other hand, experienced constructors tell me to use square wire in preference to that with an insulating covering. I have seen both types used in sets published by well-known designers, and I shall be glad if you could tell me which is the better?"

It has certainly been pointed out from time to time that the use of square section wire in high-frequency circuits is undesirable on account of the sharp bends and corners produced by its use. This, however, is fallacious when applied to receivers, since the argument was only intended to apply to the case of high-power transmitting circuits dissipating a considerable amount of energy. In such circumstances it is quite possible that a Corona discharge would occur in the neighbourhood of sharp bends and so forth, but in a receiver no measurable difference in the results will be distinguishable between round and square section wire.

The use of wire with some sort of insulating covering is very often a great advantage, since the risk of burning out valves produced by two wires touching is eliminated. This is especially helpful to the novice with but little experience in wiring up receivers. On the high-frequency side, so long as reasonable spacing is allowed between different leads, there should be no difference between the results obtained with covered and with bare wire.

In the hands of a beginner there is no doubt whatever that the covered wire is the safer type to use. It may be said that, in general, the question of which type to use is solely one of personal preference.

Filament Sag

"Does it matter whether a valve is placed vertically or horizontally in laying out a receiver?"

The answer to our reader's question depends upon the type of valve to which he is referring. For example, the popular "R" type valve has, in some makes, a horizontal filament, and should really be placed in such a position that the filament is vertical. Many dull-emitter valves, such as those of the D.E.3 type, have vertical filaments, hence the valve itself can be placed in a vertical position. Placing the valve in a position with the filament horizontal increases largely the danger of the filament sagging on to the grid, and in this way rendering the valve valueless. A large number of valves have a "V" or loop filament, one example being those of the type especially designed for low-frequency amplification, such as the B.T.H. B.4, Marconi or Osram D.E.5 and others. The mechanical construction of this type of filament seems to be of such a nature that the position of the valve in the set is of little consequence, but it would seem to be a wise plan, in order to give the valves a fair chance of working efficiently for a prolonged period, to mount them in a vertical position.

OPERATING THE "SPLIT-COIL" SET

(Continued from page 164)

very slow, otherwise it is possible the desired station may be missed.

The Reaction Condenser

So far as the reaction condenser is concerned, it will be found that by turning this in a *clockwise* direction the set may be made to oscillate. Further, with the grid-tuning condenser set at its full capacity, it will require most of the reaction capacity to bring about an oscillating condition; similarly, with the grid-tuning condenser set to its minimum value, considerably less of the reaction capacity will be needed to make the set oscillate. These points, though small, when committed to memory, will add considerably to the possibilities of distance work with a simple receiver of this type.

The Author's Results

The aerial conditions under which the set has been used for some time are very far from ideal—indeed, the aerial itself is badly screened—and the actual locality is a quarter of a mile away from one of the two hundred odd feet towers of the Crystal Palace, the garden of the house lying within the shadow of the North Tower.

Using the receiver in this locality with a D.E.5B valve and a No. 30 coil for L1, the local station (2LO) is easily cut out and Bournemouth received at good telephone strength. Of the other B.B.C. stations, Birmingham and Newcastle are also regularly received at a strength for comfortable telephone work.

So far as the Continental stations are concerned, the following are received under the same conditions, with quite easy operation and at good strength :—

Radio - Belgique, Radio - Berne, Hamburg, Kiel, Bremen and Radio-Toulouse. Another station which can be received at good strength is that of the Radio Journal, Prague.

At Ealing

In the hands of another operator the set used at Ealing gives even better results, the valve used being a D.E.3B and a No. 30 coil for L1. The selectivity of the set in this locality and with that particular aerial is again very good.

Other stations received in that locality are as follows :—

Birmingham, Belfast, Bournemouth, Manchester, Newcastle, Radio - Belgique, and several amateurs.

As an indication of the condenser settings for these stations, the following table will prove useful, though it must be remembered, of course, that some small variation from these figures is likely in all copies of the original set.

Station.	Condenser Reading.
5IT.	62 deg.
2BE.	56 deg.
6BM.	48 deg.
2ZY.	46 deg.
2LO.	43 deg.
5NO.	57 deg.
Radio-Belgique.	27 deg.

Elstree Test Report

The "split-coil" set underwent the usual tests prior to publication, and the results indicate that the method of reaction control is an advantageous one.

The selectivity of the receiver can be described as very good for a circuit of this type, and it was found possible to receive Bournemouth, with London only just audible in the background.

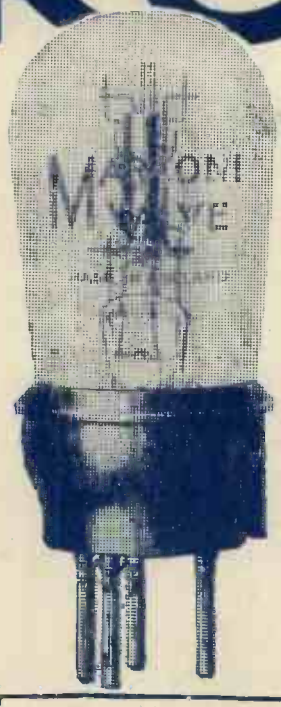
Stations heard included Birmingham, Bournemouth, Aberdeen and Nottingham (relay).

MARCONI VALVES

THE MARCONI TYPE D.E.3

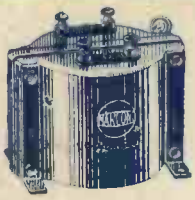
Use the MARCONI D.E.3 Dull Emitter for economical working. Equally suitable as a Detector or L.F. or H.F. Amplifier. Current consumption 0·06 amps. For use with a 4-volt accumulator or 3 dry cells.

Write for Valve Publication No. 443A



The name MARCONI on a Valve is a guarantee of outstanding performance, sound design and extreme durability. The best known experimenters and the principal Broadcasting stations of the world are equipped with MARCONI Valves.

Write for Publication No. 364F.



Marconiphone IDEAL Transformers.

Each transformer guaranteed to comply with the curve supplied with it.

Type	"A"	ratio 2·7 to 1	Price 30/-
"	"B"	" 4 to 1	
"	"C"	" 6 to 1	
"	"E"	" 8 to 1	

Junior Model. New reduced Price 21/-

Sterling "Miniloss" Square Law Variable Air Condenser

Made in three capacities:

·00025 mfd.	Price 21/-
·0005 mfd.	Price 24/-
·001 mfd.	Price 30/-

Marconiphone High Frequency Choke

For Coupling H.F. circuits. Suitable for all wavelengths up to 4,000 metres.

Price 10/6

MARCONIPHONE WAVEMETER

Enables any station to be identified without waiting for its call sign.
Range 300-500 metres.
Not recommended for Crystal Sets.
Price complete with Dry Cell

£3 : 7 : 6

Marconiphone "Velvact" Potentiometer.

Perfectly silent and smooth in operation. Price 9/-

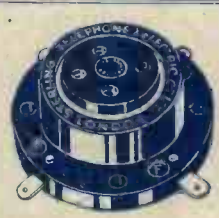
Marconiphone Auto Series Parallel Variometer

Entirely new pattern. Without any condenser and connected to 100 ft. aerial, it covers wavelengths 230-1630 metres. With a ·001 Condenser in parallel wavelengths up to 3380 metres may be received. Price 16/-

Marconiphone *and* STERLING COMPONENTS

THE MARCONIPHONE COMPANY, LIMITED

Head Office: 210-212 Tottenham Court Road, London, W.1. *Reg. Office:* Marconi House, Strand, London, W.C.2. Branches throughout the U.K.



Sterling "Non Pong" Shock Absorbing Valve Holder

Does away entirely with all microphonic noises.

Price 3/6

Published by the Proprietors, RADIO PRESS, LTD., Bush House, Strand, London, W.C.2, on Wednesday of each week, and printed for them by THE AVENUE PRESS (L. Upcott Gill & Son, Ltd.), 55-57, Drury Lane, W.C.2. Address for Subscriptions and Editorial Communications:—Bush House, Strand, London, W.C.2. Address for Advertisements:—ADVERTISEMENT MANAGER, "Wireless Weekly," Bush House, Strand, W.C.2. Registered as a newspaper and for transmission by Canadian Magazine Post. Subscription rates:—U.K., Canada and Newfoundland, 17/4 per annum; other countries, 19/6 per annum. Sole Agents for Australasia:—GORDON & GOTCH (Australasia), LTD. For Canada:—IMPERIAL NEWS, LTD. For South Africa:—CENTRAL NEWS AGENCY, LTD.

Wireless Weekly. March 24th, 1926. 3d.

Wireless Weekly

Vol. 8. No. 6.

THE 100% VALVE PAPER

A LONG-RANGE SCREENED-COIL SET

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

FULL DETAILS OF THE FIRST RECEIVER EMPLOYING THE NEW COILS

A Filament that can be tied in knots after 1000 hours life

A FILAMENT that remains ductile so that it can be tied in a knot after 1000 hours life is an achievement that assures

VASTLY INCREASED VALVE LIFE

This wonderful filament is the key feature of Mullard P.M. Valves. In Mullard P.M. Valves the filaments are so economical that *no glow is visible* during operation, and they require

ONLY ONE-TENTH AMPERE

In addition the reception they give is free from all microphonic noises.

If you use a 4-volt accumulator or 3 dry cells

ASK FOR THE P.M.3 . . . . . 16/6
A general purpose valve for every circuit

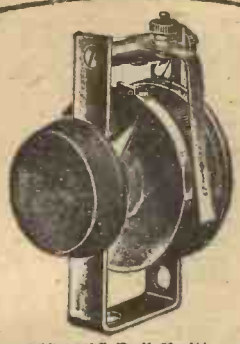
ASK FOR THE P.M.4 . . . . . 22/6
The finest loudspeaker valve ever produced

GET THEM FROM YOUR RADIO DEALER

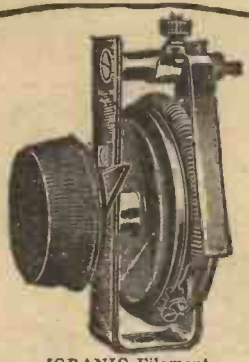
Mullard

THE·MASTER·VALVE

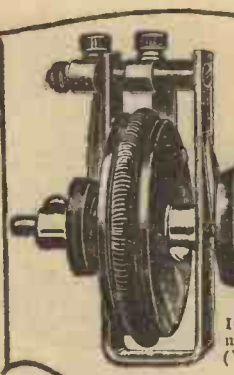
ADVT. THE MULLARD WIRELESS SERVICE CO., LTD., BALHAM, LONDON, S.W.12.



IGRANIC Dull Emitter Rheostat, 20 or 30 ohms. (Pat. No. 218604).



IGRANIC Filament Rheostat (Plain Type). (Pat. No. 195903).



(Pat. No. 195903).

IGRANIC Filament Rheostat (Vernier Type).

Smooth filament control lengthens the life of your Valves

With the Igranic Wire-wound Rheostats the resistance variation is continuous, regular and silent over its whole range. There are none of the dangerous flickerings and uneven fluctuations so often experienced with many wire-wound and carbon Rheostats.

You can build the same Igranic Rheostat into each succeeding receiver you construct and always get the smooth, even and noiseless variation which gives perfect filament control and lengthens the lives of your valves.

Ask your Dealer.

Plain Type (4, 6, 8 or 10 ohms resistance)	3/6
Vernier Type (4, 6, 8 or 10 ohms resistance)	5/6
Dull Emitter Type (20 or 30 ohms resistance)	5/6

IGRANIC ELECTRIC COMPANY LIMITED

Write for List Y 82

Exclusive Manufacturing Licensees of Pacent Radio Essentials.

149, Queen Victoria Street, London.
Works: BEDFORD.

Plug this in for better H.F. amplification

No variable condensers or extra controls are needed across Magnum Aperiodic H.F. Transformers. Perfectly stable and efficient amplification is obtained and signal-searching simplified. Connections made the same way as with the tuned type of H.F. Transformer, variable condenser being omitted.

These Transformers are invaluable in Super-Heterodyne Sets, a stage before the first detector giving greatly increased range and selectivity.

Magnum Aperiodic H.F. Transformers

as used in Radio Press sets.

No. 1. Aperiodic—300—600 metres
No. 2. " —550—1,200 "
No. 3. " —1,100—3,000 "

Price each 10/-

The New Magnadyne Super-Het., an improved design incorporating several unique features, will be ready shortly. May we register your name for particulars when it is ready?

Latest Lists, dealing with 15 Radio Press Sets and illustrated Catalogue, sent on receipt of stamp

BURNE-JONES & CO., LTD.,

Magnum House, 296 Borough High Street, London, S.E.1.

All Post Free & At Callers Prices

Orders 5/6 value carriage paid.

Under 5/6, 2d. per 1/- for packing, etc.

MARK OF RELIABILITY

Ebonite Panels.

Matt.	¼"	3/16"
9×6"	2/2	1/10
12"×9"	4/6	3/9
12"×12"	5/9	5/-
15"×9"	5/6	4/9
15"×12"	7/6	5/8
4"×4"	8d.	6d.
7"×5"	1/6	1/2
6"×6"	¼" 10d.	

Any size cut. Sq. in., ¼", ⅜", ½" 1d.
NO ADVANCE.

Square Law Var. Condensers with knob and Dial.

.001 panel type 6/6
.0005 .. .. 5/-
.0003 .. .. 4/6
Vernier Blade extra 1/4
"J.B.," "Ormond" & "Utility," usual prices.
Vernier no dial.. 2/6
5 vane, 3/3; 7, 3/6
Polar types 10/-
NO EQUAL.

SEND FOR NEW FREE *Comprehensive Price List.*

TRADE ENQUIRIES INVITED *Generous Terms · Prompt Service.*

Aerial Wire 7/22's
Enamelled. Bright.
100" 3/3 2/3
" Electron 1/8
Shell Insulators 3d.
Lead-in Tube, 9", 1/-

Coil Holders.
Reliability Vernier 3/6
"Lotus" 2-way 7/-
"Newey" 2-way 6/-
"L. & P." 2-way 8/6
"Polar" " Cam Vernier .. 8/-
"Sullivan's" 120-Ohm Phones, ex-Govt., 4/6

Fixed Condensers.
Dubilier McMichael's, Mullard, Edison-Bell, Lissen (usual prices)
New Mansbridge, 2 mfd., 3/6, 1 mfd., 2/6.

British Wires.

swg.	.dcc.	.ssc.	.dsc.
18	1/11	2/11	3/5
20	2/2	3/4	4/2
22	2/6	3/9	4/7
24	2/11	3/10	5/-
26	3/4	4/2	5/9
28	3/9	4/9	6/6
30	4/10	5/4	7/6
32	5/6	6/-	8/9
36	8/-	9/6	12/-
40	17/-	14/8	20/-

"RELIABILITY" Wireless Cabinets at BARGAIN PRICES.

FUMED OAK. HAND POLISHED.

12"	14"	18"	21"	24"	28"
14/6	15/-	16/-	17/-	18/-	19/-

Polished Mahogany, 1/- extra.

For panels 7" high; width back to front: three largest sizes 9", others, 8"; sliding baseboard; aperture at back, 9"×2", allows for terminals strip screwing at back of baseboard, assisting ease in wiring.

Transformers L.F.
Radio Inst. 25/-, 27/6
Igranic 21/- & 26/-
Ureka No. 2 21/-
" Concert Grand 25/-
" Baby Grand 15/-
Ferranti A.F.4 17/6
" A.F.3 25/-
"H.T.C." (Empire) 7/6
Formo shrouded, 10/-
McMichael H.F. 10/-
" Dimic " coil, 10/-

H. T. Batteries.
With Wander Plugs.
90v., 11/-; 60v., 7/6; 36v., 4/6; 15v., 1/10
4½v. F.L. Btry., 4d.; 66v. Ever-Rdy, 12/6
36v., 8/-; 16v., 3/6.

"Special Values."
Wates Microstats, 2/9
Mellowtone C'pler, 5/6
Liberty Detector, 3/6
Lissenola Unit, 13/6
Voltmeter 0 to 6v., 3/6
Antipong V-holder, 1/6
Hand Drill, 3/6
6 Drills 1/-

New Edition RELIABILITY WIRELESS GUIDE, No. 2 Ready. Have you got one? IT'S FREE.

J. H. TAYLOR & Co.

5 RADIO HOUSE.
MACAULAY ST., HUDDERSFIELD
Tel' 341 Grams: "THOROUGH" HUDDERSFIELD

Wireless Weekly

Phone: City 9911

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

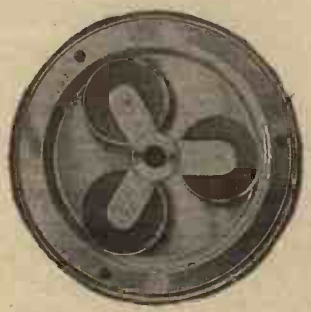
RADIO PRESS, LIMITED, Bush House, Strand, London, W.C.2

Specify BURNDEPT COMPONENTS

and ensure perfect reception

Super Vernier Dial

Model "A" for ¼ in. spindles. **7/6**



Back view showing simple mechanism.

Front view.

Burndept Coils

completely enclosed in hermetically sealed container, not easily damaged or broken. All wave lengths from 20 to 22,000 metres. Full particulars on request.

Back view.

YOU are sure of complete satisfaction if you specify any article from the wide range of Burndept Components. They are all manufactured to a very high standard of quality and are subjected to the most searching test before being offered for sale.

Burndept guaranteed Super Valves have proved their extraordinary efficiency in numerous tests. There is a wide range of types to suit every set and purpose.

Your dealer will be pleased to demonstrate Burndept Products, which include everything for radio reception, Super Valves, components and complete installations.

BURNDEPT
WIRELESS LIMITED

Aldine House,
Bedford St., Strand, London, W.C.2

Telephone: *Gerrard 9072 (4 lines).*

Telegrams: *"Burndept, Westrand, London."*

BRANCHES AND AGENTS EVERYWHERE

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 Screened-Coil Long-Distance Set

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

Mr. Reyner's work on screened coils has now reached the point of the production of a practical design for a highly effective receiver. The set incorporates three valves, is very simple to work, and has given some very remarkable results under test.

THE advantages of screened coils in transformers for high-frequency amplification have been discussed in these columns in previous issues, and, as the result of numerous experiments, a type of screen suitable for a variety of different arrangements of coils or transformers has been designed. The receiver about to be described employs two of these screened units, and constitutes in many ways a definite advance in the design of receiving equipment.

Some Difficulties

In the experiments with this new type of coil in actual reception conditions, numerous troubles were experienced which are not observed with the more usual arrangements. While stray couplings are permitted to exist between the various portions of a high-frequency amplifying circuit, there are numerous sources of extra damping which tend to swamp these additional effects. When we remove the stray couplings by enclosing the coils in a screen, then various forms of hitherto unsuspected trouble begin to become apparent, and precautions have to be taken to avoid these new difficulties.

The Circuit

In the receiver described here the principal difficulties have been overcome, resulting in a receiver which, while being easy to handle, is both sensitive and selective. The actual circuit is shown in Fig. 1, and it will be seen that the arrangement consists of a high-frequency valve, transformer coupled to the detector valve, followed by an ordinary note magnifier. The performance of the screened coils was so promising that it was decided to employ a wave-trap in order to obtain the necessary selectivity in eliminating the local station, and a tapped rejector trap has been inserted in the aerial lead.

The dial on the left controls a wave-trap, the other two being the tuning dials.

Anode rectification is employed on the second valve, the working point being controlled by a potentiometer. Experience has shown that there is little or no reduction in signal strength due to the use of this method in preference to the more usual grid-condenser method, and the selectivity is definitely improved.

Neutrodyning

The first valve is neutrodyned by employing a centre-tapped primary on the high-frequency transformer, and this neutrodyne condenser is employed to provide such inherent reaction as is necessary.

With this arrangement it is possible to obtain an adjustment for which the receiver is sensitive over the whole range, so that a separate reaction adjustment is unnecessary.

Components

The components required for constructing this receiver are as

follows (the makers' names are given in each case for the guidance of those who wish to make an exact copy, but similar components of reliable manufacture may, of course, be substituted) :—

One ebonite panel, 18 in. x 7 in. x ¼ in. (British Ebonite Co.).

One cabinet to suit panel with baseboard 7¾ in. deep (Artcraft).

A SCREENED-COIL LONG-DISTANCE SET

(Continued)

One vernier condenser (Collinson Precision Screw Co.).

One 5-ohm rheostat (Lissen, Ltd.).

One potentiometer (Lissen, Ltd.).

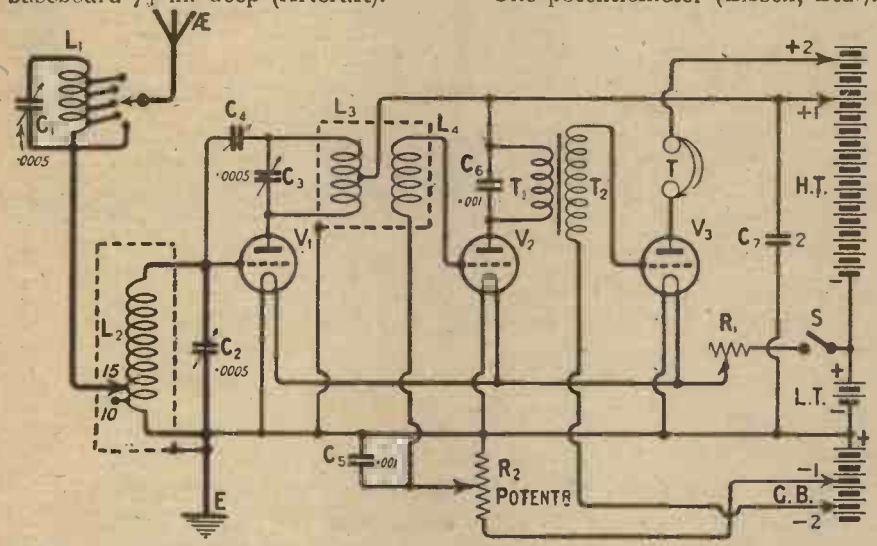


Fig. 1.—The dotted lines represent the shields, which are connected to earth.

Three Polar .0005 cam-vernier condensers (Radio Communication Co.).

Two screening boxes, complete with sockets (Peto-Scott Co.).

One special tapped inductance coil (Peto-Scott Co.).

One special high-frequency transformer (Peto-Scott Co.).

One tapped trap coil (Burne Jones & Co.).

Three antiphonic valve-holders (Burndept, Ltd.).

One low-frequency transformer, 3 to 1 ratio (Brandes, Ltd.).

One fixed condenser, .001 (Dubilier).

One fixed condenser, .001 (clip-in type), (L. McMichael, Ltd.).

One fixed condenser, 2 mfd. (Telegraph Condenser Co.).

One terminal strip with eight terminals.

Four separate terminals.

One filament "On and Off" switch (Peto-Scott Co.).

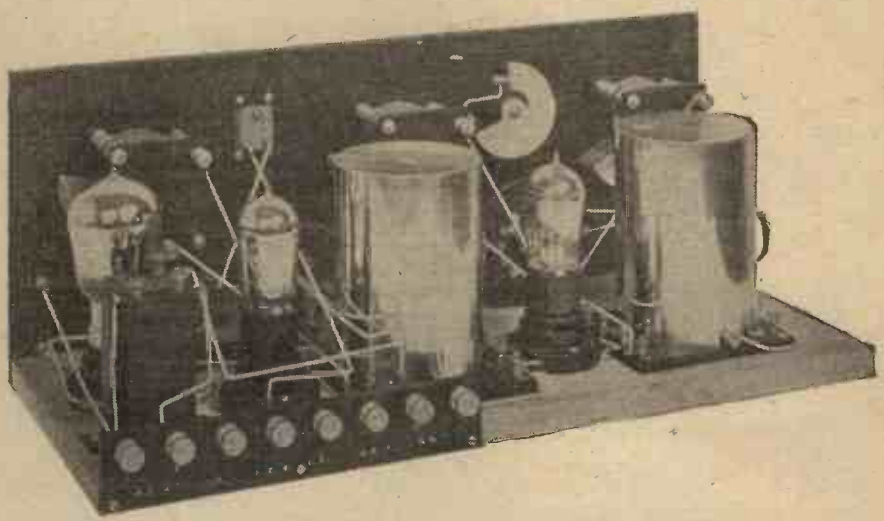
Quantity of Glazite and flexible wire for wiring up.

One packet Radio Press panel transfers.

The Coils

The construction of the receiver and the wiring up will present no difficulty, and it is not proposed to dwell to any extent on these aspects of the subject. There are, however, several points on which further information may be supplied. The screened boxes with the sockets to take the various types of plug-in coil are of a pattern which was illustrated in the last issue of *Wireless Weekly*. The base is provided with six sockets arranged in the manner shown in Fig. 4, and the connections from the sockets are brought to the fixed terminals on the outside of the base.

The aerial coil, which is connected across the grid and filament of the first valve, is a simple coil of 200 microhenries inductance, consisting of 90 turns of wire on a 2-in. former spaced 40 turns to the inch and wound with 30 d.s.c. wire. Tappings are taken at 10 and 15 turns for the aerial connection.



The use of screened coils permits the set to be made very compact.

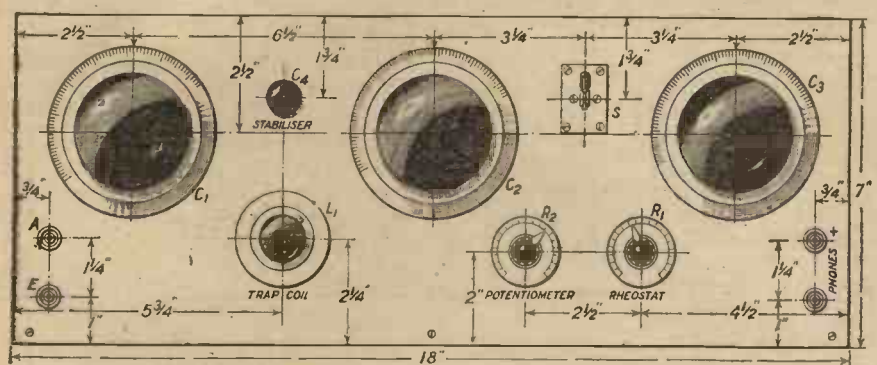


Fig. 2.—The panel lay-out gives a very convenient arrangement of controls.

The H.F. Transformer

The high-frequency transformer consists of a similar coil for the primary winding (which is tuned), except that the coil is centre tapped. The secondary winding consists of 120 turns of 36 d.s.c. wire wound on a 1½-in. former placed concentrically in the centre of the primary. The centre tapping on the primary

winding is connected to the H.T., the remaining half of the coil serving as a neutralising winding. Both these coils can be obtained comparatively cheaply from Messrs. Peto-Scott, Ltd., if desired.

The trap coil is a straightforward coil having 55 turns of 30 d.s.c. wire spaced 40 turns to the inch on a 3-in. former. This coil is tapped at 5, 10, 15, and 20 turns, and is made up as a one-hole-fixing unit, in which form it will be found very convenient where a trap of this nature is required. A tapping switch may be used to vary the coupling to the aerial circuit, or, if necessary, to cut the trap out of circuit altogether.

Oscillation Difficulties

One of the great troubles experienced with the set was that due to self-oscillation, even when the first

A SCREENED-COIL LONG-DISTANCE SET

(Continued)

valve was correctly neutralised, and this was found to be due to resistance in the high-tension leads. Even the smallest amount of resistance in the high-tension leads was sufficient to give rise to this oscillation, particularly on the lower values of the condenser settings, and for this purpose a large condenser has been connected directly from the centre tapping of the high-frequency transformer to the negative of the filament.

Working the Set

The operation of the receiver is comparatively straightforward. After the wiring has been completed, and the usual tests for accuracy have been carried out, suitable valves may be inserted, and the receiver tested on an aerial. The valves should be of the high-impedance type for the first two sockets (the high-frequency and rectifier valves), and a suitable low-frequency or power valve for the last stage. D.F.A.4 or D.E.5B. valves are particularly suitable, although the somewhat cheaper high-frequency valves, such as the D3 H.F. or a similar type, may be employed satisfactorily.

Neutralising

The receiver should be tested first of all with the aerial disconnected. The neutrodyne condenser should be placed about one-third of the way round, and the centre dial placed at about the middle of the scale. Place the right-hand con-

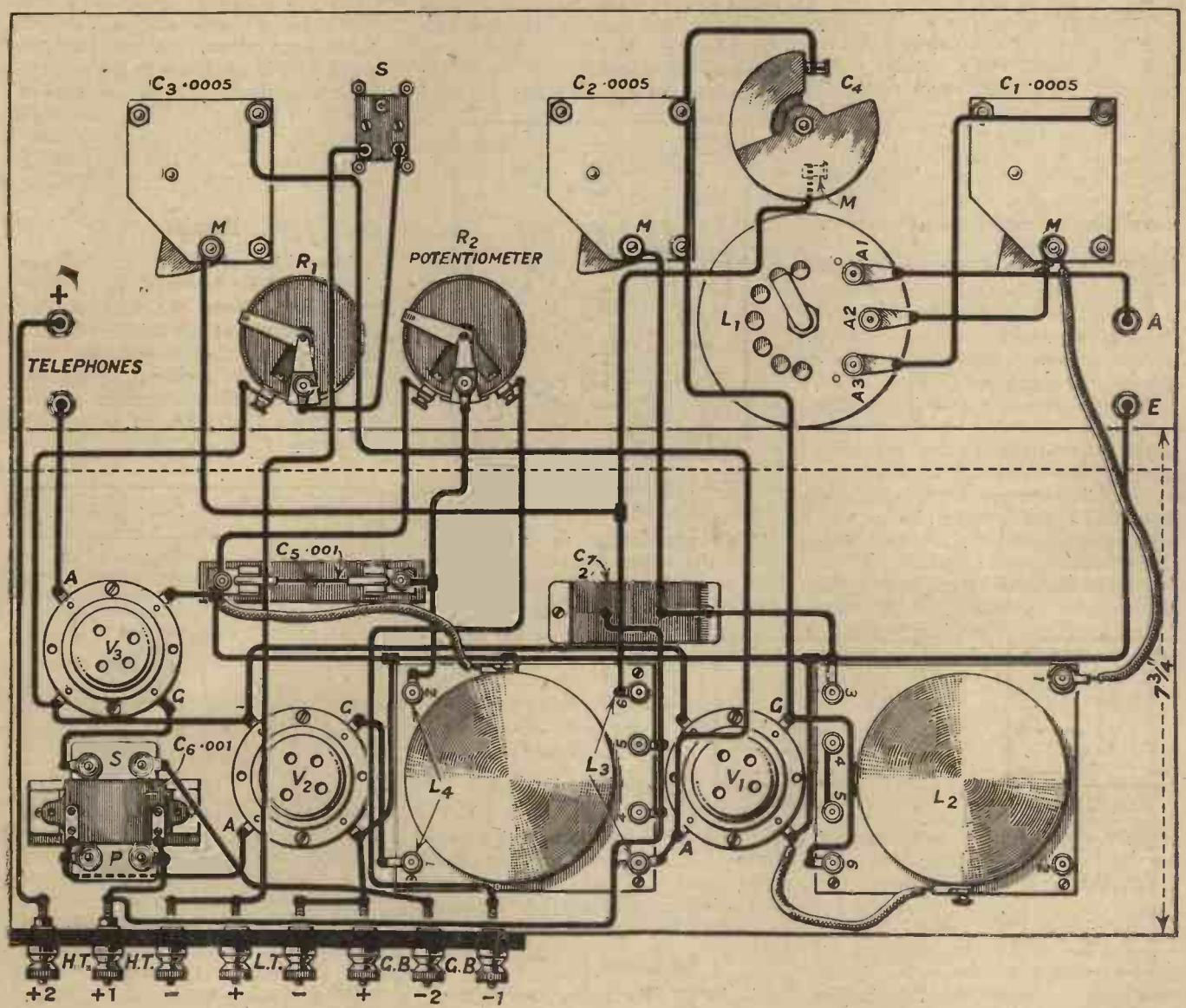


Fig. 3.—The terminals of the screened coil-units are numbered for reference purposes.

A SCREENED-COIL LONG-DISTANCE SET
(Continued)

denser in a similar position and swing it slightly from side to side. The set will probably burst into oscillation at some point, and the neutrodyne condenser should be adjusted until this oscillation ceases. The filament and H.T. voltages should now be adjusted, so that if the neutrodyne condenser is thrown slightly out of adjustment the set slides smoothly into oscillation without any suspicion of "plopping."

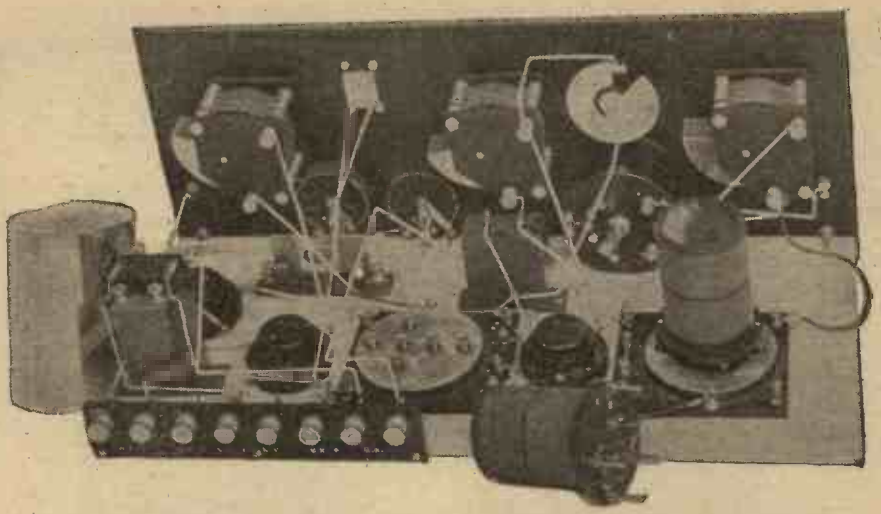
Searching

The aerial may now be connected up and the dials rotated until the local station is heard. The trap should be out of circuit at this stage of the proceedings, so that all adjustments will be made on the two right-hand dials. Little difficulty will be found in receiving the local station, and it will be found that the readings on the two condensers are practically identical. The set may be brought to a sensitive condition by a slight alteration in the neutrodyne condenser, after which other stations may be picked up by revolving the dials a little at a time one after the other.

It will be found that when the receiver is operating correctly there is a point on the neutrodyne condenser, not too sharply defined, at which the receiver remains stable practically throughout the whole range. Some slight instability may possibly be observed at the very small condenser readings, but these frequencies are outside the normal range of the receiver. On each side of this stable position oscillation will be produced, and by adjusting the neutrodyne condenser to a value slightly greater than that required for stability the receiver may be maintained in a sensitive condition.

The Wave-Trap

After the reader has become used to the handling of the receiver, the trap may be inserted. All that is necessary is that the switch on the trap coil shall be placed at a suitable value and the trap condenser rotated until the local station is reduced to a minimum. It will be found that on the full tapping it is possible to reduce the signals from the local station practically to zero, even when the other dials are tuned to the same frequency. By a little practice the best setting of the trap for ordinary conditions will rapidly be found, and the trap condenser may then be left adjusted, and searching carried out on the other two dials without any trouble.



A view of the set taken during the development of the design. Various methods of connection for the intervalve unit were tried, the final scheme being given in Fig. 3.

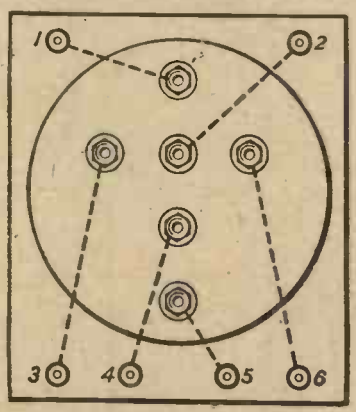


Fig. 4.—The standard connections of the coil base.

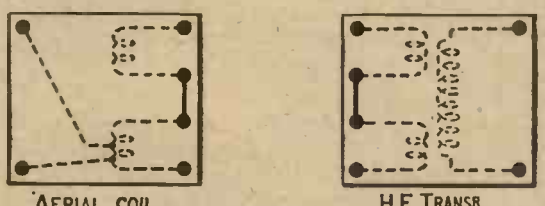


Fig. 5.—The connections of the coils themselves are given here.

An Interesting Test

It is an interesting commentary on the efficiency of the screening to notice that when the aerial and earth are removed, practically no sign of the local station can be heard even when the receiver is tuned to the appropriate frequency. A certain trace will be noticeable due to a little pick-up on the battery leads, and the general wiring of the receiver, but this will usually be found to be very small indeed.

Results

Some idea of the setting of the dials for the various stations may be obtained from the test report given below. It should be remembered that the particular condensers employed utilise a corrected square-law dial, which commences at 26 deg. instead of zero, as is usually the case.

Reading of Dials.	Stations Heard.
87	Aberdeen
82	Birmingham
78	Ecole Superieure
75	Belfast
72	Glasgow
71	Munster
69	Newcastle
68	Hamburg
67	Bournemouth
65	Manchester
61	London
59	Cardiff
56	San Sebastian
53	Nottingham

These stations are a few of those picked up in a straight run through from top to bottom of the scale, and will serve to give some idea of the performance of the receiver.

Next week further and more detailed operating notes will be given, with a full test report.

Are Short Waves Screened?

By L. H. THOMAS (6QB)

The author of these notes has carried out some very interesting experiments on the effects of local conditions on the ranges of transmission in various directions. His results are a proof of the value attaching to systematic recording of experimental data.

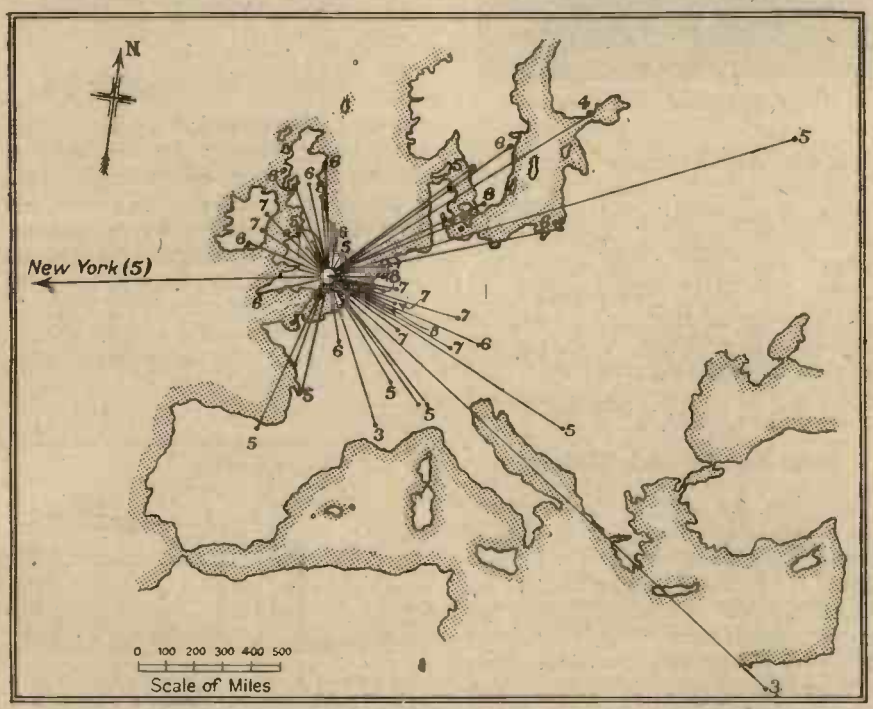
ONE often hears an amateur transmitter say, "My signals seem to get out much better towards the North than in any other direction," or some other similarly sweeping statement to that effect. The writer has noticed such peculiar effects in connection with this from time to time that a short description of his experiences and experiments will, it is hoped, prove helpful.

The lines on the map herewith join London, where the writer is situated, to the various parts of Europe in which he has been heard, and the figure at the end of each line represents the average figure of all the reports (signal strength being measured by means of the usual "R" scale) that he has received from that particular locality. These reports have been received in connection with work done on three separate frequency-bands, viz., 2,000 kc. to 1,500 kc. (150-200 metres), 3,000 kc. to 2,308 kc. (100-130 metres), and 6,667 kc. (45 metres), but it is important to note that the figures on the map concern the last wave only.

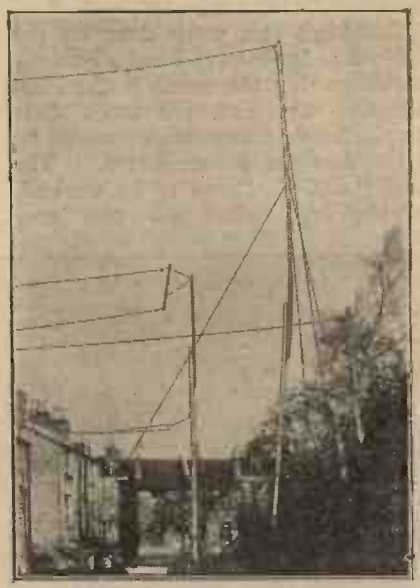
Now it will at once be seen that the direction in which greatest difficulty has been experienced in "getting out" is practically due South.

A Dead Area

Although there are quite a fair number of French stations operating which are *exactly* due south of the writer's station, not one of these has been worked, neither has a single report been received from that area. Paris, slightly to the east of the "south" line, has as its average figure R6 only, whereas Brussels, Rotterdam, and Amsterdam, all approximately the same distance away as Paris, have as their "index figures" R7-8 in each case. It is, of course, realised that the "R" method of reporting signals is apt to be fallacious, but each of these figures is the average of some forty or fifty reports, and it is hardly likely that the inhabitants of Paris, as a whole, should have an entirely different notion of signal strength from those of Brussels or Amsterdam!



The lines on this map join the author's station to various points at which he has been heard. The numbers indicate the relative strength of signals at each point, the poorness of results to the south being clearly shown.



The author's aerial is the high single wire. Note the two "BCL" aerials.

Southerly Difficulties

It will also be observed that lines are drawn to Bilbao (Spain), Avignon (near Marseilles), Milan (Italy) and Munich (Germany). Here it will be noticed at once that the line travelling most nearly due south has the lowest index figure. Also the line to Bilbao has a figure which is not in proportion to the others when one considers that a great part of it is over the sea, and one would naturally expect signals to be rather stronger there. As soon as we get away from this "due south" line, however, signal strength begins to increase again, until at Munich it is R6, as compared with R3 only at Avignon. In connection with this, it might be mentioned that, although there are several very well-known stations in Marseilles, the writer has not yet succeeded in communicating with one of them, while a very near-by station has done so quite easily, using very low power indeed.

Differences on Other Waves

Although this work done on the 6,667-kc. (45-metre) band distinctly indicates that the south is the least effective direction, the work done on the lower frequencies showed by no means the same effects. The first " DX " station to be worked, in the days when no one ever

ARE SHORT WAVES SCREENED?

(Continued)

the Midlands, much lower figures hold, but these can be easily justified by the well-known " skipped-

A general view of 6QB's short-wave transmitter and receiver.

worked very much further than Paris, was 8EI of that town. This was done on 1,500 kc. (200 metres) with 140 volts on an ordinary general purpose bright emitter! The trouble then was that communication could not be established with any other towns in a southerly direction, therefore the writer had no real opportunity of ascertaining whether the signals were getting out better in other directions. On the 3,000-kc. (100-metre) band Paris seemed quite a favourable spot, judging by the number of " QSL " cards that used to arrive!

Normal to Northwards

The factor (at present unknown) which caused this " dead line " to the south did not continue in the same straight line to the north, for here everything seems about normal. On the 6,667-kc. band the average for Newcastle is R8 (the actual figure is 8.4), and some reports of R10 signals have been received from there! At Aberdeen and other Scottish towns the figure is about R6, this being quite reasonable in view of the distance. In the nearer towns, and particularly distance " effect always observed at these frequencies. On the 3,000-kc. band this was by no means the case, very good reports usually being received from Keighley, Leeds, Sheffield, Liverpool and other towns in that area. In the North-West and the West, as will be seen from the figures for Ireland and Cornwall, the reports seemed to be quite normal.

Poor Results with Finland

Turning to the East, however, there is another irregularity that it is not easy to account for. The figure for Finland will be seen to be R4 only, whereas at Stockholm, not so very much nearer, it is R6, and at Nijni-Novgorod, Russia, about half as far again, it is R5. Not many reports have been received from this location, it is true, so that that figure may possibly not be reliable. The fact remains, however, that Finland was never worked on the 6,667-kc. band, and only one report was received, whereas no difficulty was ever experienced in communicating with that country on the 3,000-kc. (100-metre) band.

Neglecting the abnormality of Finland, then, it is quite obvious that the South has been the worst direction for transmission; at any rate, as far as distances over 200 miles are concerned, on the 6,667-kc. band of frequencies.

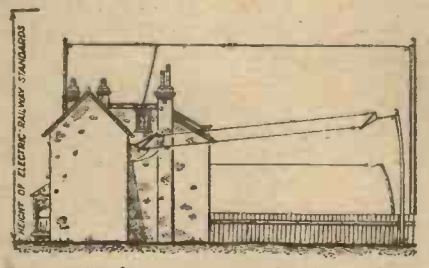
Possible Reasons

Some attempt at explaining this may now be made, but it must, of course, be borne in mind by the reader that these suggestions are purely tentative, and that no claim for a real theory can be put forward.

The direction of the aerial, and some rough idea of its surroundings, may be seen overleaf. The free end points eastward, and, although a counterpoise could be erected directly underneath it in the conventional manner, superior results have always been obtained with a short indoor counterpoise. This is, however, a purely individual case, and is probably explained by the fact that, were the outdoor counterpoise employed, two " B.C.L." aerials, which are normally either earthed or tuned to the broadcast band of frequencies, would be right in between it and the transmitting aerial.

Absence of Screening

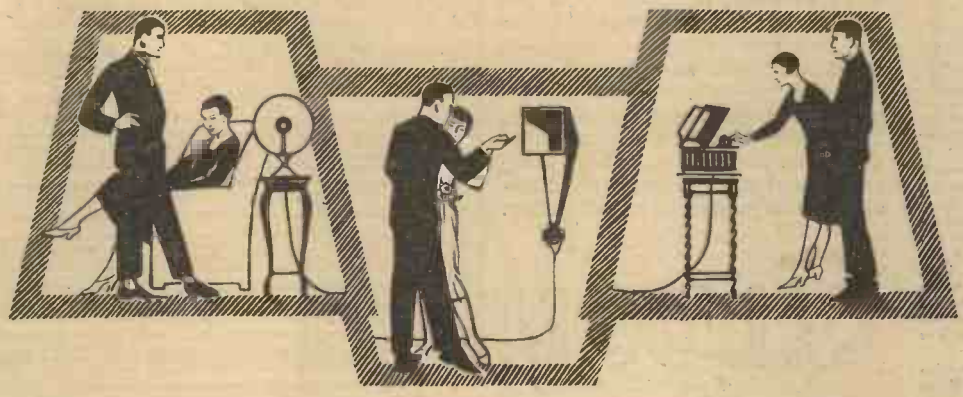
Now, the direction of the aerial may fairly clearly be treated as having little or no effect upon transmission in a southerly direction, so that the next effect to be looked for would most naturally be screening of some kind. It will be seen on page 179, however, that there is little or no screening in this direction; in fact, the only possibility



The author's aerial is well above those of his neighbours. Only a short part of the horizontal span is actually in use.

worth considering is the screening effect of a ridge of fairly high hills about 2½ miles distant.

The worst apparent screening, curiously enough, is to the West and North, the very directions in which signals seem to " reach out " best. Here the screen is in the



Not least amongst the Lissenola's charms—its versatility.

With the "Lissenola" you can obtain all varieties of loud speaker reproduction. You can attach it to any horn—including the tone-arm of your gramophone—or by following the simple instructions we give you, you can build a big power horn yourself for a few pence. By using the Lissen Reed (1/- extra) you can adapt the "Lissenola" to carry any diaphragm working on the reed principle. With it, indeed, you can perform any number of experiments and comparisons—and all at a record in low price, for the "Lissenola" costs only 13/6, or with the Lissen Reed, 14/6. It is the essential sound-reproducing base—the foundation on which you build any type of loud speaker you please. So effectively is its electro-magnetic mechanism concentrated that it is sensitive to the weakest impulses, yet it will stand up to all the power you can put through it without the slightest trace of resonance.

For biggest volume of all, build a big horn from the full-sized diagrams and explicit instructions given with every 'Lissenola." You cannot go wrong, and when it is completed it will challenge comparison with the most expensive speakers on the market. You can prove this yourself. Before you buy, make this test. Go to your dealer—ask him to put on the best loud speaker he has in stock—then use the same horn on the "Lissenola," *and see if you can notice any difference.*

Then there is the Lissen Reed which enables you to easily use a cone or any other similar type of diaphragm, and it gives you endless opportunities for experiment besides. For as soon as you go home you can actually provide yourself with a loud speaker by turning the lid of a cardboard box into a loud speaker diaphragm. You clamp the lid between the nuts on the Lissen Reed and fit the reed on the "Lissenola" as shown in the instructions with each unit, and you then have a loud speaker to keep you going until your big horn is made. Or put the "Lissenola" on to your gramophone.

Showing the Lissen Reed attached.

Your dealer will gladly demonstrate and supply—or send for the "Lissenola" post free by return, from the makers—price 13/6., or with the Lissen Reed, 14/6.

BUY THE LISSENOLA

and build your own loud speaker

LISSEN LTD., Lissenium Works, 16-20, Friars Lane, Richmond, Surrey.

'Phone: RICHMOND 2285 (4 lines). 'Grams: "Lissenium, Phone, London."

form of a large number of elevated wires and large metal standards supporting them; in short, the Elevated portion of the Southern Railway, the nearest point being only a matter of some 30 yards distant from the aerial. There are three separate lines, as shown in the figure, and the nearest one is shaped in such a manner that it might almost be expected to act as a "beam reflector" towards the South-East! It is nearly a parabola, with the transmitting aerial at its focus.

Work with America

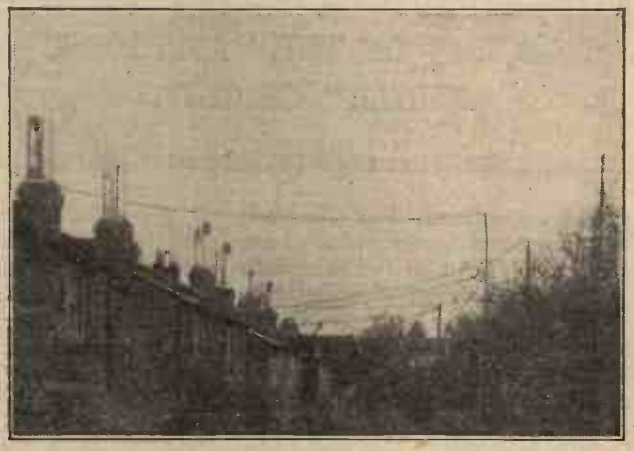
In spite of this severe screen, however, signals seem to get out very well in a northerly direction, and although the writer has only recently succeeded in working America, the very fact that it can be done with an input of 10 watts should be sufficient to prove that there is not much screening in that direction.

It should be mentioned that the aerial, being of quite small dimensions, has a natural wavelength of rather less than 45 metres, and is tuned by means of an inductance and capacity in parallel. Using this arrangement, the writer has found, in common with several other transmitters, that there is less vertical, and more horizontal, radiation than

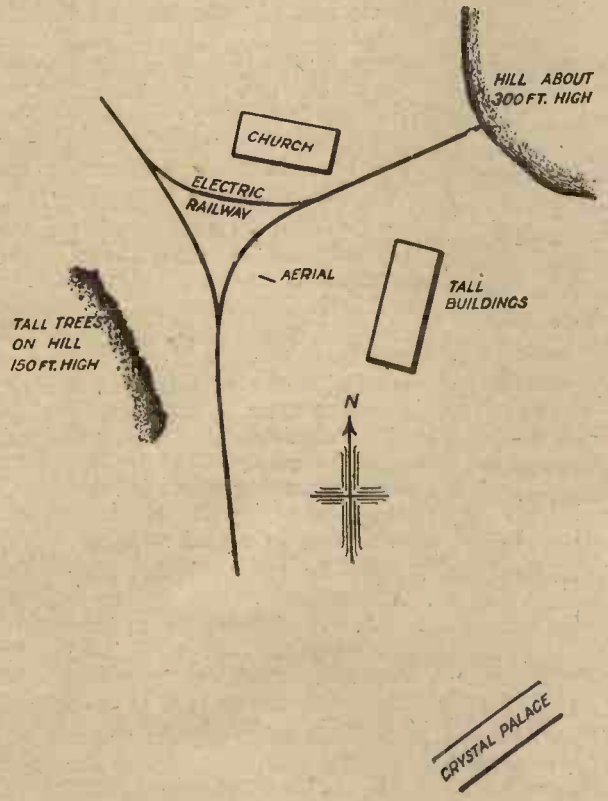
ARE SHORT WAVES SCREENED?

(Continued)

is obtained with a Hertz oscillator, or a larger aerial tuned to a harmonic. That is to say, signals will be reported rather more strongly over distances up to about three or four hundred miles, but not so strongly at much greater distances, as those radiated by an aerial of one of the other types.



The broken nature of the ground under the author's aerial would seem to provide far from ideal conditions.



The actual surroundings of the aerial would seem to promise good results to the south, yet this is actually the worst direction!

Effect of Railway

The writer has, unfortunately, not been able to give one of the other types a really fair test on account of lack of space. From the few reports received when working on an aerial about 50 ft. in length, tuned to approximately 2,222 kc. (135 metres), it appeared as if the signals were getting out southwards rather better than they did with the other arrangement. It seems, therefore, as if the large masses of metal connected with the electric railway, although that is situated to the North, possess the property of interfering with the transmission of waves in a southward direction, particularly when these are more or less in a horizontal plane.

Whether there is anything in the suggestion that they act as a beam reflector, making the signals inaudible or very weak at any distance more than a mile or so away from a line drawn due South, or perhaps reflecting the waves upwards, therefore giving weak signals up to a fairly great distance, where they would be strong again, remains to be determined, if possible, by future experiments. The probability of this is accentuated by the fact that transmission in a northerly direction is quite normal. The theory has merely been suggested because it is felt that there is no other factor which could possibly interfere with transmission to so great an extent as the railway.

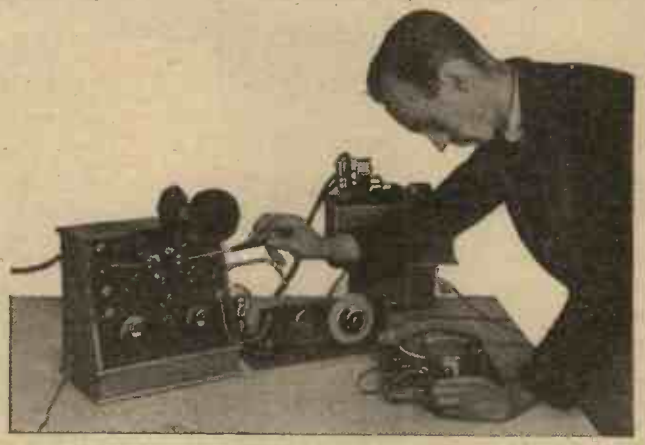
Future Work

The writer hopes shortly to commence some experiments on a frequency of 13,044 kc. (23 metres), and possibly some more data can be collected in connection with this work. The lead roof under which the set is housed will, it is feared, cause some trouble on such high frequencies as this. If any information is gained, however, the writer will consider himself repaid, as the one reward of working under difficulties is the useful information generally obtained in attempting to overcome them.

This Week's Interview

No. 5.—G. P. KENDALL, B.Sc.

These actual interviews consist of a series of questions and answers specially framed to exclude irrelevant matter and to interest the greatest number of readers.



DANGERS OF THE "APERIODIC AERIAL" CIRCUIT.

Q.—I understand, Mr. Kendall, that your recent investigations have thrown much light on the behaviour of a popular method of aerial tuning. Is it true that you have shown that this type of aerial circuit is not aperiodic at all?

A.—If the word "aperiodic" is correctly used, as meaning that the circuit is without tuning properties and responds equally well to all frequencies, that is most decidedly so: it is actually far from aperiodic.

Q.—But no means of tuning the aerial circuit is provided. How can a set with an "aperiodic" aerial circuit receive, say, Cardiff and Aberdeen equally efficiently?

A.—It cannot. If the number of turns upon the aerial coil is correct for Cardiff it is almost impossible that efficient operation will result upon the much longer wave of Aberdeen.

Q.—You speak of the correct number of turns for Cardiff. Does that mean that the size of coil must be altered for each station? If so, surely this so-called aperiodic circuit is simply a tuned one like any other?

A.—Not quite. There is some justification for the use of the word aperiodic. You must remember that the aerial circuit is usually very tightly coupled to the secondary coil.

Q.—Does the coupling between primary and secondary then affect the tuning properties of the aerial circuit?

A.—Yes, if the coupling is really tight the behaviour of the aerial circuit is completely altered. Instead of tuning sharply at a definite number of turns for any given station, it responds flatly, with little difference of signal strength for a wide range of turn numbers.

Q.—Does that mean that several stations can be heard equally well with the same size of primary?

A.—Yes, if they are working on frequencies not too widely different from one another. For example, the same size of primary will give substantially equal efficiency on London and Bournemouth, and not a very great falling off on Newcastle. Such differences as there would be would scarcely be noticed in practice.

Q.—How is it that tight coupling has this effect?

A.—That point is best explained by referring to the resonance curves of these circuits. If the coupling is weak it is found that signal strength rises sharply to a maximum for a given number of primary turns, and falls off abruptly on either side. In other words, the circuit is fairly sharply tuned.

The simple arrangement sometimes known as the "aperiodic aerial" circuit is not nearly so straightforward as it seems. There are actually a number of pitfalls for the unwary in its use, and Mr. Kendall has done much valuable work in investigating its peculiarities. He has shown that it is not "aperiodic" in the true sense, and further that in certain circumstances it may lead to serious interference troubles.

Q.—How would that fact be expressed in the "resonance curve" of which you spoke just now?

A.—By plotting horizontally on the squared paper the number of turns on the primary, and vertically the received signal strength. The result would be a sharply-peaked curve rising to its maximum at the number of turns which tuned the aerial to the station being received. The sharper the tuning of the circuit the sharper the peak of the resonance curve—a fact which is sometimes used in indicating the selectivity of a circuit.

Q.—What sort of resonance curve is obtained when the coupling is very tight?

A.—A very curious effect is noticed. Instead of rising sharply to a peak as the number of turns is increased, the curve ascends more gradually to a maximum, drops suddenly to a minimum, and rises again to a maximum, then falls off once more gradually. Two peaks are thus formed, with a sharp dip between them and rather flat outer slopes.

Q.—That seems very extraordinary. To what is the dip attributed?

A.—It indicates that the aerial circuit has come fully into tune with the incoming signals, and also, of course, with the secondary which is tuned to them by means of its variable condenser. The extremely tight coupling then results in a heavy damping effect in the secondary circuit, with a consequent reduction in signal strength.

Q.—Is the reduction very great in amount?

A.—It depends upon how tight the coupling is, but I have often found a reduction to one-third of the maximum to take place.

Q.—It seems, then, that if the aerial circuit is actually tuned to the station being received harm results. You have said that signal strength is reduced, but you have not mentioned any effect on selectivity.

A.—Selectivity is also adversely

This Week's Interview—*continued*

affected by working in the dip between the two peaks, and the tuning in the secondary circuit becomes extraordinarily flat. As a matter of fact, selectivity is then very much poorer than in the case of an ordinary direct-coupled aerial circuit.

Q.—It is evidently very important to work on the correct point on the curve. Where do you consider the best results will be obtained?

A.—The maximum signal strength is obtained by detuning the aerial to one side or the other until one of the two peaks is reached. As a rule, the peak corresponding to the smaller number of primary turns gives slightly better signals than the other one. Selectivity, however, will be improved by moving down the slope a little further away from the dangerous trough, even though a little signal strength is lost in consequence. In practice that means that the size of the primary is reduced until it is noticed that signals are beginning to fall off.

Q.—Evidently, then, we should use a primary of such a size that we are working on the outer slope of the first peak. You mentioned just now that the slope was fairly flat. Is it so flat that the number of turns is not at all critical for a number of stations?

A.—My investigations lead me to believe that a single primary can be chosen for any given aerial which will cover nearly half the broadcast band with a degree of uniformity which is adequate for practical purposes. Probably three interchangeable primaries, or a single winding with two tappings, should be regarded as necessary to cover the band properly.

Q.—You say "for any given aerial." Does that mean that the correct size would have to be chosen specially for each aerial?

A.—The correct size of primary obviously depends on the aerial, but since the size is not very critical it is usually possible to assume an average aerial, and so adopt a standard size or sizes for the coil.

Q.—Supposing that one tried to cover the whole broadcast band with a single primary, how great would be the difference in efficiency between the reception of a station like London near one end of the scale and one such as Aberdeen at the other?

A.—The only practical course to adopt in such a case would be to make the primary of the correct size for the reception of 2LO, and then the results on Aberdeen would be something in the neighbourhood of only 30 or 40 per cent. of the possible signal strength.

Q.—Would it not be possible to choose a halfway value for the coil, and so obtain fair results on both the stations?

A.—Such a proceeding is risky. It is quite likely that if the coil were big enough to give fairly good results from the longer wave station, it would result in one's falling into the trough between the peaks for the other one, which would therefore be received very poorly. This effect is, I believe, one of the greatest pitfalls of this apparently simple but really rather tricky circuit. I am under the impression that people often complain of the poor selectivity which they have got with it simply because they have been trying to do everything on one coil, and that too large a one. Complaints of poor signals, on the other hand, generally mean that the same thing has been attempted with too small a coil.

Q.—You consider, then, that it is definitely not possible to obtain the desired results with a primary of fixed size?

A.—Yes, certainly, unless some other means of varying the "tuning" of the aerial circuit is provided, such as a few fixed condensers of suitably chosen sizes which can be switched in series with the primary coil.

One of the special pieces of apparatus used by Mr. Kendall in his investigations. The inductance illustrated is one of his multi-layer cross-coils.

Q.—You have alluded to the circuit as a "dangerous" one. Just exactly what did you mean?

A.—The usual reason for employing one of these circuits is that it is desired to improve selectivity in order to cut out a strong local station. If the local station is working on a wave near the lower end of the band, and the primary is adjusted to give good results on one of longer wave, it is quite possible that it will happen actually to tune to the local wave. That means that for the local station we shall be working in the objectionable dip which I mentioned, and selectivity will be non-existent.

Q.—One last question. Since the circuit is not really aperiodic, do you suggest the adoption of some more accurate name for it?

A.—It is very difficult to describe the circuit in a convenient phrase, which doesn't sound too pedantic. One might call the scheme "tight inductive coupling" to distinguish it from the fully-tuned loose-coupled variety, but that is too long to say in a hurry. Probably just "tight coupling" would serve.

RANDOM TECHNICALITIES

By PERCY W. HARRIS, M.I.R.E.

Coil sockets—Fading at short distances—Tests by WEAF—Night distortion and its causes.

CAN you imagine anything more brutal than the present method of removing a plug-in coil from the average wireless receiver? Have you ever put your hand inside a cabinet receiver and had to struggle for a minute or two before you could remove the coil? Don't you think it is time some enterprising manufacturer brought out a socket for plug-in coils which is electrically efficient, and yet permits the coil being inserted and withdrawn without nearly pulling the panel or the baseboard off the receiver?

There are dozens of ways of doing it.

There is no special reason why the socket on the coil-holder or receiver should be of the same design as the plug on the coil mount. At present the slight differences between the makes of commercial plug-in coils are quite sufficient to make really perfect interchangeability of coils impossible. The brass split-pin idea, while having the advantage of cheapness of manufacture, requires for its successful operation an accuracy in manufactured coil holders and sockets that few firms seem to possess.

"Short-Distance" Distortion

I have held the view for a long time—and I believe I have expressed it in these columns on several occasions—that distortion of signals and fading can occur at very short distances from the broadcasting station. I know the idea of short-distance distortion has been "pooh-poohed" in many quarters (by "short distance" I mean up to, say, fifty miles), and a comparison of notes between serious experimenters is not an easy matter to arrange, so that I am very glad to be able to report the result of a series of tests recently undertaken by the American Telephone and Telegraph Co., of New York, which prove that both short-distance fading and short-distance distortion of signals do actually occur.

A Valuable Paper

The source of my information is the latest "Proceedings of the Institute of Radio Engineers," and the results are of particular interest to me personally, as the tests have all taken place in an area I am well acquainted with, and at places which I visited last year. The paper itself is very long and detailed, and therefore a short account of some of the more important facts brought to light may be of interest here.

The tests took place from a transmitting station owned by the

The special quartz crystal employed at KDKA for maintaining a constant frequency of transmission is here seen in the hand of Mr. H. W. Arlin, the chief announcer.

American Telephone and Telegraph Company in New York. The paper gives the station concerned as 2XB, the Bell telephone laboratory and experimental station, 463, West Street, New York City, and illustrations are given of it; actually, although it is not mentioned in the article, I recognise the installation as the same as that of WEAF, and probably 2XB is the call they use for experimental work. Reference is also made to another station using the call 2XY, being a station of the American Telephone and Telegraph Company at 24, Walker Street, New York. This is the site of the old WEAF station.

The Localities

If you look at a map of the New York area you will see that a part of mainland opposite Long Island is in the State of Connecticut. One of the important towns along the coast is Stamford (where the Yale locks come from). The American Telephone and Telegraph Company put up experimental receiving stations at Stamford, Conn., and another at New Canaan, Conn., these two stations being about thirty and fifty miles respectively from New York. A good deal of my own experimental listening-in to the New York stations was done at a spot halfway between Stamford and New Canaan, *i.e.*, about forty miles from New York, and I motored around the district to get a general idea of the land. It is fairly hilly, not very densely populated, and can be compared with, say, Surrey or Hertfordshire in its general receiving conditions.

Fading and Distortion

Now, careful observations reported in the paper in question demonstrated that there were points relatively near New York City, where quality distortion from several broadcasting stations in the city was marked at night and at least was detected even in the daytime. Fading was also pronounced, and it was noted as a significant fact that distortion was always accompanied by some fading, although the reverse was not consistently true. At one of the particular points near New Canaan, Conn., signals from 2XB were much weaker and more distorted than signals from 2XY (the experimental station at Walker Street, New York), even although the transmitter at 2XB was about ten times more powerful.

Daylight field strength measurements at this point showed the field strength of 2XB was only one-third of that of 2XY. This led to the rather startling conclusion that there is a ratio of 100 to 1 in the power-efficiency of transmission to that particular receiving set from the two transmitting stations which are only about a mile apart.

A Survey

Following this, a field strength survey was made, which showed

(*Continued on page* 188.)

Wireless News in Brief.

New Marconi Office. A new telegraph office has recently been opened in the West End by Marconi's Wireless Telegraph Company, Ltd. This is in Duke Street, Piccadilly, and telegrams may be handed in there for transmission to all parts of the world served by the Marconi organisation.

* * *

Wireless Power. The extensive use in the near future of power transmitted by wireless has been forecast by Mr. Herriott, speaking as counsel for the Zenith Radio Corporation of Chicago. A test case instituted against the Zenith Radio Corporation as radio "pirates" raised the question of the ownership of the air or the ground, or any other medium through which wireless waves travel. Mr. Herriott emphasised the point that legislation must take into account the possible developments of the future.

* * *

Wireless in Roumania. There is a prospect that the lot of the wireless listener in Roumania may become a distinctly unhappy one. We hear that a Bill recently placed before the Roumanian Parliament is intended to impose a number of conditions on the issue of licences. Prospective listeners must be certified of good moral character by a responsible religious official, and they must produce their baptismal certificate. The receiving apparatus installed will be inspected before it may be used by the listener.

* * *

Amundsen's Polar Flight. When the well-known explorer, Amundsen, makes his attempt to fly over the North Pole, passing from Europe to Alaska, his airship, *Norge I*, will be equipped with direction finding wireless apparatus. The crew will be kept in touch with the world with the help of their transmitter, and receiving gear to cover a wide range of wavelengths will also be carried.

* * *

Forthcoming Programme Features. Sunday, March 28.—London, 5 and 8.40 p.m.: Organ Recital and the choir of Christ Church, Oxford. Leeds-Bradford, 3 p.m.: "The Passion," relayed from York Minster.

Monday, March 29.—London, 9.45 p.m.: Special broadcast from National Sporting Club. Glasgow: Variety programme. Manchester: Masterpieces of Mozart.

Tuesday, March 30.—London, 8 p.m.: "Kitesh," a Sacred Opera by Rimsky Korsakov, relayed from the Royal Opera House, Covent Garden.

Wednesday, March 31.—Aberdeen: "The Messiah." Bournemouth: Winter Gardens Night. Newcastle: A Victorian programme.

Thursday, April 1.—London: Two sketches, "The Disorderly Room" and "Tragedy at Midnight." Birmingham, 8 p.m.: Chamber Music.

Friday, April 2.—Birmingham, 3.30 p.m.: Sacred Concert. Cardiff, 7.45 p.m.: Passiontide Music, by the Cardiff Musical Society. Manchester, 8 p.m.: Brahms' Requiem and Song of Destiny.

Saturday, April 3.—London, 9 p.m.: Seventh edition of "Winners"; 10.30 p.m., Savoy Bands. Birmingham: Popular programme. Manchester: Light Orchestral Music.

* * *

Wavelength Changes. It is announced by the B.B.C. that at the instigation of the Bureau International de Radiophonie at Geneva, certain alterations in the wavelengths of British and Continental stations were made on March 11. We understand that the approval of the Postmaster-General was obtained for the new wavelengths of 407 metres for Newcastle, 397 metres for Dublin and 387 metres for Bournemouth. Among the Continental stations, Breslau is now on 417 metres, Munster on 412 metres, Graz on 402 metres and Hamburg on 392 metres. These new wavelengths are not necessarily permanent.

* * *

B.B.C. News. The service to be broadcast from the London station on the evening of Easter Sunday will be relayed from Norwich Cathedral, the address being given by the Dean.

* * *

A series of seaside broadcasts is being arranged for the coming summer. Programmes will be relayed from the chief seaside resorts, the first town on the list being Brighton.

* * *

On St. George's Day, April 23, a narrative of the British Naval Raid at Zeebrugge during the Great War will be broadcast from the London station.

* * *

Geneva Broadcast. The broadcasting of the speeches at the League of Nations Conference on March 17 was very successfully carried out, the words of the speakers being followed by listeners in England with little difficulty. An example of the manner in which "life" may be imparted to such broadcasts was provided by the announcement made by Mr. Arthur Burrows before the commencement of the proceedings. Mr. Burrows gave a brief description of the scene in the hall at Geneva, in order to conjure up some mental picture of the Conference for listeners.

Operating the "Split-Secondary" Receiver

By L. H. THOMAS

Some further notes on the two-valve set described last week under the title "Selectivity Without H.F. Stages," with a full account of its performance on test.

SINCE the description of the "Split-Secondary" receiver last week, under the title of "Selectivity without H.F. Stages," the writer has been carrying out further experiments with the receiver, particularly with the object of determining exactly what degree of selectivity may be attained with the circuit employed.

These experiments have been carried out at a distance of about 4½ miles from 2LO, with an aerial 25 ft. long and about 35 ft. high. The reader may perhaps think that this small size of aerial may have some connection with the selectivity obtained, but the receiver has also been tested on an aerial of quite different dimensions, and seems to function just as satisfactorily in every way.

The valves used were both of the 6 volt .25 ampere type, the detector being used with a filament voltage of 4.8 and the L.F. valve with a slightly higher voltage. The anode potentials were 22½ and 90 volts respectively.

Selectivity Tests

First, a reaction coil of 35 turns, coupled to a No. 25 coil, was used in the coil-stand. The primary coil was one of 75 turns, coupled to one of 50 turns, the primary tuning condenser being used in series. With this adjustment, and quite close coupling of the primary to its portion of the secondary, Bournemouth was received at what might be termed "just loud-speaker strength" without a trace of London. Other stations received well on headphones were Glasgow, Newcastle and Birmingham. Cardiff was heard, but interference from 2LO was troublesome. With looser coupling between the primary and secondary, however, Cardiff was brought in at sufficient strength for the listener just to follow what was going on *without* interference from 2LO.

Results with Parallel Condenser

With a No. 35 coil as primary, and the condenser in parallel, the signal-strength on all stations seemed to increase slightly, a slight loss of selectivity being noticed. This was probably due, however, to the small aerial in use for these tests, and should not deter the reader from trying a parallel condenser with this receiver. (It should be mentioned here that all these tests were carried out at about 9.30 p.m. on an evening when the receiver generally used for broadcast reception seemed to be giving quite ordinary results. It was not likely, therefore, that any of the above results could be attributed to a "freak" night.)

Selectivity and Coil Sizes

It will be noticed that for the above tests the reaction coil and the portion of the secondary to which it was coupled were both quite small, compared with the other portion of the secondary and the primary. The reason for this is, of course, that the effect on the tuning of moving the reaction coil to or from the secondary will be small in this case. If the part of the secondary coupled to the reaction coil is increased in size, and the part coupled to the primary decreased to compensate for this, the receiver may be made even more selective, but will be more difficult to handle. We have, therefore, to effect a compromise between selectivity and ease of adjustment. As the ratio between these two may be said to be "continuously variable" within certain limits, the receiver should be adjusted to whatever pitch of selectivity the reader considers to be compatible with reasonable ease of control, and used with that particular adjustment.

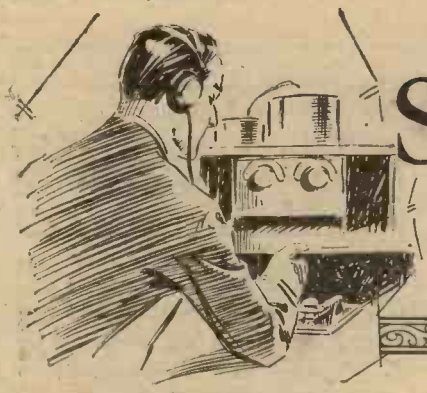
There is, however, one point in which this receiver is always superior to the set employing the more usual type of circuit. That is, that whatever coils are chosen as being suitable, the loosening of the primary coupling is not nearly so prone to cause the set to burst into oscillation.

For Local Work

In spite of the fact that the chief claim for this receiver is its selectivity, it may be used quite effectively as a loud-speaker set for the local station. For this, the primary coil should be fairly closely coupled to its portion of the secondary, which should be about a No. 50. A No. 25 or 35 should be employed for the other half of the secondary, and a 35 or 50 as reaction coil. The voltage on the L.F. valve should be at least 90, and 100 volts will be found to give excellent results with the type of valve mentioned. A grid-bias battery of about 4½ or 6 volts should be used in connection with the latter, the filament of which should also be run fairly near its rated voltage, or distortion will almost certainly result.

Taken as a whole, if one is careful about the various voltages and coil values, this set should make a really useful "all-purpose" receiver.

(*Continued on page* 191.)



SHORT-WAVE *Notes & News*

DURING the past fortnight the writer has been very glad to note the enormous increase in the number of British stations working on short waves. It has seemed for some time now that the "G's" had either gone to sleep for a period or were conducting their experiments remarkably quietly!

Low-Power Work

It is pleasing to note, too, that there are a large number of keen low-power experimenters in this country, as evidenced by beautiful D.C. notes that could only be produced by means of a dry-battery plate supply. 6WG, of Glasgow, reports excellent results with the "Inexpensive Short-wave Transmitter" described in *Wireless Weekly* for January 20. He has done some good European work with inputs of the order of 3 watts only.

Work on 3,333 kc.

2QB has been "trying his hand" again on 3,333 kc. (90 metres), but reports that there is nothing but European work to be done on this frequency, and even that is difficult.

2KW has left the north and gone to Dublin, where, it is rumoured, he is about to prove that the pen is mightier than the key. 6OH reports that he has worked "all Europe" with 1.5 watts, but not yet U.S.A. Low power and optimism seem to have some connection!

Another "Wireless Weekly" Set

5JW is another user of a transmitter constructed in accordance with a *Wireless Weekly* design. He, too, uses 250 volts of dry cells, and has done some excellent work, including an R6 report from Madeira, when his input was only 3 watts. He is awaiting the delivery of a transformer and a trans-oceanic permit.

Reports Wanted

2FM (38, Galpins Road, Thornton Heath, Surrey) has been working practically all day and night with an input of 95 watts D.C., on 6,667 kc. (45 metres). He particularly wants reports on his telephony, with regard to both strength and quality. He reports that the American 4th district stations have been received at very good strength recently. The writer has also noticed this, so that the reception of transatlantic stations may now be divided into *three* classes:—

(i) Brazilians strong, no North Americans.

One of the foremost names in American short-wave work is that of John L. Reinartz, who is seen seated with the apparatus used on the Macmillan Expedition.

(ii) 4th district and Porto Rico strong, others weak.

(iii) Nearer stations strong, no Porto Ricans, 4th district, or Brazilians.

Ireland

The Irish stations are extremely active just at present, the "big noises" being 5NJ and 6MU, although the latter uses very low power. 5NJ's telephony is usually received at quite good loud-speaker strength in London with a detector and two stages of L.F. amplification. 6MU has worked Ö-AA (Vienna), and thinks that this was the first contact between a "G" and an "Ö." He also worked FM-8MB in Morocco, 9 watts input being used in each case.

He has worked P-3FZ (1,790 miles) on telephony with only 5 *watts!* He also will be glad to receive reports on his signals. He adds his "grouse" to the many that have been received on the subject of the bad DX conditions on short waves.

A T. and R. Departure

The T. and R. section of the Radio Society of Great Britain has established a "QRA and QSL" section, which is being run by Mr. C. A. Jamblin (6BT), of 82, York Road, Bury St. Edmunds. All cards for foreign amateurs may be sent, sufficiently stamped to reach their destination, to this address, and will be forwarded.

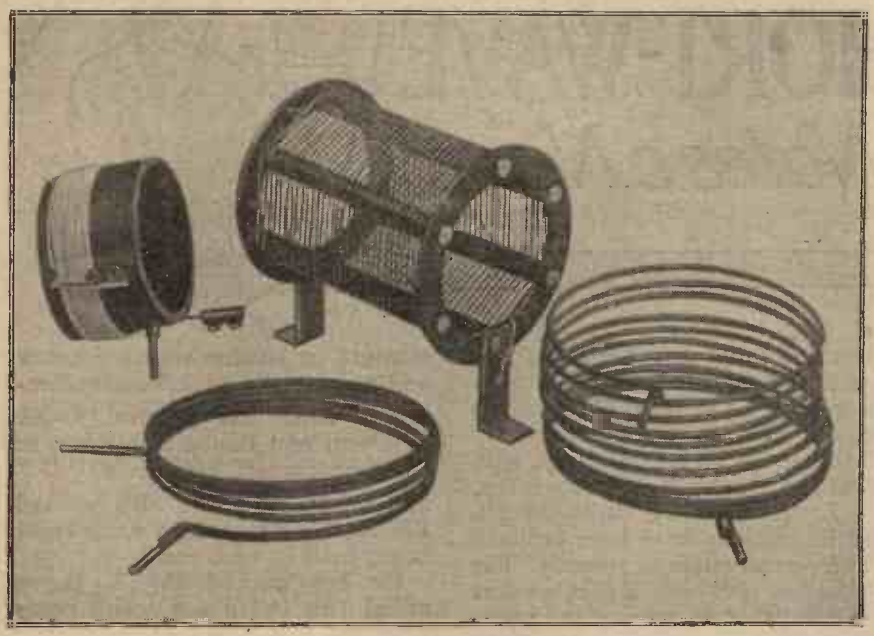
Similarly, all British amateurs who are expecting cards from foreigners whom they have worked should send a supply of stamped addressed envelopes to 6BT, who will file them and forward them as the cards arrive. This section has arranged to make exchanges in bulk with the "Journal des 8," Réseau Belge, and similar organisations.

A Good Effort

Mr. A. J. Baker (2BNU), of Barnet, has received South African A3Y when the latter was working with an input of 6 watts to a D.E.5 valve. This is certainly a fine record, and the reception is confirmed in every detail.

Poland

Various stations with the call-signs TPAV, TPAX, etc., are situated in Poland, where amateur transmission is now licensed. They are to be found in the region of 7,500 kc. (40 metres).



DOES THE INSULATION MATTER?

Coils of all sorts have been made which the designers hoped would be "low-loss," using all sorts of expedients to reduce the amount of dielectric material used. Is it really worth while?

MANY people have been puzzled by the apparent difference of opinion concerning the use of skeleton formers for making up "low-loss" coils. Some people claim that the use of a former in which all possible material has been cut away, using just the bare framework on which to wind the coil, is simply a waste of time, at ordinary radio frequencies, and only becomes important at very high frequencies. On the other hand, there are people who maintain that a considerable advantage results from such a construction.

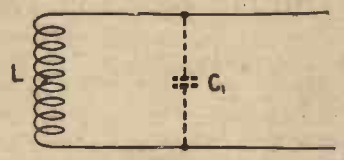


Fig. 1.—The self-capacity of a coil can be regarded for practical purposes as a condenser of definite value in parallel with the coil.

There is also the question as to the exact reason for such a construction, and the effect that the insulation of the former and the covering on the wire may have on the coil itself. It is generally appreciated that an such losses as may be occasioned by these sources are due in some way to the self-capacity of the coil, and the current flowing due to the capacity.

Capacity-Currents

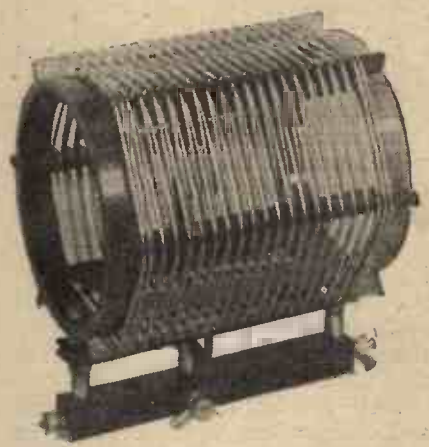
Now it is well known that if we have a coil possessing a certain amount of self-capacity, then for all intents and purposes this capacity may be represented as a small shunt condenser connected across the coil, as shown in Fig. 1. It will be obvious that if this capacity is large, then a greater proportion of the current will flow through the capacity than would be the case if it were kept small. Such capacity-currents detract from the general efficiency of the coil in two ways: in the first place, we have the losses set up by the current flowing through this condenser (which, judged by ordinary standards, is a very poor one); secondly, we have the loss of efficiency due to the fact that the coil is not carrying its full share of the current, but some is passing through the condenser.

"Condenser" Losses

Recent investigations have shown that the actual self-capacity of any well-made coil is very small, and the reduction of this self-capacity by employing a skeleton former is almost negligible. We may assume, therefore, for all purposes of this discussion, that the coil is possessed of a reasonably low self-capacity, and that without considerable trouble this figure cannot be reduced to any appreciable extent. The question then becomes one simply and solely of the losses which are set up in this distributed capacity connected across the coil.

Kinds of Losses

Now condenser losses are of three different kinds. First of all there is the loss due to the direct leakage of current across the insulation resistance, and the effect of this is negligible at ordinary radio frequencies. Secondly, there is the loss due to the actual resistance of the connections and the plates of the condenser, and this is by no means negligible. It is difficult to estimate the order of this effect in the case of the self-capacity of the coil, but it will be obvious that for a high-resistance coil the effect is greater than for a low-resistance one.



A commercial version of the skeleton-supported air-spaced coil.

Dielectric Absorption Losses

Also we have what is known as the dielectric absorption, which is a rather peculiar effect. If a condenser is charged, discharged, and then allowed to rest for a few moments, it will be found that a subsequent much smaller discharge can be taken from the terminals of the condenser. The charge appears to be absorbed into the dielectric in some peculiar manner, and does not all come out on the

The new T.C.C. Grid Condenser

YOU'LL be wise to choose this Grid Condenser. Mica throughout and guaranteed accurate, it is backed by the 20-year-old reputation enjoyed by the Telegraph Condenser Company—pioneers in the building of fixed condensers of all types.

Its upright green moulded case takes up little room on the panel or baseboard. Two flanges facilitate mounting. Observe its special duplex terminals—an exclusive T.C.C. feature—enabling connections to be made either by the milled heads or direct to the soldering tags.

The top of the Condenser is heatproof. There is no possibility that heat from the soldering iron can disturb the internal connections or damage the insulation.

Note also the convenient clips for the grid leak of such generous width as to accommodate practically every make of grid leak. Knowing the reputation of the T.C.C., you'll expect an uncommonly good Grid Condenser—and we can promise you that you will not be disappointed. Made in the same factory and under the same working conditions as the famous T.C.C. Mansbridge Condenser. Each one subjected to the most critical and searching tests it is possible to devise.

Prices of T.C.C. Mica Condensers:

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

No. 34. All capacities between ·0009 mfds. and 0001 mfds. - 2/4

Grid leak clips supplied free

Series-Parallel Type: All values between ·0009 mfds. and ·0001 mfds. 2/10, with two grid leak clips supplied free

T.C.C. Condensers

[Mansbridge and Mica]

Advt. of the Telegraph Condenser Co. Ld., Wales Farm Road, N. Acton, W.3.

Gilbert Ad. 4891.

NO NEED FOR ACCUMULATORS OR BATTERIES

IF YOU HAVE ELECTRIC LIGHTING

AERO BATTERY ELIMINATOR

(Direct Current only)

A positive boon to the Wireless enthusiast. No annoying power failure or trouble of recharging; the "Aero" Battery Eliminator enables you to

Utilise the Electric Lighting Mains for Low Tension and High Tension Supplies.

By simply plugging-in to a lamp holder, connecting the "Aero" Battery Eliminator Terminal to those corresponding on the set, and switching on, the necessary current for both filament and plate is secured. **You must make sure that the current is direct and not alternating.**

Can be operated off 100 to 240 volt mains. High Tension Voltage 40 to 120 volts is available. Will operate 4 dull emitters of the .06 amp. type, or 3 valves of the Mullard P.M. type.

No. R.B. 75/5, complete with 2 lamps, adapter and twin flex, £7 10s.

Brown Brothers Limited

— Allied Companies —

THOMSON AND BROWN BROTHERS LTD
BROWN BROTHERS (IRELAND) LTD

WHOLESALE ONLY

GREAT EASTERN STREET, LONDON, E.C.2
126, George St., EDINBURGH, and Branches.

Build the wonderful new RADION NEUTRODYNE

SOON everyone will be building Neutrodynes. For long-distance reception and perfect stability there is nothing to equal them. The new Radion Book (post free 6d.) gives fullest constructional details of the magnificent 5-Valve Neutrodyne illustrated above. Send for a copy to-day, you'll find complete instructions also given for building three other unique and efficient Receivers at low cost, a 1-Valve Set, a two-Valve Amplifier, and a self-contained Loud Speaker Set. If your Wireless Dealer cannot supply you with this Book, send 6d. to us and we will post you a copy immediately.

Panels **RADION** Dials

American Hard Rubber Company (Britain) Ltd.

Head Office: 13a Fore Street, London, E.C. 2
Depots: 120 Wellington Street, Glasgow, 116 Snow Hill, Birmingham.
Irish Agents: 8 Corporation Street, Belfast

Gilbert Ad. 4886.

Does the Insulation Matter ?—*continued*

first discharge, so that there is a small residual effect.

Obviously, if we have a condenser carrying alternating current, so that it is continually being charged and discharged, this dielectric absorption must exercise some considerable effect.

It is found that this loss behaves in many ways as if it were due to an additional resistance in series with the condenser, and in practice, therefore, it is estimated in terms of an " equivalent series resistance." This effective resistance is not constant, but decreases as the frequency increases. It is as if there were not sufficient time for any charge to be absorbed by the dielectric at very high frequencies, so that the more rapid the variations of current flowing through the condenser, the less is the actual effective resistance due to this dielectric absorption.

Effect of Frequency

It would appear, therefore, from these considerations that, as the frequency was increased, so the dielectric loss in the coil would be reduced. This would indicate that on the longer wavelengths the dielectric loss would be more important than on the short waves, which, as a matter of fact, is in direct opposition to practical experience.

A Strange Discrepancy

Although the actual losses in condensers do tend to decrease as the frequency becomes higher and higher, yet it is a well-known fact that for short-wave reception the coils have to be made with a minimum of supporting material, and even enclosing the receiver in a cabinet may introduce sufficient dielectric loss to prevent the receiver from oscillating. How, then, are we to account for this seeming discrepancy?

The answer to the problem lies in the fact that the current flowing through the self-capacity of the coil increases with the frequency. An increased current through the condenser operates in two ways: in the first place, the actual loss in the dielectric is proportional to the square of the current, so that, although the actual effective resistance of the dielectric may decrease, the total loss increases.

In addition to this, we have the fact that the coil itself is not carrying its full current, but an increasing proportion is passing through the dielectric, which further aggravates the inefficiency of the arrangement, and the net result of these two effects is that the total dielectric loss increases somewhat rapidly as the frequency rises.

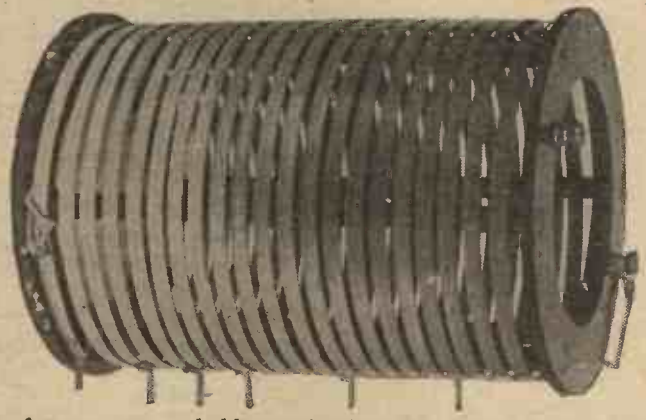
How it Varies

It has been shown mathematically that when all these effects are taken into consideration the actual losses due to the self-capacity current in the coil increase as the cube of the frequency. Thus if the frequency is doubled, the loss due to this cause rises eight times. This, of course, puts a quite different complexion on the whole subject. At ordinary radio frequencies, such as are used in the broadcast band, experiments show that the ordinary dielectric loss is practically negligible. The total losses due to the capacity effect in a reasonably good coil are something of the order of 10 per cent. of the whole only, so that any particular attention to the dielectric is hardly justified.

On Short Waves

On short-wave reception, however, the problem is totally different, because the losses in such a case would immediately predominate over the ordinary copper losses, and this is the reason that skeleton types of coil have to be adopted at very high frequencies. The design of such coils is therefore on a completely different basis to that of coils for ordinary broadcast reception, and in the latter case more efficiency and greater improvement in the result is likely to obtain from the elimination of the more straightforward factors of actual resistance and skin effects rather than from any detailed consideration of the capacity losses.

J. H. R.



Skeleton formers are probably worth while only on the higher frequencies.

A NOTE ON CHOKES FOR TRANSMISSION

The construction of H.F. chokes for use in receiving circuits was dealt with fairly recently in *Wireless Weekly*, but certain additional points on the use of chokes in transmitting circuits call for consideration.

Care should be exercised in the construction of transmitting chokes to see that the two ends of the winding are brought out well away from each other, any terminals which may be fitted to the choke being separated by several inches of space, and further to see that no two turns separated by large differences of potential cross or touch each other at any point in the winding.

A fairly satisfactory alternative to the single-layer winding for use as a choke in a short-wave transmitter is to be found in the basket-coil winding, which some experimenters even prefer for the purpose. Provided that such coils are kept fairly dry, they discharge their duties satisfactorily, and particular mention should be made of the edgewise basket coil, commonly called the " Lorenz," since such a coil tied together with string is eminently well suited to the purpose.

Amateur Transmitting Notes

THE following stations are now in operation, and are desirous of receiving reports on their transmissions :—

2BFO : H. F. Trewby, " Kumra Lodge," Kelvedon Hatch, Brentwood. Transmits on 6,667, 3,000 and 2,000-1,500 kc. (45, 100 and 150-200 metres).

5HU : A. V. D. Hort, 8, Aquila Street, St. John's Wood, N.W.8.

5JZ : H. J. Cheney, 179, Highfield Road, Washwood Heath.

5TD : T. A. Studley, 6, Rutland Road, Harrow. Transmits on 6,667 kc. (45 metres) and 3,333 kc. (90 metres).

6OO : T. Woodcock, " Santos," 8, George Street, Bridlington, Yorks. Transmits on 6,667 kc. (45 metres).

Changes of Address and Call Signs

2ZS (formerly 2AHZ) : 18, Lancaster Court, Newman Street, W.1. Transmits on 45 metres.

5GU (formerly 2AVP) : J. O. J. Hudson, 70, Huxley Road, Upper Edmonton, N.8. Transmits on 1,875 kc. (160 metres).

6IA (formerly 2IA) : T. H. Colebourn, " Ardchalligan," Selborne Drive, Douglas, I.O.M.

B-Y5 : Reports should be sent c/o A. G. Binnie, 1, Cromford Road, West Hill, Wandsworth, S.W.18.

B-W5 : Reports also via the above address. Transmits on 1,667-1,500 kc. (180-200 metres), with 50 watts input, telephony, at the following times :—

Tuesday, Wednesday, Friday, from 22.00 G.M.T. onwards. Sunday, from 09.30 to 12.30 G.M.T.

I-1RG : Radiogiornale Station, Bellagio, Lake Como, Italy. Transmits telephony, with 100 watts, at the following times, on Sundays :—

13.00 G.M.T., 30,000 k.c. (10 metres); 13.30 G.M.T., 16,667 kc. (18 metres); 14.00 G.M.T., 8,571 kc. (35 metres); 14.30 G.M.T., 4,615 kc. (65 metres).

U-1CAL : A. J. Spriggs, 1,285, Boulevard, New Haven, Conn., U.S.A. Works to a daily schedule with G-2LZ at 22.45 G.M.T.

QRA's Wanted

We should welcome any information concerning the following stations :—

G-2BL, G-2ZA, G-6JH, G-5HT, G-5SQ, G-5SR, G-5RY, G-2BAV, G-2ST, G-6GG, M1G, FL8GR, C1OK, IRA, GMB, STL, KPD, DD7, AG5M, MIGB.

QRA's Found

NOT : U.S.S. *Pittsburgh*, in Mediterranean waters. Cards may be sent via G-6BT, 82, York Road, Bury St. Edmunds.

P-3BB : Portugal. Cards via A. C. M. de Carvalho, 25, Crewdson Road, S.W.9.

RCRL : D. A. Rozansky, Leningrad, Russia.

G-6FT : R. F. Frost, 19, Highfield Road, Felixstowe.

Y-8UG : R.A.F. Radio Section, Kohat, India.

N-STB : Dutch Military Aerodrome, Soesterberg, Holland.

NBA : U.S. Naval Station, Balboa, Panama.

U-6XI : G.E.C., Oakland, California.

K-Y7A : Reports via K-Y4, R. Formis, Alexanderstr., 31, Stuttgart.

KFUH : U.S.S. *Kaimiloa*, c/o Messrs. Heintz and Kohlmoos, 219, Natoma Street, San Francisco, California.

C-8AR : Loyal Reid, St. Johns, Newfoundland.

SDK : Norwegian S.S. *Kiruma*, trading between Norway and Brazil.

GFP : R.A.F., Gosport, Hants.

E-1BK : H.Q., Mid-East R.A.F., Villa Victoria, Cairo.

G-AKA : Royal Signals Mess, Catterick Camp, Yorkshire.

QSL Cards Held

We possess cards addressed to the following, and would be glad if they would claim them :—

G-2BOR, G-2BKQ, G-5UQ, G-2IT, L-1AG, G-2LF, G-5HG, G-2ZA, G-2IA, RRP, F-1ZA, B-O8, N-oRP, GBM, B-U3, PCLL, OCNG.

RANDOM TECHNICALITIES

(Continued from page 182)

that there is a series of long, nearly parallel, " hills and valleys " of field strength which would appear to converge in New York, and which extends to the north-east as far as it was thought worth while to follow them.

Another interesting series of tests was taken on three different wavelengths, one corresponding to the carrier wave and the other two to the limits on the side bands given by a 250-cycle note. These tests showed that the fading on the carrier and on the side band signals was not the same. Put in another way, there is selective fading, *i.e.*, fading is a function of frequency as well as time. Oscillograph records are given in the paper to prove this.

Conclusions

There is a wealth of other interesting matter in the paper, which extends over some seventy pages of the proceedings. Here are the main conclusions reached : Fading can be quite sharply selective as to frequency, and the evidence points towards wave interference as the cause. The evidence for wave interference indicates that some of the energy of the received signals reaches its destination by a circuitous route, which suggests that this route is by way of upper atmospheric regions. Quality distortion may result from dynamic instability of the transmitter. Fixed wave-interference patterns in connection with " shadows " sometimes exist in daytime transmissions.

Night Distortion

The paper also throws some light on what we often call " night distortion " such as we experienced at one time from KDKA. Tests, using transmission from an ordinary type of broadcasting transmitter, show that such transmitters have a dynamic-frequency instability or frequency modulation combined with the amplitude modulation. At night the wave-interference effects which produce selective fading result in distortion of the signals when frequency modulation is present. It is shown that stabilising the transmitter will eliminate this distortion.

I have previously remarked in " Random Technicalities " on the great improvement which has come about in the transmission from KDKA, so far as the quality is concerned. Last year, although we used to hear KDKA quite well, the quality was so bad as to make it almost impossible to distinguish what was being said by the announcer. Recently crystal control has been introduced, and now, when conditions are favourable, it is possible to follow the programme with considerable pleasure, as we no longer notice the distortion which characterised last year's transmissions.

Let come what will, I mean to bear it out
And either live with glorious victory,
Or die with fame, renowned with chivalry.
He is not worthy of the honey comb
That shuns the hive because the bees have stings.

SHAKESPEARE

The reward of Victory

"VICTORY," said Napoleon, "belongs to the most persevering." Clement Ader in 1890 built a machine which successfully flew several hundred feet. But, discouraged by his lack of progress, he left the real conquest of the air to the brothers Wright thirteen years later.

It was Edison who sacrificed a fortune to achieve finally the miracle of the electric lamp. Graham Bell faced starvation and poverty to give the world the telephone. In fact, almost every important contribution to Science has been the result of sheer perseverance. It has been the dogged persistence of these pioneers which has won for them the crown of Victory and silenced for ever the tongues of the sceptics.

The same unconquerable spirit of determination was responsible for the evolution of the Cossor Valve. For years the R-type Valve—with its tubular anode and long slender filament had been accepted as the ultimate in valves. But a man with unusual vision sensed the wastefulness of this design. He realised that the efficiency of any valve depended upon the use of the all-important electron stream emitted by the heated filament. His experiments proved that in any valve with straight filament and tubular anode a considerable proportion of the electron stream escaped from each end of the anode. He knew that if he could but solve the problem of retaining the bulk of these electrons, an astonishing increase in sensitivity and volume would be inevitable.

Five years and a small fortune were spent upon the development of the unique electron retaining principles employed in the Cossor Valve. But even to the inexpert—to the man who knows little or nothing of the technique of Wireless—its masterly qualities are at once apparent. He appreciates that no other valve can give him such rare mellowness of tone, such extreme sensitiveness and such lasting satisfaction.

Types and Prices:

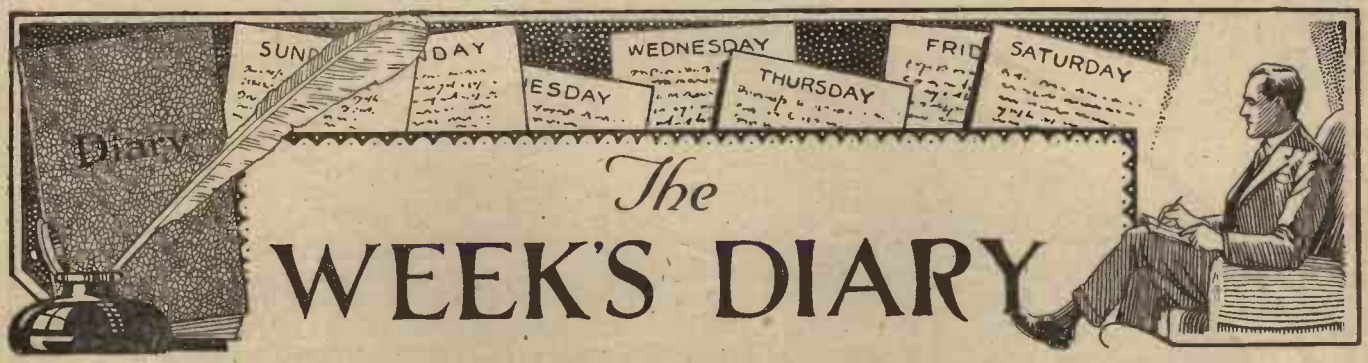
*W.1. For Detector and L.F. use - 14/-
1·8 Volts. Consumption: ·3 amps.
*W.2. (With red top) for H.F. use 14/-
1·8 Volts. Consumption ·3 amps.
W.3. The Loud Speaker Valve - 18/6
1·8 Volts. Consumption ·5 amps.

*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. 4870.



The WEEK'S DIARY

THE Broadcasting Committee's report does not seem to have been particularly well received anywhere, although its mildness has brought a sense of relief to several quarters. Nobody seems to like the idea of Government officials influencing the broadcast programmes, and it is generally felt that the proposed system may kill initiative. This kind of omniscient commission—these supermen and women who are to rule the destiny of broadcasting—are such people really available? Or shall we be pushed off with a lot of political busybodies?

* * *

DAME CAROLINA BRIDGEMAN, wife of the First Lord of the Admiralty, stated the other day that in hospitals broadcast music sent patients to sleep; they forgot to demand an aspirin or a cup of tea or a hot-water bottle! The trouble is that one cannot rely upon the programme always being soothing in this way. I was lulled into a beautiful snooze the other night by Mr. Somebody-or-Other giving a talk on "The Home Life of Snow Shovellers in the Straits Settlements," or some such inspiring topic, only to be brought back to reality by "Yes, Sir! That's my Baby" from the Savoy.

* * *

THE Post Office is experimenting very actively at the present time with apparatus which will introduce into the Rugby-New York wireless telephone service a degree of distortion that will make the talk completely unintelligible to any radio eavesdropper who hopes to intercept these trans-ocean chats. Such apparatus has been tried very successfully in America, and while the speech is violently distorted at the transmitting side, and in this form traverses space, a compensating apparatus at the receiving end provides a kind of reverse distortion, which brings back the quality to normal.

* * *

THE number of broadcast licences now in force is approximately two million (it was actually 1,906,000 on February 28). If we assume there are three people interested in listening on each set (not to mention those who listen without a licence), we have about a seventh of the total population within reach of the microphone. It is fascinating to think of what an enormous influence broadcasting must have already produced on the national life, and we may think quite rightly that we have gone a long way, but what of the teeming millions who are not yet accustomed to broadcasting? A broadcast receiver of some sort is a necessity in every home, no matter how humble. It is of infinitely greater service than the average piano and for far less than the cost of the cheapest piano one can build or buy a really first-grade receiving set.

SAGGING FILAMENTS.

When bright-emitter valves are used in such a position that the filament is horizontal a perceptible sag may develop in course of time. This can often be cured by mounting the valve temporarily the other way up and "flashing" the filament momentarily with a rather higher voltage than the normal. Take care not to use so high a voltage as to risk injury to the filament.

* * *

I SEE the Post Office is not hesitating to prosecute listeners who have installed and worked wireless apparatus without a licence, and the magistrates are making short work of the flimsy excuses so often put up. I have no time for the licence dodger, and he deserves all he gets.

* * *

LOOKING in at Elstree the other day, I found Mr. Reyner very busy with his new Screened Coil set. There have been a lot of troubles in the past in receivers using several stages of high frequency, and Mr. Reyner has found a very ingenious way of overcoming most of them. While examining the receiver I heard strains of dance music from a loud-speaker at the other end of the particular experimental building, and assumed that it was London. I found, however, that the station in question was one of the distant relays—and this in broad daylight! I wish I could tell you more about the set, for it was by far the most remarkable I have ever seen. Certainly it is the first I have known which can be made to bring in every one of the relays in broad daylight at full loud-speaker strength. It is not a superheterodyne, and has an entirely new circuit which, I understand, will be described shortly.

* * *

THE short-wave enthusiasts are having a fine time in these days. It is a most fascinating field to work, particularly as you never know whether the loud signals you are hearing are coming from New Southgate or New Zealand. A friend of mine who rather objects to the conventional methods of obtaining his high-tension supply for a transmitter, and having a particular loathing for messy electrolytic rectifiers, acquired a whole series of high-tension accumulators, and with 1,500 volts obtained in this way, succeeded in getting quite easy two-way communication with Australia! More than one enthusiastic "short waver" has succeeded in relaying the British Broadcasting Company's transmission to the Antipodes.

I am wondering how short a wavelength will soon be in use for practical transmission. A year or so ago we were all wildly excited by the wonderful results we were getting on 90 metres; now the man who uses 40 is looked upon as

The Week's Diary—*continued*

rather a long-wave enthusiast, and 23-metre transmissions are every-day occurrences. Many people now use 5 metres (although they don't seem to reach out very far with it), and for all I know, by next year we may be reaching the border line of visible light!

* * *

THE high hopes engendered by the opening of the "Office Internationale du Radiophonique" at Geneva have not yet been satisfied. I listened the other night to about twenty Continental stations, and fully half of them seemed heterodyned or messed up by harmonics. The interference problem in Europe will never be completely solved until the various Administrations are made to realise that the use of, say, a 5,000-metre wavelength for a commercial station does not give them the right to occupy a dozen other wavebands with their harmonics. Daventry, by the way, is no saint in this respect. Quite a number of harmonics have been traced, with any sensitive set; one

Wireless will play an important part in the operations of the U.S. Navy polar expedition under Commander Byrd. The S.S. "Chantier," a lake steamer of 3,000 tons, will form the base of the expedition, part of the power panels of her transmitter being seen here.

comes very close to the Newcastle wavelength.

* * *

THE trouble caused by Daventry, however, is comparatively slight, and only a very small percentage of listeners with very sensitive sets are likely to be annoyed by them. The chief sinners are high-power commercial stations and some of those owned by the services. The Leafield harmonics were at one time a nightmare to all serious experimenters, but these have been practically all repressed, together with the "mush" emitted by that station. Northolt is still a sinner, and I have heard Aldershot called many bad names.

* * *

THE Amundsen airship, *Norge* 1 is naturally fitted with wireless apparatus. The equipment is of the latest type, and should prove exceedingly useful.

I often wonder just what happens with the wireless apparatus on some of these expeditions. One seldom hears of the really interesting troubles arising when trying to get signals with the mercury in the thermometer hiding away at the bottom of the bulb. So few sets have been used in really Arctic conditions that there is relatively little information available as to what works best there.

* * *

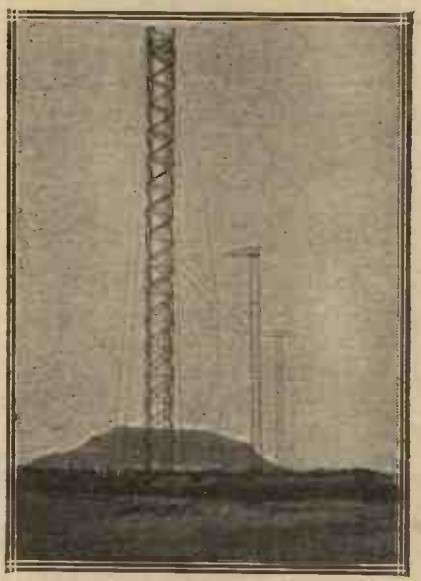
I REMEMBER how, a few years ago, a wireless company supplied a good deal of apparatus for the tropics. It was of a standard pattern which had worked exceedingly well in normal conditions, but after it had been in use a month or two in the tropics it was rendered completely useless. The tremendous heat played havoc with the ebonite, the moisture and heat combined warped all the woodwork out of recognition, while sundry insects, by eating away the insulating material or boring into the wood, set up all kinds of short-circuits.

* * *

THE apparatus was subsequently replaced by another make, the manufacturers of which had given a good deal of thought to providing apparatus for the tropics. Instead of sending out their usual sets, they brought out special equipments on metal frames with porcelain insulation and no wood or ebonite whatever. What annoyed me about the incident was that the specially designed apparatus was of foreign manufacture!

* * *

SOME people appear to be under the impression that the new Commission recommended by the Committee to control broadcasting will prove a little gold mine for the fortunate individuals appointed as Commissioners. Salaries of £5,000 for the chairman and £2,000 for the members of the Commission have been mentioned. I do not know where this idea originated, but I can say quite definitely, in a



The great beam station near Poona, in India, is making rapid progress. The five masts are each to be 297 feet high, and they are being sent out from England in sections. They are 12 feet square and the cross arms are 20 feet long.

phrase which was on everybody's lips a few years ago, that it is "only a rumour." The intention is to pay the expenses of the board out of the funds available from the licence fees, and salaries on such a scale as those quoted are quite out of the question.

OPERATING THE SPLIT-SECONDARY RECEIVER

(Continued from page 184)

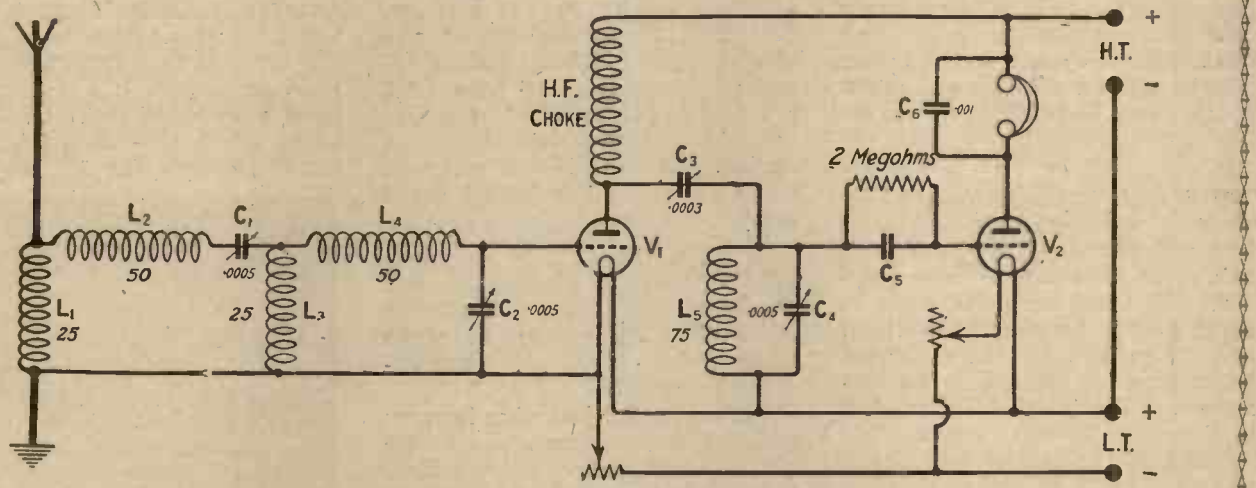
Elstree Test Report

In the course of the usual tests at the Elstree laboratories it was found that the set worked quite well with all the valves tried. Selectivity, however, was decidedly better with a valve of high impedance as detector.

With the correct coils it was found possible to separate Bournemouth entirely from London. Other stations heard included Munster, Stuttgart and Birmingham.

CIRCUITS FOR THE EXPERIMENTER

No. 9—A "CASCADED-FILTER" CIRCUIT.



ONE of the standard methods of obtaining a high degree of selectivity is to use a chain of filter circuits arranged "in cascade." In other words, a series of tuned circuits is arranged with a suitable coupling arrangement between each successive pair, so that a signal which is fed in at one end may be passed through the successive stages and appear at the other end of the chain of filters. Such an arrangement, of course, is an alternative to the more usual scheme of making the successive tuned circuits the intervalve circuits of a high-frequency amplifier, the coupling arrangements in such a case being then provided by the valves themselves. The use of cascade filters has the possible advantage that they can be used with a small number of valves, and for some experimental work much interesting experience can be gained with such a piece of apparatus.

Special Coils

To obtain the best results from a chain of filters it is necessary that the coils of which they are composed should be specially wound for the purpose, since a fairly low value of resistance is desirable, providing that the damping of the circuits is not made so low as to cause distortion of telephony. Further, to obtain the most satisfactory working, it is desirable that stray coupling effects be eliminated between the various portions of the circuits, and for this reason small and compact coils are desirable. As an alternative, some form of fieldless coil may be used, such as a twin winding, or—probably a better alternative—a shielded coil can be used in each case.

With Plug-In Coils

Much interesting experimental work can be done, however, using ordinary plug-in coils, provided that it is understood that stray couplings must be avoided carefully, and therefore the apparatus must be laid out with plenty of space upon the experimental table. The whole success of a receiver of this type depends upon the use of suitably weak coupling between the successive filter circuits, and therefore the spacing out of the various coils is extremely important when full-sized plug-in inductances are used.

CIRCUIT No. 9
SPECIAL FEATURES

1. High selectivity.
2. Small number of valves required.
3. Stable operation.
4. No special valves needed.
5. Plug-in coils can be used.

Coupling

A simple method of coupling the successive stages is to make use of auto-coupling, and this method is included in the circuit illustrated above. The first filter circuit is composed of the coils L1, L2 and L3, tuned by the variable condenser C1. This constitutes, in reality, a secondary circuit, the primary being composed of the auto-coupled aerial circuit, consisting of the aerial and earth and the coil L1 (which is common to both circuits). The coil L1 should therefore be of the customary size for auto-coupling purposes, or for use in a tight-coupled semi-tuned aerial circuit. About a No. 25 is indicated as a preliminary value, this being reduced if it is found possible to do so without any serious loss of signal strength.

Inter-Stage Coupling

The coil L3 acts as the auto-coupling winding common to both first and second filter circuits, and the value indicated for this is a No. 25 at the outset. Once the circuit is got into working order and a general idea of its behaviour has been obtained by the operator, the size of L3 should be reduced considerably, since the value suggested is decidedly too large for real selectivity. At the same time, it will be observed that a reduction of this coil size will bring down signal strength if carried too far.

Intervalve Circuits

One further tuned circuit is provided in the receiver, and this consists of the coil L5 and the condenser C4, forming the tuned intervalve circuit. This circuit is excited by the parallel-feed method of

CIRCUITS FOR THE EXPERIMENTER

(Continued)

coupling from the anode circuit of the high-frequency valve, the variable condenser C3 being provided to adjust the amount of energy passed on from the valve. This condenser will be found to be in effect a reaction control, since if it is above a certain value the whole circuit will oscillate. For practical operation it will be found desirable to keep this condenser considerably below the value which produces self-oscillation, otherwise the whole apparatus becomes exceedingly tricky and difficult to operate.

Other Values

The H.F. choke in the anode circuit of the high-frequency valve may, of course, be of the conventional type, the grid condenser and leak of the detector valve are also of conventional values, while the shunting condenser across the telephones (shown as of .001 capacity) is similarly conventional and may be omitted in many cases without ill effects.

Valves

Such a circuit will not be found at all critical as to valves, one of the typical high-impedance H.F. variety being quite suitable for the first socket. In the second socket any kind of detector valve may be used, since there are no special reaction schemes to complicate matters.

To obtain the best results from a cascaded filter circuit it is important that the damping of each successive stage be reduced to a suitable value, and in the first filter circuit this is very easily done by the expedient of making the coils rather small in value, and the variable condenser large. If it is desired to make up the circuit in a more permanent form, instead of using plug-in coils, the coils may be wound to a total inductance (sum of L1, L2 and L3) of, say, 100 microhenries, and a variable condenser of .001 should then be used for C1. The circuit L3 L4 C2, however, should have the usual high ratio of inductance to capacity in order to obtain the maximum potential difference across the valve V1. G. P. K.

READERS' COMMENTS

"Local Conditions"

SIR,—One hears so many references to the very great influence of local conditions upon the results given by a particular set that there would seem a real danger of the fact being accepted without truly realising its importance.

Most of us know that the locality in which a set is used has some effect upon the results obtained, but do we truly realise how enormous that effect may be? If we did, I cannot help thinking we should be more cautious how we say that a given type of set will produce such and such results, and in this connection I believe that some recent experiences of mine will be of interest.

I am at the present time engaged upon the design and construction of a portable superheterodyne for the coming season, chiefly for motoring use. In its present form this instrument incorporates only six valves, the first being an H.F. amplifier at the incoming frequency, the next a modified tropadyne oscillator-detector, then two intermediate frequency amplifiers, second detector and one-note magnifier, the space occupied by the whole lay-out having been reduced to 6 × 12 × 14 in.

The set is now giving distinctly better results than any super which I have previously used, however many valves were employed, and to gain a correct idea of its capabilities it has, of course, been necessary to test it in various localities.

Most of the testing has been done at my home address in Wimbledon, and here it is normally capable of giving very full loud-speaking from all those of the main B.B.C. stations not too hopelessly heterodyned or otherwise assassinated by miscellaneous jamming, several relays, and shoals of Continental stations.

One is forcibly reminded all the time, however, of the fact that the ether in these parts is in great need of a real good spring clean. Numbers of otherwise excellent stations are made unrecognisable every night by heterodyning, as many as three carriers being sometimes mixed up together in one grand cat-chorus.

Whole bands of frequencies are buried in mush and harmonics (did anyone say Northolt?); trams and electric trains add their quota of crackles and bangs, and last, but *not* least, directly 2LO closes down in the evening all the local oscillation fiends (and there must be hundreds of them within a mile or so of me!) take a firm grip of their reaction coils and proceed to make any further long-distance reception impossible for everyone.

As a corrective to the pessimistic view of the capabilities of an ultra-sensitive set which is apt to result from its use under such conditions, I took the experimental model of the super last week-end to Thetford, in Norfolk, and spent a considerable part of Saturday evening in testing it under the delightful etheric conditions obtaining there.

FORTNIGHTLY FEATURES.

In response to inquiries it is pointed out that the following regular features of "Wireless Weekly" are now appearing fortnightly:—

Circuits for the Experimenter.
Short-wave Notes and News.
Operating Notes.
Jottings by the Way.
Interview.

In nearly three hours' listening to distant stations I did not hear a single howl from an oscillating valve set! Mush has apparently never been heard of in those parts, harmonics were negligible, and every British station came in on the loud-speaker clear and strong without the slightest difficulty.

Stations such as Hamburg and Toulouse appeared to be no further away than the next parish, such was their strength, and they all came in, on turning the dials, one after another in such numbers that it was difficult to resist the conviction that the set was really rather wonderful after all!

However, I had struck such localities with portable sets before, and so the results will merely be used for comparison with those obtained with last year's set in a similar place. The only fly in the ointment was the fact that spark jamming was rather troublesome, but since most of this was coming from the North Sea, the directional properties of the frame were very helpful.

It was interesting to note the great improvement in the strength of 2LO in the locality in question as compared with the signals obtained last year. London is now by far the loudest station heard there, coming in with great vim, whereas last year there were occasions when Bournemouth was the stronger. 2LO is now so strong that fading is no longer perceptible, and actually overloaded my loud-speaker unless detuned somewhat.

The next night (Sunday) the set was back in London, and the difference was really amazing. Numbers of Continental stations which had been within easy reach from Thetford were absolutely lost in the mush and general noise, and the sum total was as though at least a valve had been cut out of the set. In the early evening, of course, before 2LO commenced work at 8 p.m., nothing whatever could be done, for the oscillators were smothering every single Continental station with their din, a state of affairs of which it is difficult to write with becoming restraint.

I hope this somewhat lengthy account will serve to emphasise my point that "local conditions" are worthy of much more serious consideration in predicting the performance of a set than some of us are apt to imagine.—Yours faithfully,

G. P. KENDALL.

Wimbledon.

A Strange Affair

SIR,—I wonder if any other reader has observed anything like this? I have a neighbour (exact location unknown, but he must be very near) who oscillates persistently on 2LO, and appears to try to carry out all his reception on the silent point.

He fiddles about frequently during the evening, and causes appalling howls and yells, but the interesting point is this: When he settles down upon the silent point and appears prepared to go on oscillating indefinitely, I find that if I vary my tuning suddenly it throws his set into a squeal once more!

My set is non-reacting (a crystal set will do it), and I find that if I agitate my condenser vigorously for a few minutes he appears to conclude that

READERS' COMMENTS
(Continued)

reaction is a baffling business, and perhaps not worth while after all, and so stops.

So long as he is oscillating on the silent point my reception becomes distorted, as if I were using an oscillating set, and I wonder what his results are like?

Any other experiences would be welcome.—Yours faithfully,

J. R. CLYNE.

Hampton Court.

Short-Wave Notes and News

SIR,—As one who welcomed the inauguration of this feature in *Wireless Weekly*, I regret to see that your "Short-Wave Notes and News" pages do not appear in the current issue. I trust that this is only a temporary break in the continuity of these notes, since I find them most useful to me in keeping my records and observations of short-wave reception, and it is mainly for the assistance they give me each week that I have recently become a regular subscriber to *Wireless Weekly*. I should much appreciate your reassurance on a subject which must be of interest to a number of experimenters besides myself.—Yours faithfully,

Manchester. L. HARTLEY.

[EDITORIAL NOTE: A statement regarding this feature appears opposite.]

International Symbols

SIR,—I was much interested in Mr. Barton-Chapple's article, "Why do we use Symbols?" in the March 17 issue of *Wireless Weekly*. I have wondered for some time why the English alphabet does not suffice for the symbols used in electrical work. Disregarding Mr. Barton-Chapple's sneer at the "patriotic inclinations" of some people, of whom I am proud to be one, I must say that his answer to the above question does not seem to me complete. He states that the twenty-six letters of our alphabet are insufficient in number, and yet he gives a list, professing to be "complete," which includes only 16 English letters, leaving out the compound symbols. In these 16 letters two are used twice over. Where is the logic in the author's argument?

Might I humbly suggest that if both the small and the capital letters of the English alphabet are used separately, then 52 symbols will be available. In putting forward this suggestion, I have in mind such horrors as "television" and "autobus," which have made their insidious entrance into our mother tongue.—Yours faithfully,

Ely. H. S. FLETCHER.

[EDITORIAL NOTE: Mr. Barton-Chapple will deal with the points raised by our correspondent in a future issue.]

B.B.C. Hours

SIR,—As an experimenter, interested both in short wave reception and "DX" reception on the broadcast frequencies, I have for some time been wondering why it is necessary for the B.B.C. to keep their stations in action until midnight, and, occasionally, even later. I really cannot imagine myself sitting up until the small hours to listen to "canned stuff" and jazz music. No doubt there are many who do this and enjoy it, but I cannot imagine how they got along before broadcasting commenced.

It seems to me that broadcasting, as a luxury, has a weakening effect upon the present generation, who are finding rapidly that they cannot amuse themselves now that there is a "ready-made" amusement available.

Surely the B.B.C. could effect a great economy by enforcing a normal "closing-down time" of 10.30 p.m., thereby allowing the experimenters about 15 per cent. of the time occupied by their programmes?—Yours faithfully,

R. D. WATTS.

Herne Hill, S.E.24.

A hint for the short-wave enthusiast: If you hear noises do not assume atmospherics, but make sure your condenser bearings are properly adjusted.

APPARATUS WE HAVE TESTED

Conducted by the Radio Press Laboratories, Elstree.

Messrs. The Athol Engineering Company's "Tiger" single coil holders are of very simple design.

Valve Holder

Messrs. Garnett, Whiteley & Co., Ltd., have submitted to us for test and report at the Elstree Laboratories a sample of their Lotus anti-microphonic valve hc'der.

Description of Component.

The two main features of this valve holder are, apart from its actual appearance, that it is anti-microphonic, and that it is impossible to injure the valve when inserting it into the holder. The latter quality is assured by the valve sockets being sunk into the insulation material. The anti-microphonic quality of this valve holder is ensured by the use of thin, bent strips of metal which serve to support the insulating material containing the sockets, and also to connect the socket to the respective soldering tags.

Laboratory Tests.

On test it was found that this valve holder provided an excellent fit for several makes of valves, and that it was impossible to burn out the filament by attempting to insert the valve in the wrong way. On testing out in a set with dull emitter valves it was found to insulate the valve satisfactorily from shock and vibration. The insulation resistance of this valve holder was found to be infinite.

General Remarks.

This valve holder is of excellent material and workmanship. The soldering tags with advantage might be made slightly longer, but this is not a serious matter, and the valve holder can therefore be recommended with every confidence.

The Lotus valve holder is of the anti-microphonic type.

Coil Holders

Messrs. The Athol Engineering Co. have submitted to us for test samples of their "Tiger" single coil holders for panel mounting.

Description of Component.

These coil holders are of very simple design, both plug and socket being mounted on black enamelled porcelain

This two-valve holder, a product of Messrs. The Marconiphone Co., Ltd., employs a rubber shock-absorbing system.

1¼ in. long, ⅝ in. wide, with rounded ends. Two nuts are provided for making connection.

Experimental Tests.

On test it was found that the insulation resistance of this coil holder was infinite, and that the fit for most makes of coils was satisfactory. It was also found on test that the porcelain was sufficiently strong to withstand very rough usage.

General Remarks.

This coil holder is of good appearance and the electrical efficiency is high, and can be confidently recommended.

Anti-Microphonic Valve Holder

Messrs. The Marconiphone Co., Ltd., have sent us two of their anti-microphonic valve holders for test and report.

One of these is for two valves and the other for three valves. The two-valve holder consists of an insulating block 3⅛ in. long by 1 in. wide standing about 1¼ in. high. A valve is carried at each end of this block, while in the centre is an oblong hollow recess, in which is placed a piece of "Sorbo" rubber. Two holes are drilled through the bottom of this recess to allow fixing screws to pass through, and beneath this again is another piece of rubber. The whole of this mounting is therefore supported on resilient rubber, so as to absorb all shocks and jars. It can be fixed to a baseboard by means of two fixing screws passing through a metal strap, the screws being inserted at the top of the holder.

Since the valve connections have to be made to the holder, it will be necessary to employ flex, and no alternative to soldering for making the connections is provided. Further, it is necessary to make the connections before mounting the holder on the baseboard.

The three-valve holder is constructed on similar principles, except for the fact that the three valves are placed one at each angle of an equilateral triangle. The springy mounting is circular in form and placed in the centre of the triangle. The same method of making connections to the valve is employed as in the other holder.

Several types of valves were tried in the sockets of these two holders, and found to be a good fit. The insulation resistance of adjacent valve pins was found to be infinity.

Although both are strongly constructed, these holders leave much to be desired, not only as to their mounting, but also in the method of making the connections to the socket.

"Atlas" Aperiodic Coupler

We have received from Messrs. H. Clark & Co. (Manchester), Ltd., one of their Aperiodic Couplers for test and report. This consists of a cylindrical case of black insulating material 2¾ in. long and 1¾ in. in diameter. Three terminals are provided on one of the ends of this cylinder, and they are marked in accordance with the circuit diagram supplied by the makers, with instructions for use.

When tested in a three-valve receiver, inserting it in the centre of the aerial coil, it was found that a marked improvement in selectivity resulted, Bournemouth being received free of interference from London, which had not previously been possible.

This component provides a convenient method of converting a receiver employing single circuit tuning to "untuned" inductive coupling, with resulting improvement in selectivity and without altering the wiring, while at the same time an increased

Apparatus We Have Tested

(Continued)

The "Atlas" aperiodic coupler is a product of Messrs. H. Clark & Co. (Manchester), Ltd.

wavelength range is obtained from the coil in use in the receiver.

Coil

Messrs. The Automatic Coil Winder and Electrical Equipment Co., Ltd., have submitted to us for test and report at our Elstree Laboratories a sample of their "Slektun" inductance coils.

Manufacturers' Claim.

A special point is made that this coil has an extremely low self-capacity.

Description of Component.

This coil is contained in a solidly-made case of insulating material about 3 in. diameter and 1 in. thick. It is a multi-layer coil, ebonite separating strips being employed. A special feature is that these ebonite separating strips are thinner at one end than the other. This is for the purpose of securing the maximum separation between those turns which are at the maximum high-frequency potential difference.

Messrs. The Marconi Company's three-valve holder is built on the same principles as their twin valve holder.

Laboratory Tests.

On test it was found that the constants of the No. 200 coil submitted were as follows:—Inductance 2,000 microhenries, resistance 46 ohms, giving an $\frac{R}{L}$ ratio of .023 ohms per microhenry. The natural wavelength of this coil was found to be of the surprisingly low figure of 220 metres.

The fit of this coil was tried in several makes of coil holders, and it was found to be perfectly satisfactory, and its performance is satisfactorily good.

General Remarks.

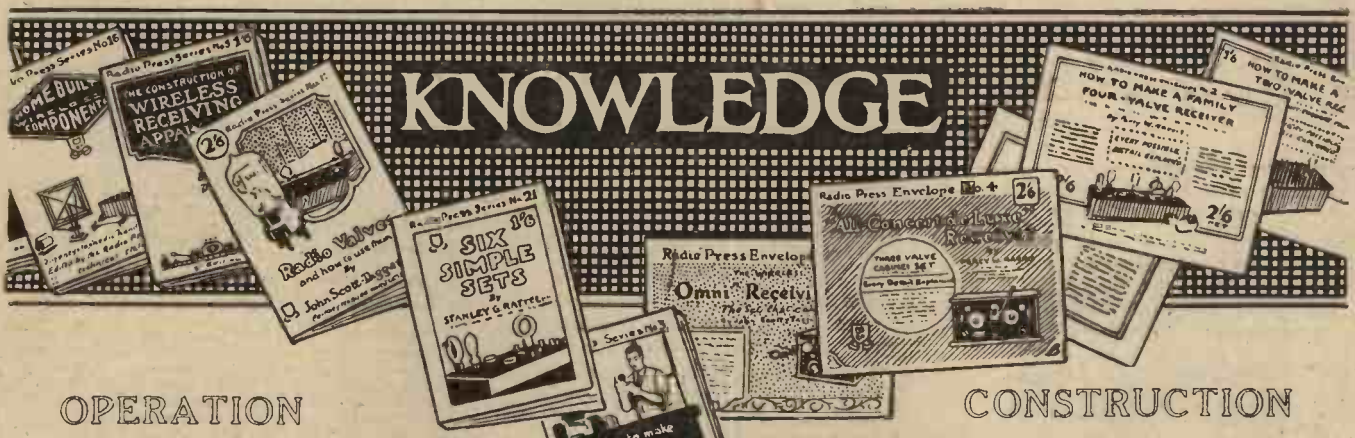
This coil has an exceptionally low $\frac{R}{L}$ ratio, while its natural wavelength is well below that of most coils of its size. Its appearance is also good, and it can be thoroughly recommended for general use.

The Slektun low-loss coil is of the plug-in type.

Plug and Socket

We have received a plug and socket from Messrs. Goodchild & Partners, Ltd., which is intended for use in wireless sets. The plug has a coloured insulating sleeve which is used to cover the joint between the flex and the body of the plug. The socket has a coloured ring of insulated material round it, and is fixed on the panel by means of a 2B.A. clearance hole. The plug is a good mechanical fit in the socket and makes good electrical connection, while the workmanship and finish of this accessory is satisfactory.

They should prove particularly useful for connecting up batteries, and the coloured insulated sleeve and ring enable connections to be correctly made without any fear of mistaking the polarity of the leads.



OPERATION

COMPLETE satisfaction from a radio receiver depends upon the operator's knowledge of its fundamentals. The R.P. Books listed here are expressly written for the man who appreciates the convenience of home study.

CONSTRUCTION

THE building of a Radio receiver becomes a most simple job when working from instructions contained in an R.P. Envelope. Every step is explained fully. You cannot go wrong!

RADIO PRESS BOOKS

No.		Price	Post Free
1	**Wireless for All** — By John Scott-Taggart, F.Inst.P., A.M.I.E.E.	9d.	11d.
2	**Simplified Wireless** — By John Scott-Taggart, F.Inst.P., A.M.I.E.E.	1/-	1/2
3	**How to Make Your Own Broadcast Receiver** — By John Scott-Taggart, F.Inst.P., A.M.I.E.E.	1/6	1/8
4	**How to Erect Your Wireless Aerial** — By B. Mittell, A.M.I.E.E.	1/-	1/2
5	**The Construction of Wireless Receiving Apparatus** — By P. D. Tyers.	1/6	1/8
6	**The Construction of Crystal Receivers** — By Alan L. M. Douglas.	1/6	1/8
7	**How to Make a "Unit" Wireless Receiver** — By E. Redpath.	2/6	2/8
8	**Pictorial Wireless Circuits** — By Oswald J. Rankin.	1/6	1/8
9	**Wireless Valves Simply Explained** — By John Scott-Taggart, F.Inst.P., A.M.I.E.E.	2/6	2/8
10	**Practical Wireless Valve Circuits** — By John Scott-Taggart, F.Inst.P., A.M.I.E.E.	2/6	2/8
12	**Radio Valves and How to Use Them** — By John Scott-Taggart, F.Inst.P., A.M.I.E.E.	2/6	2/8
13	**500 Wireless Questions Answered** — By G. P. Kendall, B.Sc., and E. Redpath.	2/6	2/8
14	**12 Tested Wireless Sets** — By Percy W. Harris, M.I.R.E.	2/6	2/8
15	**More Practical Valve Circuits** — By John Scott-Taggart, F.Inst.P., A.M.I.E.E.	3/6	3/10
16	**Home-Built Wireless Components**	2/6	2/8
17	**Wireless Sets for Home Constructors** — By E. Redpath.	2/6	2/8
18	**Tuning Coils and How to Wind Them** — By G. P. Kendall, B.Sc.	1/6	1/8
21	**Six Simple Sets** — By Stanley G. Rattee, M.I.R.E.	1/6	1/8
22	**Switches in Wireless Circuits** — By Oswald J. Rankin.	1/6	1/8
24	**Wireless Faults and How to Find Them** — By R. W. Hallows, M.A.	1/6	1/8
	Elementary Text-Book on Wireless Vacuum Tubes — By John Scott-Taggart, F.Inst.P., A.M.I.E.E.	10/-	10/6
	Radio Engineering — By J. H. Reyner, B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.	15/-	15/9
	Modern Radio Communication — By J. H. Reyner, B.Sc. (Hons.), A.C.G.I., D.I.C. A.M.I.E.E.	5/-	5/6

RADIO PRESS ENVELOPES

No.		Price	Post Free
1	**How to Build an ST100 Receiver** — By John Scott-Taggart, F.Inst.P., A.M.I.E.E.	1/6	1/9
2	**How to Build the "Family" 4-Valve Receiver** — By Percy W. Harris, M.I.R.E.	2/6	2/9
3	**How to Build the "Simplicity" 3-Valve Set** — By G. P. Kendall, B.Sc.	2/6	2/9
4	**How to Build the All-Concert de Luxe Receiver** — By Percy W. Harris, M.I.R.E.	2/6	2/9
5	**How to Build the Omni Receiver** — By John Scott-Taggart, F.Inst.P., A.M.I.E.E.	2/6	2/9
6	**How to Build the ABC Wave Trap** — By G. P. Kendall, B.Sc.	1/6	1/9
7	**How to Build a 2-Valve Amplifier de Luxe** — By Herbert K. Simpson.	1/6	1/9
8	**How to Make a 1-Valve Reflex Receiver** — By Herbert K. Simpson.	1/6	1/9
9	**How to Build an Efficient Single-Valve Set** — By Herbert K. Simpson.	1/6	1/9
10	**How to Make the Twin-Valve Loud-speaker Receiver** — By John Scott-Taggart, F.Inst.P., A.M.I.E.E.	2/6	2/9
11	**An Adaptable Crystal Set and How to Build It** — By Percy W. Harris, M.I.R.E.	1/6	1/9
	For Aerial, Anode and Reaction Coils "MODERN WIRELESS" COIL TABLE	6d.	8d.

SIMPLEX WIRING CHARTS.

1	**For 2-Valve Set**	1/-	1/3
2	**For 3-Valve Set**	1/-	1/3
3	**For 4-Valve Set**	1/-	1/3

RADIO PRESS PANEL CARDS.

1	**How to Make the W1 Receiver** — By Herbert K. Simpson.	1/-	1/3

RADIO PRESS PANEL TRANSFERS.

	Large Packet of 80 Labels	6d.	8d.

Obtainable from all Newsagents and Bookstalls or direct from the Publishers,

RADIO PRESS, LTD., BUSH HOUSE, STRAND, LONDON, W.C.2

Transformer Ratios

"I have heard it stated that the low-frequency transformer which follows the detector valve in an amplifier should have a low ratio. Is this true, in view of the fact that first stage transformers frequently have a ratio as high as 4 to 1 ?"

It is a mistaken idea that the first stage transformer should have a high ratio. The position of the transformer depends not upon the ratio, but upon its primary impedance and upon the impedance of the valve which immediately precedes it. It is common practice in these days to use for the detector a valve with a high amplification ratio and a correspondingly high impedance, hence the transformer primary in series with the anode of this valve should have a high impedance.

A high primary impedance necessitates a very large number of turns, and a transformer with both a high primary impedance and a high ratio would be most difficult to design. To combine a high ratio with a high-impedance primary would mean that the number of turns on the secondary would have to be extremely large, which in turn would mean a winding with considerable self-capacity, the shunting effect of the self-capacity having a detrimental effect upon the results obtained.

A very good plan is to use a valve such as the D.E.5b or D.F.A.4 as a rectifier, connecting in its anode circuit the primary of a transformer having a ratio in the neighbourhood of 2.5 to 1. The valve following this transformer could be of the small power type such as the D.E.5, D.F.A.1, P.V.5 D.E., or B.T.H. B.4, this valve in turn having in its anode circuit the primary of a transformer with a ratio of about 4 to 1. The last valve could be a similar type with a low impedance. In the case of a transformer following a crystal a low ratio is unnecessary, since the impedance of a crystal is fairly low and, in fact, very excellent results can be obtained with transformers having ratios as high as 6 or 8 to 1.

If a detector valve having a moderate impedance of, say, 16,000 ohms, is employed, the average 4 to 1 ratio transformer will give perfectly good results, and as the impedance of the valve gets lower so the transformer ratio may be made correspondingly higher.

Resistance and Transformer Coupling

"In a combined resistance-capacity and transformer-coupled low-frequency amplifier I am told by a friend that the resistance stage should come first. In many sets, however, I notice that the transformer stage is placed first, this being followed by a stage of resistance amplification. Which is correct ?"

The position of the resistance and transformer stages is wholly a matter of design, since it is quite possible for both arrangements to be quite correct. For instance, with an amplifier making use of a high impedance detector valve, it would be better to put the resistance first on account of the possibility of distortion being intro-

Is Your Problem Here?

(*Continued*)

duced by placing an unsuitable transformer in this position.

By following the type of detector valve mentioned by a low-frequency valve of moderate or low impedance, it is possible to use one of the conventional 4 to 1 ratio transformers and still to retain purity of reproduction. On the other hand, the use of an anode resistance in series with the anode of the detector valve renders the use of switching rather difficult, and in many designs in order to enable some form of switching to be employed a very carefully chosen transformer is used. In this way it is possible to devise some simple method of switching by which the low-frequency stages can be cut out when desired.

Another point in favour of placing the resistance first is that a common anode potential can be applied to the detector and L.F. valves. This is possible owing to the fall in potential across the anode resistance in series with the plate of the detector valve, which ensures that the anode voltage applied effectively to this valve is lower than that applied to the low-frequency valves following. Perhaps this explanation will help to clear up our querist's difficulties.

"Gettering"

"What is the object of the silver mirror present in most dull-emitter valves?"

With dull-emitter valves of the thoriated filament types it is essential that a very high degree of vacuum should be obtained if the valves are to function efficiently, and some method has therefore to be adopted to remove all traces of water vapour, carbon monoxide and other gases which are occluded within the electrodes, etc. This process, known as "gettering," is responsible for the silvery mirror-like effect on the inside of the bulb. What actually happens is that some metal, or other element which readily combines with the particular gases to be eliminated, is introduced into the bulb during the course of manufacture and is subsequently heated up during the exhaustion process, when it volatilises and combines with the unwanted gases. The "getter" at the same time deposits itself over the bulb, so producing an obscuration of the glass. Magnesium metal is often employed, and the silvering effect is due to its use.

Accumulator Charging

"Can I charge my 6 volt 60 ampere-hour (actual) accumulator together with my house lighting battery which is rated at 100 volts 200 amperes? The house battery is charged by a dynamo driven by an oil engine."

The charging rate for the main house lighting battery is much too heavy to permit of the small accumulator being placed in series with it for charging, and some other means must therefore be adopted. The best way out of the difficulty is to connect the 6-volt 60 actual ampere-hour accumulator in series with a resistance across the main battery, a low-reading ammeter being employed, one with a range of 0 to about 10 amperes being suitable, to make certain that the small battery is not charged at an excessive rate. The series resistance should be capable of carrying about 6 amperes without undue heating, and one of 16 to 20 ohms will allow the battery to be charged at a suitable rate.

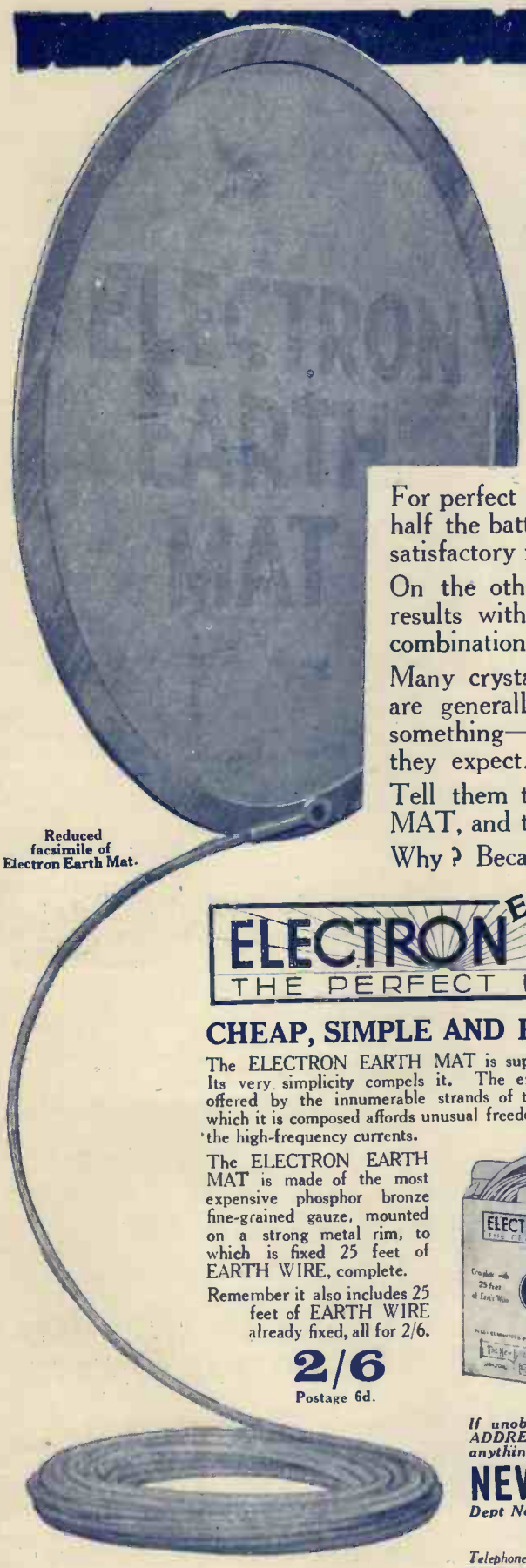
Radio Press Information Dept.

2/6 QUERY COUPON 2/6

WIRELESS WEEKLY. Vol. 8. No. 6. March 24, 1926.

This coupon must be accompanied by a postal order of 2/6 for each question, and a stamped addressed envelope.

A PERFECT COMBINATION FOR PERFECT RECEPTION



Reduced facsimile of Electron Earth Mat.

For perfect reception a good aerial and earth system is more than half the battle. The most ingenious and expensive set will not give satisfactory results if the aerial and earth system is bad.

On the other hand, a very ordinary set will give amazingly good results with the SUPERIAL and ELECTRON EARTH MAT combination.

Many crystal users do not know the capabilities of their sets, and are generally satisfied with very ordinary reception. They hear something—a tinkle of music, a whispered talk—and that's al they expect.

Tell them to instal the SUPERIAL and ELECTRON EARTH MAT, and they will be amazed at the increased volume.

Why ? Because this combination is built that way.

ELECTRON Earth MAT
THE PERFECT EARTH

CHEAP, SIMPLE AND PERFECT

The ELECTRON EARTH MAT is supremely efficient. Its very simplicity compels it. The enormous surface offered by the innumerable strands of the fine mesh of which it is composed affords unusual freedom of release to the high-frequency currents.

The ELECTRON EARTH MAT is made of the most expensive phosphor bronze fine-grained gauze, mounted on a strong metal rim, to which is fixed 25 feet of EARTH WIRE, complete.

Remember it also includes 25 feet of EARTH WIRE already fixed, all for 2/6.

2/6
Postage 6d.

SUPERIAL
THE KING OF AERIALS

EXTRA-HEAVY INSULATION FOR LONG-DISTANCE RECEPTION

The mathematical combination of heavily tinned strands with a plated copper core in SUPERIAL —the King of Aerials—greatly improves the reception, both of voice and instrumental music. SUPERIAL, being insulated with extra-heavy vulcanised rubber, renders insulators an unnecessary extravagance, besides increasing the long-distance range of your set.

2/6
Postage 9d
Including Wooden Spool.

If unobtainable from your Dealer send direct to us, together with HIS NAME AND ADDRESS, and we will deliver promptly by return. Do not be persuaded to buy anything else.

NEW LONDON ELECTRON WORKS, LTD.
Dept No. 65. *(Members of the B.B.C.)*
EAST HAM, LONDON, E.6.
Telephones : Grangewood 1408-1409. *Telegrams : "Stannum, London."*

B.500. INTERVALVE TRANSFORMER.—Guaranteed for 12 months. Price **21/-** each. This Transformer has been adopted by leading manufacturers of wireless receiving sets and discriminating amateurs in all parts of the world. **Excellent results have been obtained on tests carried out by the National Physical Laboratory. Copy of the curve can be had on application.**

Silvertown

on a Wireless Component-

Means

B.558 VARIABLE CONDENSERS.—For use as independent units.—Strongly constructed on the same principle as variable condensers for panel mounting. Enclosed in dust-proof non-inflammable Celastoid covers, and fitted with dial, knob, two terminals, and three feet for fixing to table or board if required. Price **12/-** each.

an assurance of the finest quality obtainable. For over 50 years The Silvertown Company have been manufacturing Electrical Apparatus, during which time they have gained an unassailable reputation for quality, accuracy and workmanship in all their products. To say "Silvertown," therefore, when buying wireless accessories, is a safeguard to you in ensuring

Perfect Reception

SILVERTOWN POTENTIOMETERS.—On rectangular ebonite former complete with knob and pointer. Former mounted on cast brass frame. Resistance approximately 400 ohms.

New Reduced Prices.

B.529.—For panel mounting, **5/-**; old price, 7/6.

B.564.—Mounted, **15/6**; old price, 18/-

Makers:

THE SILVERTOWN COMPANY

106, Cannon Street, London, E.C.4 ***Works:* Silvertown, E.16**

BELFAST: 75, Ann Street.
BIRMINGHAM: 15, Martineau Street.
BRISTOL: 4, Victoria Street.
CARDIFF: Pier Head Chambers, Bute Docks.
DUBLIN: 70, Middle Abbey Street.
GLASGOW: 15, Royal Exchange Square.
LEEDS: 1, New York Road.
LIVERPOOL: 54, Castle Street.
LONDON: 100 and 102, Cannon Street.
MANCHESTER: 16, John Dalton St.
NEWCASTLE-ON-TYNE: 59, Westgate Road.
PORTSMOUTH: 49, High Street.
SHEFFIELD: 88-90, Queen Street.

Published by the Proprietors, RADIO PRESS, LTD., Bush House, Strand, London, W.C.2, on Wednesday of each week, and printed for them by THE AVENUE PRESS (L. Upcott Gill & Son, Ltd.), 55-57, Drury Lane, W.C.2. Address for Subscriptions and Editorial Communications:—Bush House, Strand, London, W.C.2. Address for Advertisements:—ADVERTISEMENT MANAGER, "Wireless Weekly," Bush House, Strand, W.C.2. Registered as a newspaper and for transmission by Canadian Magazine Post. Subscription rates:—U.K., Canada and Newfoundland, 17/4 per annum; other countries, 19/6 per annum. Sole Agents for Australasia:—GORDON & GOTCH (Australasia), LTD. For Canada:—IMPERIAL NEWS, LTD. For South Africa:—CENTRAL NEWS AGENCY, LTD.

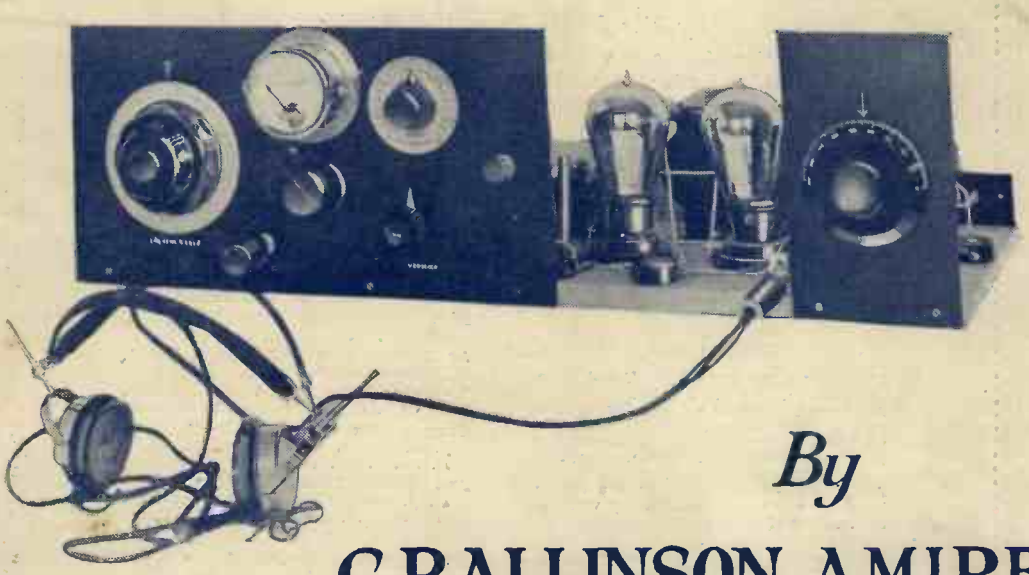
Wireless Weekly. March 31st, 1926. 3d.

Wireless Weekly

Vol. 8. No. 7.

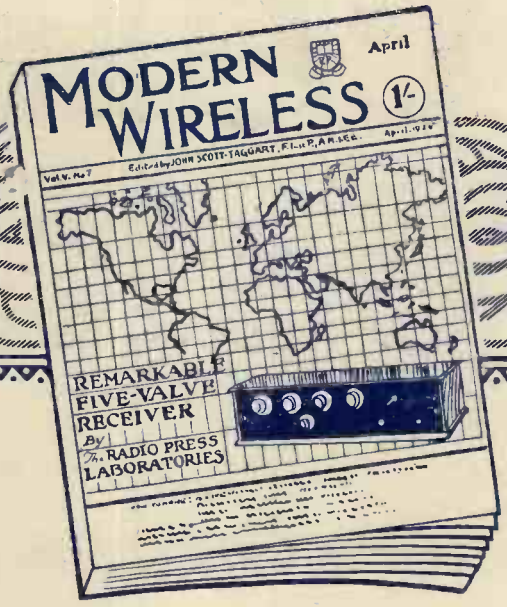
THE 100% VALVE PAPER

15 to 100 METRES on A SUPERHETERODYNE



By

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



Ever in the lead with news concerning developments in construction, design, etc., the April number of MODERN WIRELESS lives up to the high reputation it has established.

REMARKABLE FIVE-VALVE RECEIVER.

By The Radio Press Laboratories.

On the occasion of a recent visit of Press Representatives to our Laboratories at Elstree, this selective receiver was used for the demonstration, despite the fact that two superhets were available.

Incorporating a true neutrodyning scheme and being both sensitive and selective, the simplicity and ease of handling will appeal to all.

The circuit is 3 H.F., Detector and 1 L.F., and large numbers of B.B.C. (main and relay) and Continental Stations can be received at will.

FURTHER CONTENTS:

ARE YOU PREPARING FOR THE SUMMER MONTHS? *By John Underdown.*
A set largely designed for outdoor Loud-Speaker work on local station and Daventry, also telephone reception on many other stations.

THE "COMPACTUM" TWO-VALVE RECEIVER. *By E. H. Berry.*
A compact Receiver suitable for putting into a small attaché case for transport purposes.

A BIJOU CRYSTAL RECEIVER. *By The Radio Press Laboratories.*
A semi-permanent detector with a tuning inductance which is continuously variable are features of this set.

SOME INTERESTING CIRCUITS FOR THE EXPERIMENTER. *By G. P. Kendall, B.Sc.*

HOW INTERFERENCE HELPS. *By H. L. Crowther, M.Sc.*

AT HOME WITH THE SET. *By A. Johnson-Randall.*

WORKING VALVES FROM THE D.C. MAINS. *By Capt. H. J. Round, M.C., M.I.E.E.*

CUTTING OUT THE STRAY FIELDS. *By J. H. Reyner, B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.*

ALL ABOUT YOUR CONDENSERS. *By H. J. Barton-Chapple, Wh. Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.*

Obtainable from all Newsagents, Booksellers and Bookstalls, or direct from the Publisher, Bush House, Strand, London, W.C.2.

Subscription Rates: 15/- per annum, 7/6 for six months, post free.

RADIO PRESS Ltd. Bush House, Strand, London, W.C.2

Modern Wireless

Make two bob act like five!

Mr. Wraydio : "*It's dead accurate.*"
You : "*So is a Smith.*"
Mr. Wraydio : "*It's fully guaranteed.*"
You : "*So is a Jones.*"
Mr. Wraydio : "*It's made from the finest ruby mica and other raw materials.*"
You : "*Nothing New about that.*"
Mr. Wraydio : "*You can fit it in series or parallel.*"
You : "*Good, but Robinson's make an attachment like that.*"
Mr. Wraydio : "*Yes, but (and here he has you), all these points—accuracy, written guarantee, perfect raw materials, patent series—parallel clip, combined AND made by Graham Farish, AND sold for two bob.*

AND YOU'LL SAY : "*THAT'S DIFFERENT, WHERE CAN I GET 'EM?*"

PRICES.

CONDENSERS.		GRID LEAKS.	
.0001—.002 mf.	1/-	All Resistances -	1/3
.003—.01 „	1/6	COMBINED. Grid Leak and Condenser	2/-

Why at your local dealers, or if he is out of stock send us his name and we will despatch to you C.O.D. on receipt of a P.C. only.

The GRAHAM FARISH Mfg. Co., Wray Works, BROMLEY, Kent.

GRAHAM-FARISH

CONDENSERS & LEAKS

SEND NO MONEY—*Pay the Postman*

Wireless Weekly

Phone: City 9911

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

RADIO PRESS, LIMITED, Bush House, Strand, London, W.C.2

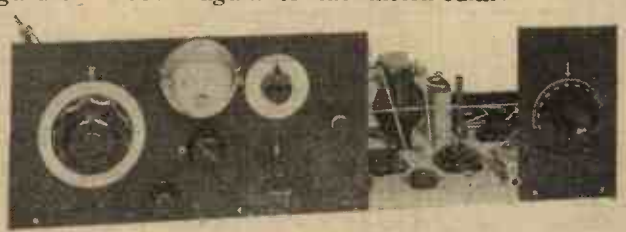
Wireless Weekly
Edited by
JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.
Technical Editor
J. H. REYNER
B.Sc.(Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

15 to 100 Metres on a Superheterodyne

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

The superheterodyne is an instrument of fascinating possibilities on the higher frequencies. Ease of handling, great sensitivity, and economy of current consumption characterise this easily-built set.

ONE of the most important applications of the supersonic system of reception is to the higher frequencies, due to the fact that the use of ordinary H.F. amplification has not as yet been found practicable above, say, 3,000 kc. (100 metres), even if as high as that. If, however, a superheterodyne receiver is not to present any disadvantages at all with regard to the simplicity of handling when compared with a low-loss detector, followed by one or two stages of L.F., it must comprise one tuning control only, and perhaps one reaction control.



The small panel on the right carries the condenser of the long-wave oscillator used for C.W. reception.

Two Frequency Changes

With the usual superheterodyne receiver there are two controls, one for the aerial tuning circuit or input circuit and one for the oscillator, and if it is desired to use a separate oscillator on the high frequencies it will be found that the tuning and oscillator circuits when correctly adjusted are so very nearly in tune, especially when a low intermediate frequency is used, that the slightest "overshooting the mark" with either of the condensers tuning these circuits may result in the oscillator going out of oscillation with a click.

One method that may be employed to overcome this trouble is to step the frequency down to what we may call a high intermediate value corresponding, say, to a wavelength of 600 metres, and then amplify at this frequency only, or, having amplified at this frequency, step it down again to the intermediate frequency usually employed, by means of a second oscillator.

A Simpler Method

Another method, which is that used in the set to be described, is to take advantage of the very fact that the difference in frequency between the tuning and oscillator circuits is so slight as to result in these circuits being practically in tune to use the same valve and the same circuit both for the first detector and oscillator. In this case the circuit will, of course, be tuned to the oscillator frequency, and will therefore be detuned from the signal frequency, but since the factor with which we are concerned is to all intents and purposes the percentage detuning, this is, especially at the really high frequencies, almost negligible. At 50 metres, for instance, which is equal to a frequency of 6,000 kc., the percentage detuning when an intermediate frequency of 50 kc. is used is approximately .83 per cent. At higher frequencies it is, of course, still less.

Its Advantages

The advantages, however, greatly outweigh this slight disadvantage, and they may be enumerated as follows:—

Ease of control, only one dial to adjust.

A fine adjustment of reaction is provided which is entirely independent of the tuning, so that telephony as well as C.W. may easily be received.

Great amplification, resulting in very distant stations being received at good signal strength.

No moving coils, so that the

15 to 100 Metres on a Superheterodyne—*continued*

receiver may be calibrated without risk of subsequent inaccuracy.

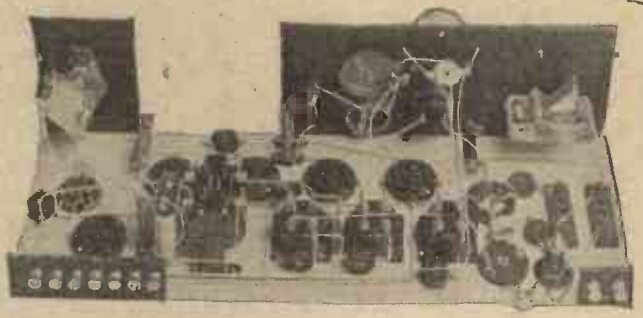
Short indoor aerial only is necessary, which helps to eliminate "dead spots."

It will be seen from the photographs that the complete receiver makes no pretentions to appearance, but has rather been designed to be as economical as possible compatible with good performance. Two small ebonite panels only have been used, while the cabinet (an expensive item) has been dispensed with.

Controls

The large dial on the left is the only tuning control. To its right is a small milliammeter (which, incidentally, does not need to be an expensive precision instrument, since it is merely for the purpose of indicating whether the first detector is oscillating or not), below which is the filament resistance controlling the detector-oscillator valve. The other valves are controlled by means of fixed resistances, and, since the receiver has been designed for use with .06 amp. valves, two of these are run in series in one case. These are the second detector and the low-frequency amplifier.

The small panel on the right carrying a variable condenser is for tuning a long-wave oscillator as a means of obtaining a beat note when C.W. is being received, and, though this is not absolutely necessary (since the intermediate frequency amplifier of the receiver can be made to oscillate), it was found that the use of the separate long-wave oscillator gave a better "background," which was frequently found a desirable feature. This valve may be switched on by means of a small push-pull switch located on the right-hand side of the main panel.



The removal of coils and valves permits it to be seen that the lay-out of the set makes the wiring a very easy matter.

Jack Switching

Close to the small panel, and fixed to the baseboard, is a filament control jack, by means of which the 'phones are placed in the anode circuit of the L.F. valve. This at the same time comprises the low-tension switch for the set, so that when the 'phone plug is withdrawn the whole set is switched off. All terminals for aerial, earth and batteries are carried on terminal strips at the back of the baseboard.

The circuit diagram is shown in Fig. 1, from which it will be seen that the circuit employed is a perfectly simple and straightforward one. "Parallel feed" to the first detector is employed, which is similar to the circuit used by the writer in a short-wave receiver described in a previous number of *Wireless Weekly*. The aerial is connected to a tapping on the anode coil L2 through a small neutrodyne condenser, the reaction condenser C2 having a capacity of .0003. This coil is coupled permanently to the grid coil L1, which is tuned by a .0003 variable condenser.

Valve Controls

The milliammeter in the plate circuit of this valve is shunted by a fixed condenser of .006 capacity, while the H.T. + terminals of all three intermediate frequency transformers are connected to L.T. through separate .006 condensers.

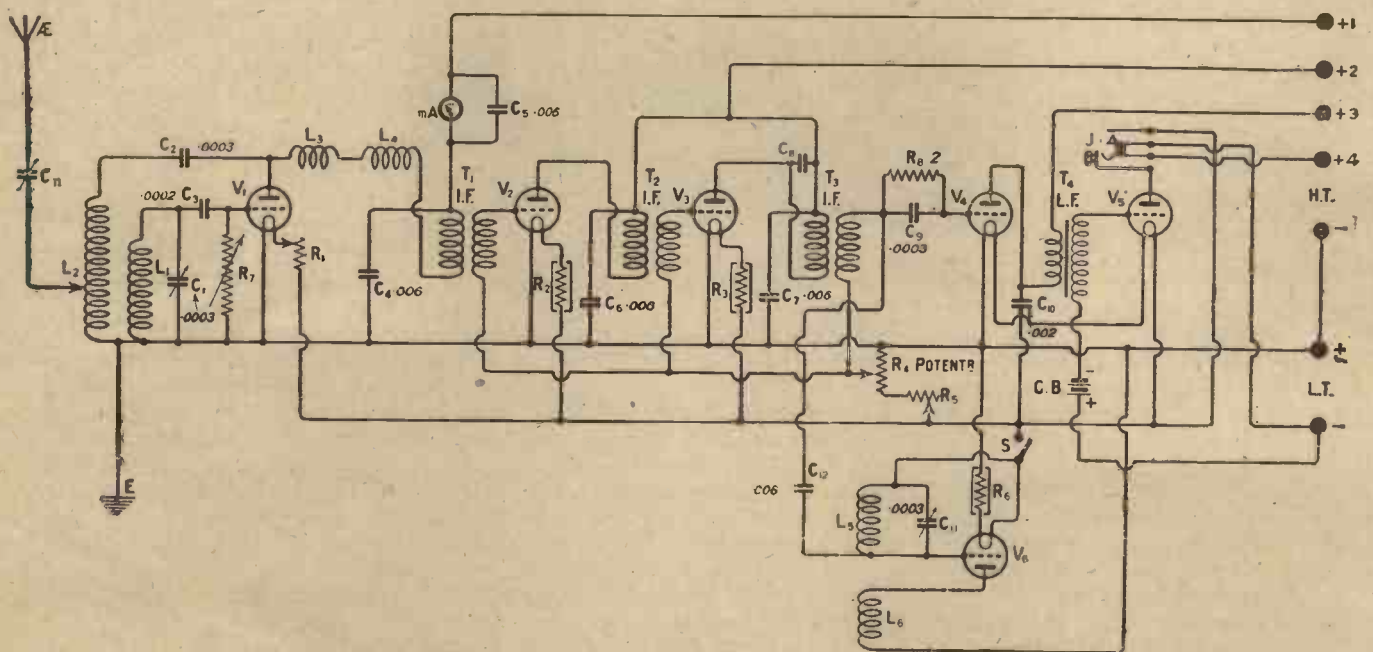


Fig. 1.—The condenser in the aerial circuit is of the small neutrodyne type, while C8 is supplied with the intermediate transformers.

15 to 100 Metres on a Superheterodyne—*continued*

Both the inter-frequency valves are controlled by fixed resistances, while the second detector and L.F. are run in series. It should be noted that the L.F. valve is the one which is connected to L.T. −, and this must be done, else the grid potential will be upset. This point should be borne in mind with regard to the inter-frequency amplifying valves also, since should the attempt be made to run these in series the grids will be at different potentials, and the receiver will not function.

A fine adjustment is obtainable on the potentiometer by means of the filament resistance R_5 connected in series with it, and this will be found to be a refinement well worth while, especially when receiving telephony.

Components Used

A list of the components used in the construction of this set is given below, and the names of the manufacturers are given for the reader's guidance. Other parts of known quality may, of course, be used instead of those mentioned, but if inter-frequency transformers other than those specified are employed by the constructor, the results obtained by the writer cannot be taken as any criterion.

One ebonite panel, matt, 13¾ in. x 7 in. x ¼ in. (Paragon Rubber Co., Ltd.).

One ebonite panel, matt, 4 in. x 7 in. x ¼ in. (Paragon Rubber Co., Ltd.).

One .0003 "Amsco" S.L.F. variable condenser (Rothermel Radio Corporation of Great Britain, Ltd.).

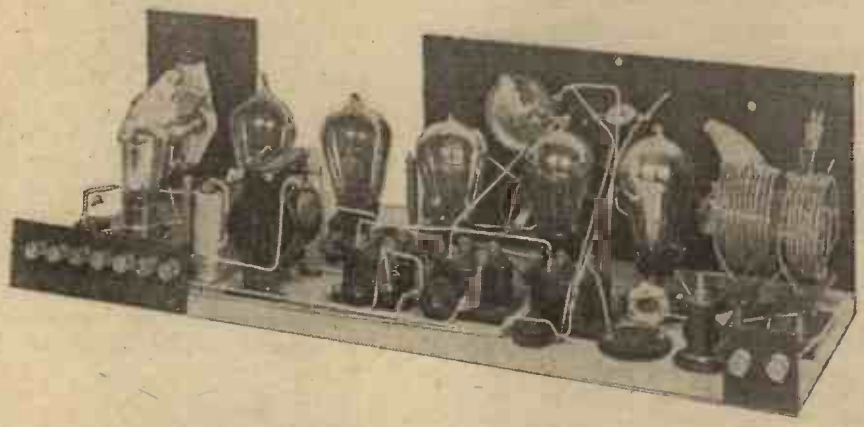
One Silver-Marshall inter-frequency transformer kit (Rothermel Radio Corporation of Great Britain, Ltd.).

One "Gee Haw" vernier dial (Rothermel Radio Corporation of Great Britain, Ltd.).

One panel mounting milliammeter, 0-5 m/a.

One "Antipong" valve-holder (Bowyer-Lowe Co., Ltd.).

Five Lotus valve-holders.



This view shows how the aerial lead from the series condenser is attached to the appropriate tapping point on L2.

Three 50-ohm fixed resistors (Burndept Wireless, Ltd.).

One potentiometer (Burndept Wireless, Ltd.).

One Yesly 30-ohm filament resistance (Engineering Supplies, Ltd.).

One Peerless Junior 30-ohm filament resistance (Bedford Electrical Co., Ltd.).

One Dekko baseboard neutrodyne condenser (A. F. Bulgin & Co.).

One L.F. transformer (Ferranti type A.F.3).

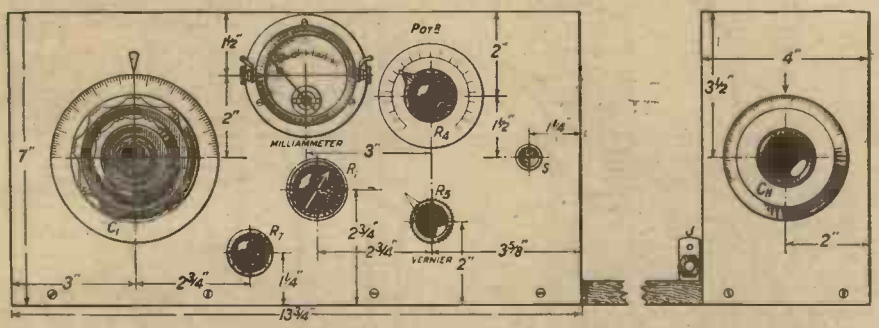


Fig. 2.—Two separate ebonite panels are used, but they could be combined in one of suitable size if desired.

One single-circuit single-filament control jack, and one telephone plug (Igranic Electric Co., Ltd.).

One .0003 and one .0002 fixed condensers (Watmel Wireless Co., Ltd.).

One .0003 condenser and 2 MΩ leak (Watmel Wireless Co., Ltd.).

Five .006 fixed condensers (Watmel Wireless Co., Ltd.).

One .002 fixed condenser (Watmel Wireless Co., Ltd.).

One variable grid-leak (Bretwood, Ltd.).

One Utility .0003 variable condenser (Wilkins and Wright).

One Magnum valve-holder, anti-capacity type (Burne-Jones & Co., Ltd.).

One H.F. choke (Burne-Jones & Co., Ltd.).

One push-pull three-point switch (Lissen, Ltd.).

One No. 4 H.F. plug-in transformer (L. McMichael, Ltd.).

One wooden baseboard, 24 in. x 7¾ in. x ⅝ in.

Nine 4 B.A. terminals and material for terminal strips.

Some gauge 10 bare copper wire and pieces of ebonite 3 in. x 1 in. x ¼ in.

Valve legs and pins for the coils.

Quantity of Glazite wire for connecting up.

One spring clip.

One Dekko dial indicator.

One set Radio Press panel transfers.

Constructional Details

It is important that ebonite known to be free from all possibility of leakage be employed in the construction of this receiver, and the panels should be drilled according to the dimensioned drawing shown in Fig. 2. The components carried on the panels should be mounted thereon and the panels fixed to the baseboard by means of some No. 3 ½-in. wood screws. The terminal strips should also be made up and fixed to the rear edge of the board.

Next, the remaining components which go on the baseboard should be fixed in position, and the wiring diagram will be found a useful guide

15 to 100 Metres on a Superheterodyne—*continued*

in doing this. Wiring up the receiver may now be commenced, and the L.T. circuits should be done first. The wiring diagram should be followed carefully as a guide to the disposition of the leads. The remainder of the connections may be made as convenient, and there is no point that calls for special comment in this connection.

The Coils

The construction of the coils used is described in detail in a previous issue of *Wireless Weekly*, but for the benefit of those who have not got this copy the necessary details are given in the accompanying sketch.

The coils are wound on a 3-in. or 2¾-in. diameter former, five coils being required of 14, 10, 7, 5 and 4 turns respectively. These are spaced by weaving thin string over and under the turns, the ends of the string being brought out to the same side of the coil and tied. This is done in four places on each coil. The completed coils are mounted on the special holders constructed according to the dimensions shown, these being arranged so as to plug into the sockets shown. All coils should be wound in the same direction.

Connections are made to the coil sockets by placing soldering tags under the valve legs, and to the coil mountings by placing these tags under the securing nuts for the valve pins, a short piece of wire being soldered to the tags and the ends of the coil. Five of these mountings are required and two of the sockets. Short pieces of wire bent at right angles may be soldered on to the 7- and 4-turn coils for the aerial tap, and it may be advisable to provide alternative taps, especially if an outside aerial is to be used.

Testing

Having completed all the connections, the receiver should be tested out by connecting up the L.T. battery (a six-volt one is used so as to allow a 5-volt power valve to be employed for the first detector), screwing in the fixed resistors and inserting four .06 valves into four of the valve-holders and a ¼-amp. valve into the first one. Insert the 'phone plug in the jack, and see that the last four valves light up correctly while the first valve is controlled by its resistance. A .06 valve may also be inserted in the last holder to see that the push-pull switch turns it on and off.

Next test the H.T. circuits, for this purpose strapping all the H.T. positive terminals together. First tap off at 6 volts in case a short is occurring anywhere, but if all is well and the valves do not change in brilliance try a higher value. Everything being in order, the correct values of H.T. should be applied to each valve. For the first valve this should be as high as possible without producing a squeal, and the variable grid-leak should be set at a fairly low value, say, with the plunger screwed out about a third of the way. With .06 valves a suitable value for the intermediate

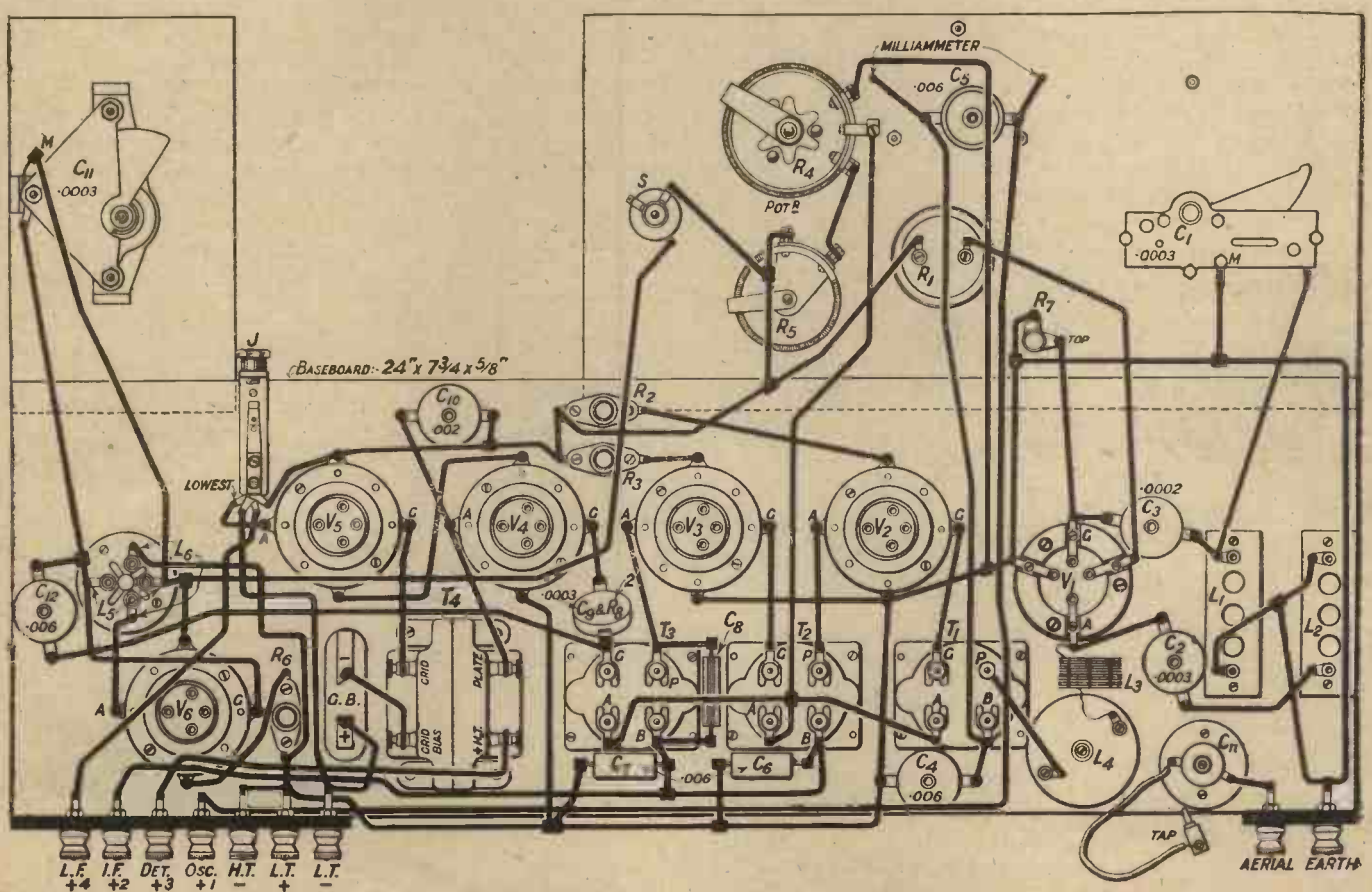


Fig. 3.—Certain parts of the wiring are here shown outside the limits of the baseboard for clearness' sake.

15 to 100 Metres on a Superheterodyne—*continued*

stages is 90 volts, about 60 for the second detector and 100 for the L.F. D.E.5 type valves will also function satisfactorily in the intermediate stages, in which case only 60 volts will need to be applied to them.

The Oscillators

Should any difficulty be experienced in getting the first valve to oscillate over the whole scale of the condenser, it may be necessary to try out different sizes of reaction

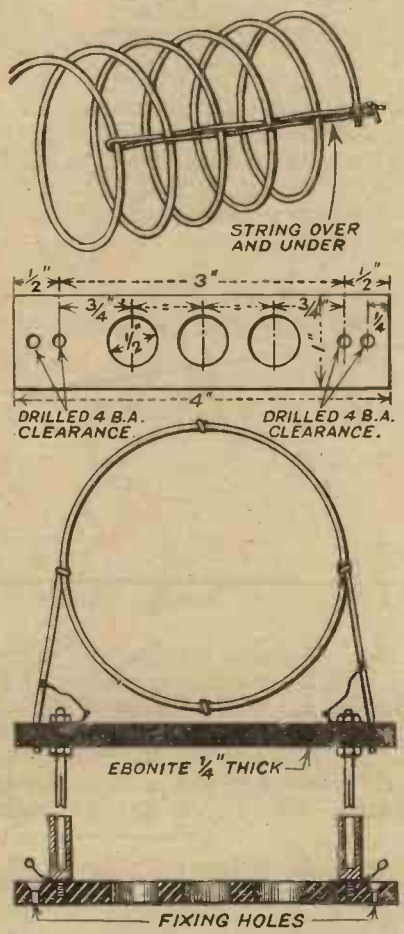


Fig. 4.—The coils are quite simple to construct.

coil, and the milliammeter will be found indispensable for indicating when the valve is oscillating. A test may be applied by touching the fixed plates of the tuning condenser when a rise in plate current should be observed if the valve is oscillating.

It will be noticed that no H.T. is applied to the long-wave oscillator, for it was found that by putting the filament resistance in the positive lead, and connecting the plate to L.T.+, sufficient positive was applied to the plate to make the valve oscillate.

Operating Details

On connecting the receiver to aerial and earth, and tuning in with the condenser C1, it will be found that transmissions come in from all over the world. C.W. reception may be obtained, either by means of the potentiometer, so as to cause the long-wave side to oscillate, or by keeping this just off the oscillation point and making use of the long-wave oscillator. A little practice will soon enable the experimenter to get the best out of the receiver, which will be found to be exceedingly powerful and yet simple to handle.

The 10-turn coil is used for L1 with 7 turns for reaction, and this approximately covers the frequency band between 12,000 and 3,750 kc. (25 and 80 metres). With the 5-turn coil for L1 and the 4-turn coil for reaction, the frequencies between 20,000 and 7,000 kc. (15 and about 43 metres) will be covered. WGY on 8571.4 kc. (35 metres), for instance, comes in at 140 degrees on the dial with the 10-turn coil and at 60 degrees with the 5-turn coil. With this coil 15,000 kc. (20 metres) comes in at about 130 degrees.

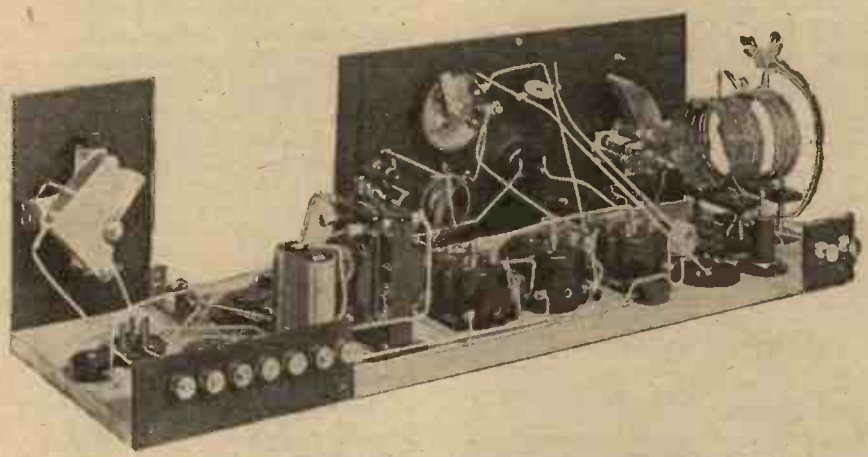
For frequencies around 3,000 kc. (100 metres) use the 14-turn coil as L1 and the 10-turn one for reaction.

Additional Choke

A small choke placed in series with the main H.F. choke may be found helpful in getting the receiver to oscillate at the higher frequencies, and the one shown in the set consists of 30 turns, wound basket-weave fashion on a ¾-in. former with 7 pegs. It is bound together with silk, and is entirely self-supporting.

Some Results

The writer has received WGY on the loudspeaker at 11.30 p.m., with a 10-foot indoor aerial, with the above receiver; KDKA has also been received well, but has been very poor recently in strength. Among the stations received during a few nights listening in one week were: SMVH, YS 7XX, I 1AD, NSTB, OCTU, B 4YZ, KY5, I 1BB, NPC2, PR 4UR, PR 4SA, C 1AR, U 4EI, EAC9, S 2ND,



The long-wave oscillator forms a separate unit in the lay-out.

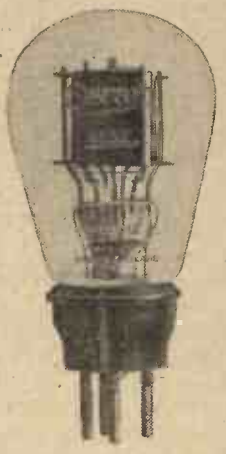
U 1RD, U 1CV, U 2OR, U 1CNP, U 2CVJ, U 1CMP, BS5, D 7MT, 1CG, FJJ, D 7BX, U 2BGI, U 1CH, U 1AKM, U 2AKY, U 1BS, U 1AJO, U 8RAL, NZ 2LC, BW4, K 4GA, ICS, U 1KJ, U 2BG, U 1YZ, U 2ACP, U 1APH, SP, C 2CC, G 1RW, EWB2.

These calls are just a few taken from the writer's log, and do not give any idea of the innumerable British, French, Italian, Belgian and other stations that have been received. Of the calls given above there are not more than two or three which were less than R7, and many of them could be put on the loud-speaker.

I have found that this receiver is ideal for short-wave reception, giving, as it does, what is little short of amazing signal strength with economy of upkeep. It is generally used with five valves only, consuming less than half an ampere of L.T., while the H.T. current is less than 5 milliamps.

(Next week some further operating notes will be given, and a detailed test report).

Things That Matter . . in a Valve . .



By Captain H. J. ROUND, M.C., M.I.E.E.

This talk on valves, their functions, and the characteristics which matter, will provide interesting reading for novice and advanced experimenter alike.

HE characteristic business is in a serious state: complicated graphs are published for advertising purposes by valve manufacturers, which, without doing a lot of arithmetic, I cannot read myself. I think a graph, and particularly one for public information, should give at once to the eye the essential properties and merits of a valve.

Things that Matter

Let us consider what properties most interest us in the valves we buy. First of all, it is essential to know the plate-to-filament conductivity to enable us to choose our transformers, etc.

Then we desire to know the magnification that is obtainable. Afterwards details, such as filament volts and current, grid conductivity when the grid is positive, and some

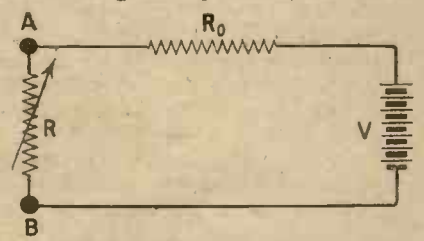


Fig. 1 (A).—In this circuit Ro represents the "resistance" of the valve.

knowledge of the life of the valve and the H.T. volts it will stand. Only on the two first points can I quarrel with the published curves, and I propose to show here how the plate-filament conductivity is a measure of the useful properties of the valve when taken in conjunction with the "M" value.

Conductivity

The conductivity of the valve that is chiefly used is between the plate and the filament, since the grid-to-filament circuit is nearly always used electrostatically with no current flowing. We will therefore study the interconnection of the plate-to-filament conductivity in connection with an outside circuit.

Let us take a circuit like Fig. 1A In this, V is a battery which we can switch on and off, R_0 is a fixed resistance representing the internal resistance of the valve from plate to filament, and R is a variable resistance which can be varied from zero to infinity. Fig. 1B. shows the same circuit with the plate-filament resistance replacing R_0.

Maximum Changes

Suppose we are switching on and off the battery, and across the points A and B we have a voltmeter: it is quite obvious that we shall get the whole voltage change from zero to the maximum when R is infinite. Any lower value of R will divide our volts between R_0 and R, but when R is very big the power used up is negligible, so that we see we can get the full voltage change with no use of power. This is a very important point.

The case is very different, however, when we consider the power question. If we short-circuit A and B, obviously the current flowing is $\frac{V}{R_0}$ but between A and B no power is obtained. If we put a very high resistance between A and B, as practically no current flows again, there is no power between A and B, so that probably somewhere between O and infinity is a resistance to which we can deliver maximum power. I show the

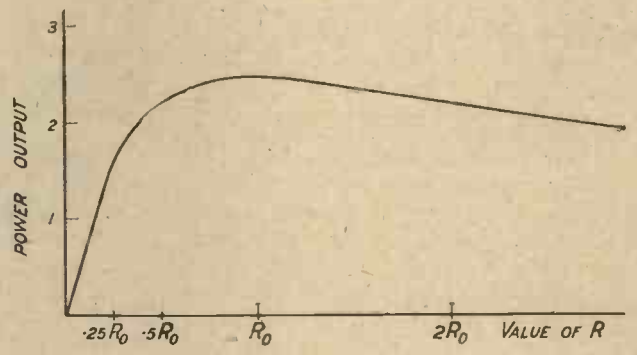


Fig. 2.—The external resistance must be of a certain definite value if the maximum power is to be developed in it.

curve of power between the points A and B at different values of R in Fig. 2. We see from this curve that we want R to be somewhat the same resistance as R_0 to get the best power into R if our voltage is fixed. Of course, the maximum

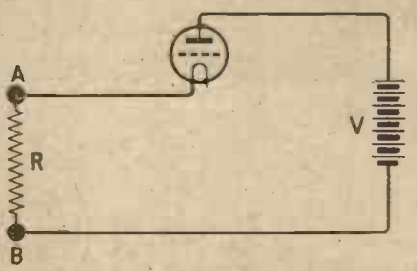


Fig. 1 (B).—Here the valve and external resistance are shown in their correct relationship. Compare with Fig. 1 (A).

current change will be when R=O, but we seldom require this case.

An interesting point arises in connection with alterations in R_0: suppose we halve R_0, then for maximum power R also will be halved,

Things That Matter in a Valve—*continued*

but as the current is doubled we have double the power into R without altering the battery V, because the power has gone up as the square of the current. This indicates the

Fig. 3.— With a two-electrode valve current will only flow in one direction.

importance of low resistance in a valve. Of course, if we double V, all powers go up to four times, but high voltages are not always convenient.

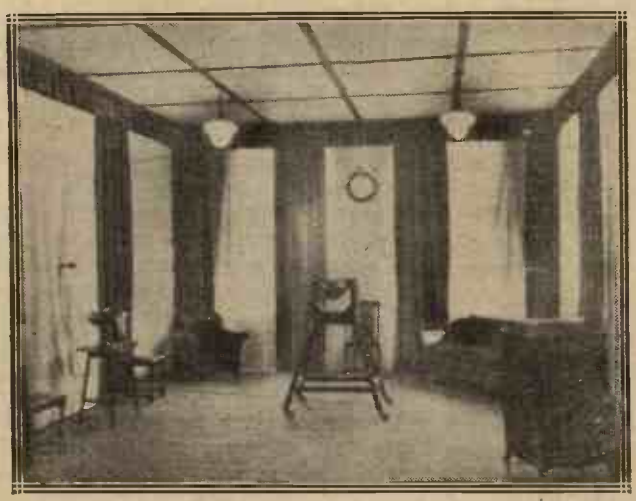
Choke and Transformer

Suppose V supplied an alternating current: we could make R a choke coil. Now, the choking effect of a choke coil varies with the frequency of the current passing—the higher the frequency the more the choking effect—and we should have to take care that for the lowest frequencies we want to handle the choking value or impedance is much greater than R_0, so as not to get a serious change in the voltage across A and B, as we change our frequency from a low one to a high one. Hence, the lower the resistance R_0 the easier it is to make the choke of sufficient size. The general rule for transformer primaries and the choke coils used in choke amplification is that the impedance must be larger than R_0 at the lowest frequencies we wish to deal with if we want uniform amplification, but the lower-resistance valves can have shorter primaries, and hence greater step up ratios.

Shunt Capacities

If across our resistance R we put a condenser and still make V an alternating voltage, a somewhat similar effect to that of the choke coil occurs, only that in this case the amplification falls as the frequency rises. This capacity, unfortunately, is always present to some extent. We endeavour to keep it as low as possible, but even the tiny valve capacity becomes very serious with the higher radio frequencies. It is useless to make R big if the impedance of the accidental shunt capacities is already low.

Fortunately, capacity and inductance have opposite effects, and in the well-known tuned anode circuit the condenser balances out the choke and we get the effect of a high resistance in the plate circuit, and consequently bigger voltage across the circuit at the tune position.



Captain Round has been closely concerned in the development of the microphones and amplifying equipment used by the B.B.C.

The Valve as a Trigger

So far I have only talked of the valve as a conductor. Its second function as a trigger complicates one's ideas a lot. Suppose F (see Fig. 3) is a hot filament and P is a plate in a two-electrode valve, if we put a battery on to P and F, as long as the plate is made positive and the filament is negative, a current will flow. Unlike our resistance wire R_0, twice the volts do not give twice the current, and reversing the volts gives no current at all. The effect is too complicated to think of, so we draw a graph.

Fig. 4, A and B, shows in graph form the distinct difference between conduction in a wire and conduction in a valve. A valve has really no resistance value like a wire, but we have a crude habit of guessing a line such as the dotted one, and calling the resistance of the valve that which the dotted line represents.

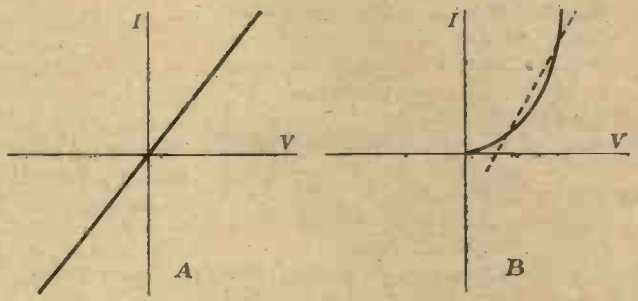


Fig. 4.—Graph A shows the relation between current and applied volts in a simple resistance, and B the same thing in the case of a valve.

Now, if we double the length of the filament and plate—in other words, make the equivalent of two valves in parallel—then for the same voltages we get double our previous current, and if we bring the plate to half the distance, we again double our current, and crudely we can say that the valve in each case has been brought to half the resistance, and from our previous arguments about the circuit with R_0 in it we shall be able to handle twice the power or get more voltage with the right transformer.

Three-Electrode Valves

If we take a three-electrode valve and neglect for the moment the plate, the grid and filament form a system like this two-electrode valve, and between the grid and filament we can get a curve resembling that given by Fig. 3. This we can call the basic graph of the three-

(*Continued on page 230.*)

THE very moment that the door of my study opened to admit Poddleby, who entered with such a rush that he tripped over the cat and alighted upon his face after performing three perfect aerial loops, I realised that my stout friend had something upon his mind. For it is not the way of Poddleby in normal circumstances to go dashing like that at doors or anything else; his body, like his mind, moves slowly and sedately. He is, in fact, one of those fellows whom Shakespeare described as

"Fat-headed men, and such as sleep o' nights."

You remember, do you not, the beautiful words of Caesar in the play, words that for centuries have been one of the most solid comforts to those inclined to adiposity. "Let me have about me," said Caesar, "men that are fat; yon

. . he tripped over the cat . . .

Cassius hath a lean and hungry look; *he thinks too much; such men are dangerous."*

A Lean Fraternity

Nearly all the wireless experts that I know intimately are practically living skeletons. Mr. Bendall, for example, takes boys' size in sock suspenders, whilst Mr. Hercy Parris, if only he could ride, would be one of the most successful lightweight jockeys of the day. You may draw your own conclusions. Poddleby is in the ordinary way what I call a comfortable friend. He seldom bothers you by asking awkward questions, and if he does so the interval between questions is so long that you have ample time to produce a satisfying answer to each.

Poddleby's Brain Wave

On this occasion, however, it was clear directly he had launched his first remark that Poddleby's brain had been functioning and was continuing to operate with remarkable agility. "Wayfarer," he cried even whilst his face still provided his only point of contact with the floor, "Wayfarer, I have a really great idea." "Yes?? Yes??? " I retaliated, picking him up, "But first of all let us see to your left eye which I perceive is shortly about to become black. The proper thing to apply is steak."

I rang the bell. "Bring a steak," I ordered. My hand-maiden appeared a little flustered. "We've nothink in the 'ouse but a leg of mutting," she flustered "Very well," quoth I; "bear in your ovine fragment." Maud Emma was just beginning to tell me that she did not know what a novine fragmink was when I bustled her from the room, bidding her produce instanter the sheep's discarded limb of whose presence in the larder she had spoken.

Poddleby Speaks

This I gently applied to Poddleby's eye, and he sat holding it there while he unfolded to me the details of the great idea with which he had been so unexpectedly stricken. I will not quote his words verbatim. I could not do so in any case, because before he got really started on the unfolding of the brain wave he had quite a lot to say about cats, and you can take it from me that what Poddleby thinks, or at any rate thought at that moment, about cats is not printable in ordinary type, which fuses at a temperature of 2413.97062 deg. Centigrade.

Passing over Poddleby's lurid comments upon the practical-joke propensities of cats I will get at once down to what our American cousins call brass tacks. Not quite at once though, for I must say that I never have been able to understand the expression. In the land of hundred-per-cent. efficiency one expects a spade to be called a spade. *We* speak loosely of a tin tack, though no tack was ever made of tin; but *brass* tacks—well, I ask you.

The Poddleby Inductance

To put the thing in a nutshell, Poddleby had given birth to a perfectly marvellous new method of winding coils. When you wind a coil in the ordinary way it has what we experts know as a large external field. A remarkable new way of discovering the extent of this field has recently been suggested by Mr. Smartun-Grapple.

Simplicity Itself

All that you have to do is to place your coil in a hole cut in the top of a common or garden dining-room table. You then pass a current of several thousand amperes through

. . . Poddleby sat holding it there . . .

the coil, what time you sprinkle horseshoes, tenpenny nails, and other iron fragments upon the table. You tap the table to make the bits of iron arrange themselves along the lines of force, and whilst you are doing so the coil goes up in a blue flame, which proves that it would have been extremely efficient if only it had not.

Anyhow, just as every dog has his day, so every coil has its field, only more so. Poddleby had evolved a really extraordinary method of winding coils with simply no field at all. I have calculated that when he employs his alternative compass method Mr. Smartun-

How the Wuncell defies old age

OLD friends, they say, are best. The longer one uses the Wuncell Dull Emitter, the more one appreciates its many sterling qualities—its supreme sensitiveness — its outstanding ability to produce a wonderful mellowness of tone—its complete freedom from microphonic noises—and, above all, its unvarying high standard of performance.

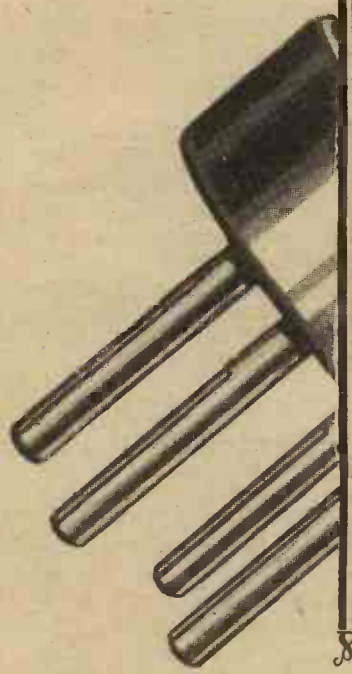
Owing to its unique filament, found in no other valve, the Wuncell is essentially a long-life valve. It is one you can choose with complete confidence, knowing that it will give you a long period of faithful unremitting service. A Dull Emitter, in fact, worthy of the reputation enjoyed by Cossor throughout this country and abroad.

Wuncell superiority is due to two great fundamental features. The first is its triple-coated filament. This filament, instead of being whittled down to the point of fragility in an effort to ensure low current consumption, is built up *layer upon layer* until it is practically as stout as that used in any bright emitter. Yet so prolific is it in electrons that at a temperature of barely 800°—less than the embers of a dying match—the Wuncell is operating at its best. Compare this with the many types of so-called dull emitters which function only when their filaments are at white heat. Because of this special process of manufacture the Wuncell filament is exceptionally sturdy and able to withstand scornfully all the rigours of everyday use.

But the Wuncell filament is only one feature. It would be of little advantage producing a perfect torrent of electrons at a low temperature if the ordinary type of Grid and Anode were employed. In any valve the only electrons of any importance are those reaching the Grid and the Anode. If the ends of the Anode are open a considerable proportion of the electron stream must escape only to be wasted.

For this reason, therefore, the Wuncell utilises standard Cossor construction. Its arched filament functions within a hood-shaped Grid and Anode. Practically every electron given off by its barely-glowing filament is usefully employed.

This greater efficiency—coupled with its triple-coated filament—is responsible for a volume and purity of tone which has yet to be equalled. It is small wonder, therefore, that wireless enthusiasts, disappointed with the fragility and uncertainty of ordinary filaments, have turned eagerly to the Wuncell—the one Dull Emitter which admittedly defies old age.



Types and Prices:

*W.1. For Detector and L.F. use, 1·8 Volts. Consumption ·3 amps. - - - 14/-

*W.2. (With red top) for H.F. use, 1·8 Volts. Consumption ·4 amps. - - - 14/-

W.3. The Loud Speaker Valve, 1·8 Volts. Consumption ·5 amps. - - - 18/6

**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

JOTTINGS BY THE WAY
(Continued)

Grapple must need at least a fortnight for plotting the field of any ordinary coil. Poddleby and I are quite willing to allow him a month with one of the new Poddleby-Wayfarer inductances, and to wager that at the end of that time he will have failed to detect the presence of a single external line of force.

We Calculate

"I have brought with me," said Poddleby, "a simple coil made upon the new lines that I have worked out. It has been calibrated, and I am informed that this inductance is precisely 400 microhenries. Will this be suitable for closed-circuit work upon the broadcast waveband?" "My dear Poddleby," I smiled, "have you forgotten *everything* that you learnt at school? It is the easiest possible matter to determine what the maximum and minimum wavelength of any coil will be when it is wired into a tuned circuit. Has the most important of all formulæ departed from your mind?" And then, as though I was always doing that kind of thing, I remarked nonchalantly,

$$\lambda = 1885\sqrt{L \times C} \ldots\ldots (1)$$

I have not the slightest idea what (1) means, but all the best men do it. Sometimes they even go as far as saying (1.3) or (2.9).

Dissension

"Yes," said Poddleby. "Let's just work it out. The square root of 400 is obvious. Any fool knows that it's 25." I maintained that it

. . . *Maud Emma won a Prize for Rabbits* . . .

was 15, and we had quite an argument for a time. Eventually I multiplied 15 by 15 and found that the answer was 365, whilst Poddleby worked out 25 by 25 and discovered that this came to 743.

Luckily, Maud Emma came in with the tea at that moment. As Maud Emma won two prizes for good conduct and one for keeping rabbits at school she is an authority on mathematics, and she told us in a flash that the square root of 400 was 20.

So far so good. We came next to the knotty little problem of $\sqrt{.0003}$. This, I told Poddleby, was a perfectly straightforward calculation. You began by marking off your figures in pairs. "From the right?" inquired Poddleby. "Certainly not," I said. "From the left." We almost came to blows over this, and, in fact, I think that we should have done so had we not discovered simultaneously that there were four figures, and that it really did not matter from which end of them you began the marking off.

A Simple Operation

This point settled, I proceeded to tell Poddleby how to find the square roots. "First of all," I said, "you find the nearest square to your first two figures." Poddleby would have that it was $.00^2$, but I disagreed over this, pointing out that it must be $.0^2$, for otherwise the decimal point would come in the wrong place. Then, I explained, you subtract, bring down your next two figures, double them, take away the number you first thought of, and there you are. After a great deal of work I got the answer out to $.0^3 1762$, whilst Poddleby found that it was 1926, without any decimal point at all.

Poddleby's figures were due, I am sure, to the long time which he spent in gazing at the calendar over the mantelpiece. Neither answer appeared, upon being tested out, to be correct.

The Slide Rule

Going across to my writing table I produced Ferdinand, my trusty slide rule, and proceeded to put him through the hoops. First of all I set the 1 in scale C over what appeared to be the right point in scale D, and remarked confidently that the answer was 9.993. This upon verification by pencil and paper methods appeared to be slightly out. Upon examining Ferdinand carefully I found that the slide thing was inside out. I therefore pulled it out and pushed it in again the other way. On trying again I was able to declare emphatically that the required figures were 71.235 kilograms. This seemed promising, but calculation showed that there was a slight error somewhere. Growing frantic I pulled and pushed Ferdinand about like anything, obtaining answers to the problem, each of which was clearly worse than that which preceded it.

So Simple

"I am sorry," I moaned, "but I had quite forgotten that my slide rule had become slightly sprained owing to my having used the to-and-from thing for swatting flies during the —

. . . *Poddleby found that it was 1926* . . .

summer. Let us let sleeping slide rules lie and do our calculations in the simplest possible way with the aid of logarithms." I produced a book of log tables. After examining it for some time I found that it was incomplete, since it did not go below 10, and what we required was .0003. Poddleby thought that we might wangle things by taking simply the three. We did that, and found that the mantissa was .4771. "The characteristic," I said (Poddleby looked puzzled, and I felt fearfully bucked), "is er . . . hum . . . ha . . . yes . . . let me see . . . Oh, well, don't let's bother about characteristics. All that we have to do is to find the square root of .4771, and there we are."

Poddleby said that we had not got to find the square root at all; what we had to do was to divide it by 2. I soon sat upon this silly suggestion by pointing out that .4771 would not divide by 2. "By the way," I asked, "are we doing this by Naperian logarithms, or the other sort?" Poddleby was visibly impressed, but offered no help.

The Solution

"It is quite clear, Poddleby," I sighed at length, "that there is no square root to .0003 discoverable by any human method. Now if only your condenser had been .0004 the thing would have been as easy as π." A flash of genius, was it not? With tears welling up in our eyes Poddleby and I shook hands over the great inspiration. In future no set of ours will contain any condenser which has not a maximum capacity of .0004 or .0009.

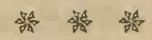
WIRELESS WAYFARER.

(The next instalment of "Jottings" will appear in the issue for April 14.)

Some Operating Notes on the "Screened Coil" Receiver

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

Simplicity of operation is a particular feature of this set. Mr. Reyner gives below some useful notes on how to get the best from it, the use of the trap, and so on.



THE operation of this receiver is really extraordinarily simple once the minor details have been mastered. There are, in general, two main operations to be performed in adjusting the set: the first of these is the adjustment of the neutralising condenser.

Place the centre dial at about 60 degrees, and the stabilising condenser about halfway round. (The trap should be cut out of circuit during this portion of the testing.) Now rotate the third dial in the neighbourhood of 60 degrees and adjust the stabilising condenser until no oscillation is obtained.

The Neutralising Condenser

It may be found with some types of valve, however—notably the high-frequency type having somewhat smaller electrodes—that the condenser employed for neutralising is too large, and that the set oscillates even when this stabilising condenser is set at its minimum value. In such cases the neutralising condenser may be connected to the mid-point of the first grid coil instead of to the end. (The grid coil employed is provided with a centre tap which is not actually made use of in the set.)

Should any trouble be experienced in this direction, it is simply necessary to connect the end of the stabilising condenser which normally goes to the grid on to the middle point of the coil instead.

Using a Smaller Condenser

Alternatively, a slightly smaller neutrodyne condenser may be used if it is desired to operate the set with such valves (such as the D.3.H.F., D.E.2., or similar types), and, in fact, such a course of action is preferable owing to hand effect.

The results, however, are appreciably better when the larger types of valves, such as the D.F.A.4. or the D.E.5b, are employed, and in such cases the condenser provided is quite satisfactory.

The next procedure is to tune-in to the local station, the trap still being out of circuit. Little difficulty will be found in finding the local station if the two dials are rotated together over the whole scale. Having tuned-in satisfactorily, the trap may now be inserted and tuned to the point at which the local station vanishes; the actual rejection effect will depend upon the tapping employed, being increased as the aerial-circuit is tapped further up the coil.

Using the Trap

At the same time, if the trap is made too effective, a certain amount of reduction in signal strength will be noticed on stations close to the one which is being rejected. A practical compromise is therefore necessary, and it will be found that if the signal strength when the set is tuned to the local station is reduced by the trap nearly to zero, then a satisfactory condition will be obtained. The aerial tapping should be placed on whichever of the two possible taps gives the results best suited to the aerial in use. This is simply a matter of trial and error. The smaller tapping naturally gives somewhat more selective results, and unless the aerial is comparatively small, little decrease of signal strength will result.

Searching

The operation of searching for distant stations is very simple indeed. Starting from the local station, the two right-hand dials should be rotated a little at a time, one after the other, or together, keeping the dial readings similar. For instance, if the right-hand dial reads two degrees less than the centre dial when tuned to the local station, then in searching it should be kept two degrees behind the centre dial all the way round. The discrepancy may possibly increase to perhaps three or four degrees towards the higher readings, but this will be found by practical experiment.

Reaction Control

It will be found that by rotating the dials in this manner station after station can be picked up with little difficulty, and when any given station has been tuned in the stabilising condenser may be increased slightly, which will give a small amount of reaction effect on the first valve. Care should be exercised when doing so, of course, because, if the receiver is permitted to oscillate, the aerial will radiate.

Constancy

It will be found, however, that a sensitive position for the stabilising condenser may quickly be found for which the adjustment remains constant practically throughout the whole range of the receiver. This is more particularly the case when utilising the special valves recommended, so that the neutralising condenser is connected as originally shown. If the arrangement has to

(Continued on page 226)

Will the Variometer Return?

By the Staff of the Radio Press Laboratories.

There is a tendency nowadays to regard the variometer as an out-of-date instrument, but it is possible that it has been condemned too hastily. Some very interesting experimental results are given in this article, which indicate that the instrument possesses little-suspected properties.

THERE has been a pronounced tendency of recent years to discard the variometer, and to substitute a plug-in coil used in conjunction with a variable condenser. There are several reasons for this: in the first place, the use of a plug-in coil enables different frequency bands to be covered; a very important factor when it is desirable to change quickly from Daventry to the broadcast frequency band, and back again. Secondly, variable condensers are easier to adjust than the variometers available a year or so ago. Another handicap from which variometers suffer is that it is not easy to obtain reaction with them, owing to the difficulty of coupling a coil to their windings in a satisfactory manner.

Advantages of Variometers

Although suffering from several drawbacks, a variometer undoubtedly possesses advantages in certain cases. It is proposed in this article to show some of these advantages, and to discuss in which circuits variometers are likely to be useful. Perhaps the most obvious advantage of a variometer is its compactness. A variometer is usually of about the same size as a variable condenser, so that the space occupied by a plug-in coil is saved.

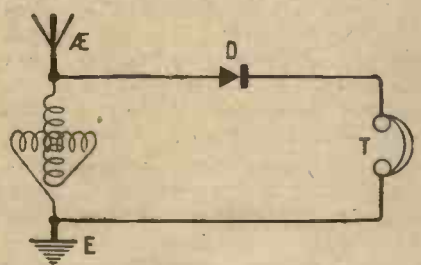


Fig. 1.—In even the simplest circuit the variation of tuning by means of a variometer produces quite different effects from those of a condenser method.

H.F. Losses in Variometers

It is frequently thought that since a variometer consists of two coils in series, it must have an unvarying high-frequency resistance equal to that of the sum of the two coils. In order to investigate this point experiments were conducted at the Radio Press laboratories which showed quite definitely that the high-frequency resistance was so far from being constant that it was nearly proportional to the effective inductance of the variometer. The surprising result was obtained that at the position of maximum coupling between the rotor and stator of a certain variometer, the whole had a resistance of about 100 ohms, while at the position of minimum coupling the resistance had decreased to 10 ohms. This result, however, appears less remarkable if we remember that the ratio of the maximum to the minimum inductance of the variometer was as much as 12 to 1.

An Interesting Point

The ratio of high-frequency resistance to inductance was then calculated for various variometer settings, and it was found that this was not very far from constant. There was, however, a distinct hump at a point not far from the minimum of the variometer, and this indicated that at that particular point the variometer was inefficient.

These results are the reverse of those obtained with a tapped coil, in which case the ratio of resistance to inductance generally increases slowly but continuously with the size and inductance of the coil. It would seem that the variometer is most efficient at or near the point of maximum inductance.

Effect of Coupling

A most important result obtained from these experiments is, however, that the high-frequency resistance definitely depends on the coupling between the coils. In other words, the high-frequency resistance of a coil is not only associated with conditions in the immediate neighbourhood of the wire, but may be influenced by another inductance to which it is coupled, and that this influence will be in the direction of keeping the ratio of resistance to inductance constant in the case of a variometer.

Crystal Tapping

When variometers were extensively used in conjunction with crystal sets, it was a very common practice to tap the crystal across one winding of the variometer only. This resulted in reducing the load of the crystal on the aerial, and therefore in certain circumstances conducing to greater efficiency.

An Important Advantage

It is well known that a variometer tunes by virtue of varying the inductance instead of the capacity as in the case of a variable condenser and plug-in coil. This renders the consideration of circuits in which a variometer is employed somewhat more complex than in the other case. Consider, for example, the circuit shown in Figure 1.

Will the Variometer Return?—*continued*

It will be seen that the crystal is tapped across the whole of the variometer coil, and thus imposes a load on the aerial circuit proportional to the square of the effective inductance of the variometer. Thus, at the lower readings of the variometer the crystal load will be less than at the higher. The load on the crystal, however, does not vary only as the square of the inductance, but also as the square of the frequency. The effect of this is that the crystal load will vary directly as the inductance or inversely as the square of the frequency.

Variometers in Intervalve Circuits

In Figure 2 we see another circuit in which a variometer is employed, this time for tuning an intervalve circuit. For this purpose a fixed condenser is usually placed in parallel with both windings of the variometer. Now, in a circuit of this description we have the resistance of the preceding valve, and the damping introduced by the grid-leak rectification which follows, both in parallel with the whole of the inductance of the variometer. Thus, as we rotate the variometer, in order to receive different stations, both the damping of the preceding valve, and that of the grid current of the detector, vary as the square of the inductance and as the square of the frequency.

The net effect of this is that the damping will decrease with frequency instead of increasing, as in the usual case. This naturally has an effect on reaction adjustments and their constancy on different frequencies, and should be borne in mind when designing receivers.

We see, therefore, that the variometer has several qualities, which cause its action to be different to that of the variable condenser and coil. We should, indeed, expect there to be cases where the variometer is a definite improvement over the more usual means of tuning.

Making the Reaction "Stay Put"

Thus, in the case of a single valve detector in which there is a pronounced tendency to oscillate at the higher condenser readings, a variometer would prob-

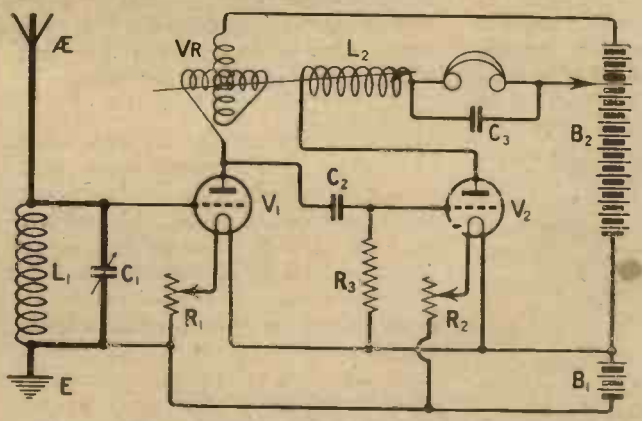
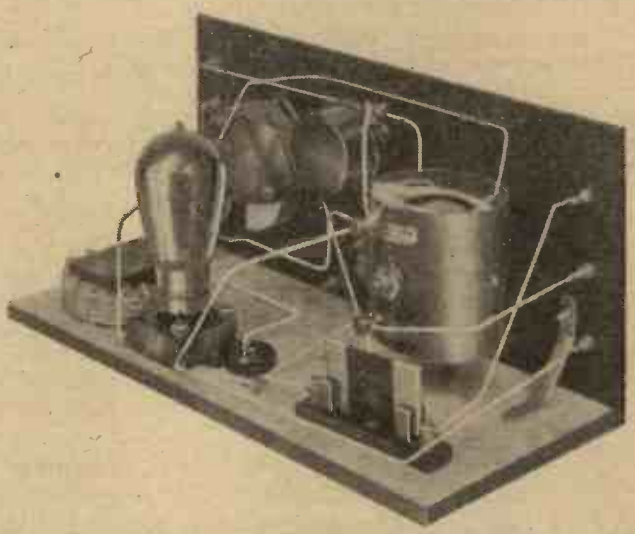


Fig. 2.—When a variometer is used for tuning in this way the reaction-demands at different settings may vary in a curious way.

ably render the set more nearly "single-control." This sometimes occurs on the shorter waves, where losses increase rapidly with frequency, thus indicating a possible use for the variometer on the higher frequencies.

Interesting Experiments

By placing a variable condenser in parallel with a variometer some very interesting experiments can be made on varying the tuning inductance in different circuits. These are the more useful in that, as shown above, the ratio of resistance to inductance does not



This receiver (described by Mr. G. P. Kendall in March, 1926, issue of the "Wireless Constructor") illustrates one method of applying reaction to a variometer. (Note the hank coil in one end of the tube.)

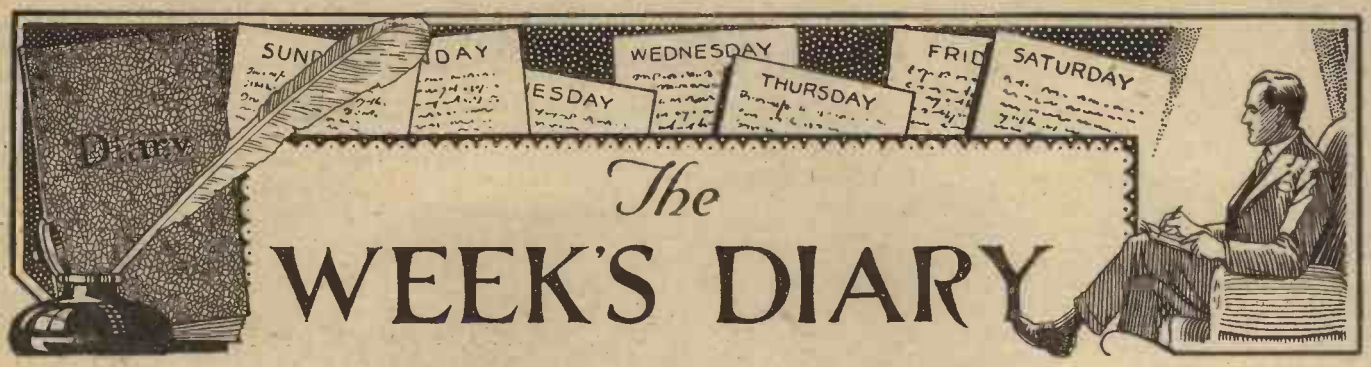
vary a great deal from minimum to maximum of the variometer.

Tapping the Variometer

In these days of neutrodyne circuits in which centre-tapped inductances are required, variometers are at a discount owing to the absence of a true electrical centre point. This, of course, is due to the variation of inductance which causes the electrical centre to vary with the relative positions of stator and rotor. There are, however, a number of circuits in which a centre tap is not essential, and in such cases the connection between rotor and stator frequently provides a natural tapping point.

Amateur Transmitting Notes

WE have been asked by Mr. C. A. Samblin (6BT) to make it clear to our readers that the "QRA and QSL section," mentioned in "Short-Wave Notes and News" last week, is only for the benefit of members of the T. and R. section of the R.S.G.B. He already has several hundred cards both for members and non-members, however, and will forward them on receipt of a stamped addressed envelope of sufficient size. This section cannot, however, undertake to forward cards to unknown stations unless the sender is a member of the T. and R. section. A list of those for whom Mr. Samblin possesses cards will be published from time to time in the *Bulletin*, the organ of this section.



The WEEK'S DIARY

SO this is Spring! While I am writing this the wind is blowing an icy blast outside, and I am grateful for the comfort of a blazing fire. My next door neighbour's aerial may come down any moment—I know what these March winds are when they start hooking themselves around the garden poles and shaking roof-top erections in the suburbs. If you have not yet done so, I suggest you look at your own. You may find it hanging on by the skin of its teeth!

* * *

I MET a man at my club the other day who was holding forth on the recently settled wireless operators' strike. "Of course," said he, "these new companies take a little time to settle down. These young men are in a new profession. When I was a boy the lad who wanted to go to sea had to go as a sailor, not as a telegraphist."

"How old are you now?" I asked.

"Forty," he said.

"And when do you think the Marconi Company sent its first operator to sea?" I asked.

"Five or ten years ago, I suppose," he responded. "When was it actually?"

"When you were fourteen!"

After which, for some reason or other, he got up and went out.

Speaking of the old days of wireless reminds me that Chelmsford, where the British Broadcasting Company are preparing a new experimental station of high power, has rather a long wireless history. The first station there was finished on June 1, 1899, while Poldhu, which has figured recently in short wave experiments, was begun in the following year.

* * *

WE have heard a lot lately about pirates who do not pay their licence fees, but there is another type of pirate, fiercely hated by the small circle of amateur wireless transmitters, who pirates other people's call-signs, and frequently gets them blamed for faults which are purely his own. Mr. Harris tells me that he has just received a "QSL" (acknowledgment) card from a listener who heard his signal (or what was supposed to be his signal) at Westcliff. Mr. Harris tells me his transmitting apparatus has been dismantled for alteration for several months, and indeed he has not done any transmitting with it for six months or more, and for that matter has never worked on the wavelength mentioned.

EXTENDING THE TUNING RANGE OF A VARIOMETER.

One of the main drawbacks of an otherwise attractive instrument is the limited tuning range of the simple type of variometer. Probably the easiest way of overcoming the difficulty is to provide a small fixed condenser and a series-parallel switch. A capacity of .0001 or .0002 is suitable, and a very wide range of frequencies can be covered in an aerial circuit with this simple addition.

* * *

I SEE Mr. Ford (not he of "Lizzie" fame, but the London listener who was recently prosecuted by the Post Office for non-payment of his licence fee) tried to raise the whole question again by proceeding against the Postmaster-General for the refund of his money. I think he will be well advised to let the matter drop, as public sympathies are not with him, and the fee of half-a-guinea is by no means an unreasonable one. What many thinking people do feel is that obviously the British Broadcasting Company does not get a big enough proportion—a view I hold myself.

* * *

LISTENING the other night to the Royal Artillery String Band at 2LO I could not help noticing what a big improvement in reproducing the lower tones has been effected recently. The drums and other percussion instruments which are always most difficult to reproduce were rendered with a remarkable faithfulness, so much so that a group of us who normally would let an ordinary orchestral piece go by without comment, stopped our conversation to remark on it. The more faithful the studio reproduction, the more necessary it is to have a really good receiving set. By this I do not necessarily mean an expensive one, but one which can be guaranteed to give really faithful reproduction of the whole musical scale.

The set we were listening on had a crystal detector and three resistance-coupled note-magnifying valves—quite an inexpensive outfit built from a recent design in *The Wireless Constructor*. It is designed for use on the local station and nothing else, a practical scheme which deserves a greater popularity. Several of my friends are using two sets—one for loud-speaker work on the local station, the other, a more sensitive one, for long-distance work. The local set can have its own batteries and loud-speaker and a change-over switch for an aerial, so that the family can always have the set when they require to listen-in.

* * *

THERE were many sighs of relief when we learned that Mr. Baldwin had decided not to allow the broadcasting of Mr. Churchill's Budget Speech. There are some illusions that it is wise not to destroy, and one of them is that the proceedings of Parliament are of the short and almost snappy nature that some of our newspapers present as the state of affairs. When you read that Mr. So-and-so or Sir Somebodyelse expressed certain opinions, you may not be aware that the Parliamentary reporter of your favourite newspaper has cut out the "hums" and "ahs,"

The Week's Diary—*continued*

corrected his English, polished everything up a bit, and presented the gist of half-an-hour's inconsequent ramblings in half a column of concise and lucid English. There is a lot that can be done in improving the entertainment side before we do more on the educational.

* * *

ACCORDING to a London morning paper, tenants of the Council houses of the Buddicombe Park estate of Chester have to pay for an agreement with the Council when they wish to erect wireless aerials. Just to add to the cheerfulness which such an action engenders, the Chester Corporation has forbidden the keeping of dogs by the same tenant. Ninety-eight per cent. of the residents have signed a petition protesting in strong terms against this oppression. I am puzzled about the other 2 per cent. Do they think the charge and the prohibition are right, or is it simply apathy? Let the Chester Bumbles take their hands off the people's amusements, and remember that other Corporations have tried the same trick, and have been promptly squashed. I fancy the Local Government Board has views on this matter, too.

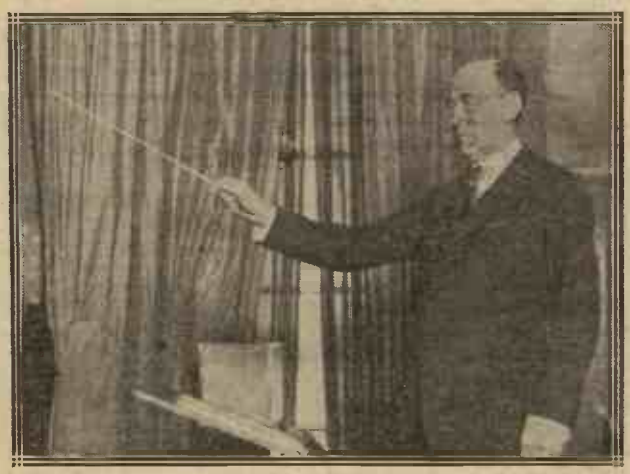
* * *

THERE is one very happy invalid in Tunbridge Wells to-day. He is the fortunate winner of the Fada 5-valve neutrodyne receiver, awarded by *Wireless—The One-Word Weekly*, as first prize in the "Cartoonigrafs" Competition. Mr. Tydeman, who has been confined to his room for many months, was visited one evening by a friend, who showed him the "Cartoonigraf" entry form, and suggested that he should try his hand at the limerick. After he had thought over the matter for a little while he filled in the line, posted the letter, and promptly forgot about it till the Editor's letter reached him, informing him of his good luck. The Editor of *Wireless* tells me that there was no difficulty whatever in choosing the best line sent in, and Mr. Tydeman's effort was picked out by half-a-dozen independent people without a moment's hesitation from a final list of about 70 or 80.

* * *

LOOKING in at the Savoy the other day, I found about half of the occupants of the Grill Room Americans, many of whom, I believe, were about to sail that afternoon on the *Majestic*. American visitors who have spent a few months in this country are loud in their praises of the present quality of the transmissions sent out by the British Broadcasting Company, and particularly commend the high quality of the orchestral items. There is no question that in the matter of microphones we now lead the world, thanks largely to the activities of Captain Round, who is tireless in his endeavours to raise the standard of broadcast reproduction.

Major H. O. D. Segrave, who recently broke the world's kilometre record for racing cars on Southport sands, broadcast an interesting account of his experiences from 2LO.



A recent symphony concert at 2LO was conducted by the eminent musician Felix Von Weingartner.

* * *

WELL, I hope you will all have a very Happy Easter. I am going down to a south coast seaside resort to fix up an aunt of mine with her first crystal set. I have thought of all the fancy attachments that can be hooked on to a crystal set, and I can tell you definitely that every one of them will be conspicuous by its absence. There will be one condenser dial on the front, a fixed coil inside, a permanent detector, and three pairs of telephones. The local station is only about a couple of miles away, so with a good outdoor aerial and an earth tube she will get really good signals for about a month. After that, as sure as fate, some kind friend who knows a great deal more than I do about it, will come along and show her how to improve her receiver. This will probably be the reason why I shall have to go down there again (to put it right!)

Wireless News in Brief.

Programme Exchange with Holland Commencing on April 19, it is announced that a regular fortnightly exchange of programmes will be arranged between Daventry and Hilversum, Holland. The Hilversum programme will be picked up at Hayes and sent to Daventry by land line, while the Hilversum station will pick up Daventry's transmission and relay it over Holland.

* * *

Broadcasting of Parliament It has been decided that there shall be no broadcasting of the Budget or any other debate. The Prime Minister made an announcement to this effect in the House of Commons on Monday, which was received with cheers. It is possible that the question of broadcasting debates may be raised again at a future date, but for the present it is put on one side.

* * *

Geneva Conference Further efforts to improve the broadcasting conditions of Europe were begun at Geneva on March 22, when a conference of representatives of European broadcasting organisations opened. Special attention is being directed to providing adequate separation between the wavelengths of stations which are at present causing mutual interference.

* * *

From the Programmes Sunday, April 4.—Birmingham, Light Classics. Bournemouth, Easter Festival Concert, relayed from King's Hall Rooms.

Monday, April 5.—London, 7.25 p.m.: Musical Series, Brahms, interpreted by Lafitte.

Tuesday, April 6. — London, "Loyalty," a one-act play by H. E. Bates. Daventry, Symphony Concert. Birmingham, Mirth and Melody. Manchester, Violin Recital by Leonard Hirsch; The Roosters Concert Party.

Wednesday, April 7.—London, Chamber Music by the Philharmonic Trio. Birmingham, Grand Opera and Light Opera. Manchester, Radio Humour.

Thursday, April 8. — Bournemouth, Winter Gardens Night; the Municipal Orchestra (also from London). Belfast, Hunting Programme and Pantomime. Glasgow, Variety programme.

Friday, April 9.—London, Excerpts from "Wildflower," relayed from the Adelphi Theatre. Newcastle, A Request Night. Manchester, Wagner Programme.

Saturday, April 10.—Aberdeen, "The Rose Maiden," by Cowen. Birmingham, "Listening Time" Revue. Belfast, Popular Concert; Scottish Programme.

* * *

Broadcast French Lessons We hear that the B.B.C. are arranging for a lecturer from the Institut Français to broadcast an elementary French lesson for about 20 minutes on Fridays at 3.15 p.m. The London Elementary Education Sub-Committee are recommending that this broadcast be utilised by central schools where French forms part of the curriculum.

* * *

Non-Oscillating Receiver Circuit It is reported that Sir Oliver Lodge has been working for some time past on the development of a simple receiving circuit which will not cause interference to other listeners by re-radiation. No definite details of the circuit used have yet been made public, since Sir Oliver Lodge is not yet certain that the results of his experiments will prove satisfactory as a solution for the "howling" problem. He intends to invite experts to test his arrangement thoroughly, and hopes to be able to make some definite announcement before long.

Radio Society Meeting At a recent meeting of the Thornton Heath Radio Society, Mr. E. Banwell gave a demonstration of the "Special Five" Receiver designed by Mr. Percy W. Harris. The set amply fulfilled the claims of the designer, and Mr. Banwell succeeded in logging 31 different stations, about 19 of which were received at good loud-speaker strength.

* * *

B.B.C. News A speech by Mr. Lloyd George at the annual dinner of the London Head Teachers will be broadcast on April 7. This will be the first occasion on which Mr. Lloyd George has broadcast to the country generally.

* * *

A novel competition, entitled "What Would You Do?" is to be introduced into the broadcast programmes next May. Several dramatic episodes will be broadcast, and listeners will be invited to attempt to solve the problems presented in these episodes.

* * *

During the summer months the B.B.C. proposes to broadcast the two main portions of the evening's programme from 8 to 9.30 p.m. and from 10 to 11 p.m., the News Bulletin being given at 9.30 p.m.

* * *

On the occasion of a luncheon given by the United Associations of Great Britain and France at the Hotel Victoria, on April 26, speeches by Lord Derby, Sir Austen Chamberlain and the French Ambassador will be broadcast.

* * *

The concert to be broadcast from a number of stations on April 8 is part of the Bournemouth Musical Festival. The Municipal Orchestra will be conducted on this occasion by Dame Ethel Smyth, Sir Herbert Brewer and Sir Dan Godfrey.

NEUTRODYNING YOUR .. NOTE MAGNIFIER ..

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

Is the low frequency amplifier being unduly neglected? It presents problems which often resemble those of the H.F. amplifier.

HIGH-FREQUENCY amplifying circuits have been developed to such a pitch of efficiency that it is now possible to construct absolutely stable amplifiers which remain properly adjusted over a wide band of frequency, even if the actual tuning coils employed are changed for others covering a different range. This being the case, one is tempted to inquire whether our low-frequency circuits are really as efficient as they might be.

Stability in H.F. Circuits

Stability in high-frequency amplifiers may be achieved in various ways: we may weaken the couplings between the various stages so that the energy fed back is too small to permit any self-oscillation. This is not a very satisfactory method, because we lose signal strength at the same time. In the case of a high-frequency amplifier this loss of energy can be compensated for, to some extent, by the provision of reaction on the last valve or valves. In a low-frequency amplifier such a procedure is not possible.

The "Losser" Method

Another method of checking oscillations, one which is now practically discountenanced, is that of introducing damping in the circuit by some suitable means, whereupon the resistance in the circuit becomes too high to permit of self-oscillation. A third method, which is one of the most satisfactory hitherto devised, is that of neutralising the effect of valve capacities by means of a suitable arrangement.

Now, the design of low-frequency transformers has been advanced considerably in the last few years. Not so very long ago, if two similar transformers were employed in a two-stage note magnifier, there was a considerable tendency to the generation of low-frequency oscillations or whistles. Such oscillations could sometimes only be checked by the use of some form of damping device, or else by the reduction of the high-tension battery voltage, all of which tended to detract from the efficiency of the arrangement.

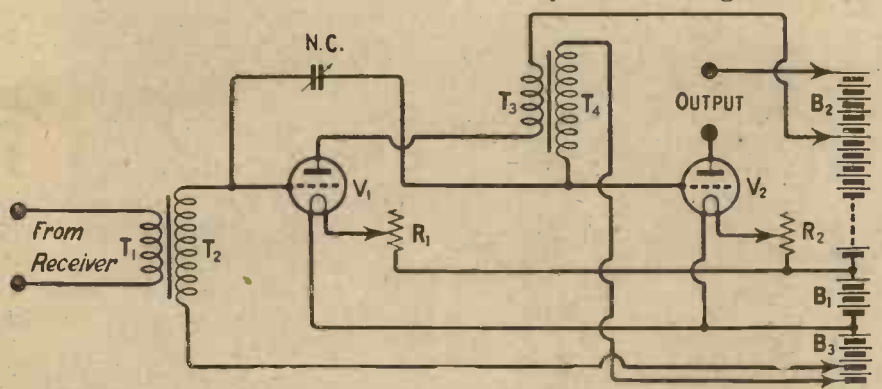


Fig 1.—A simple scheme resembling the Hazeltine neutrodyne arrangement.

Transformer Ratios

One solution of the difficulty which was adopted was to utilise a transformer having a smaller ratio of step-up for the second stage. This, of course, is equivalent to a reduction in the over-all amplification, and cannot be considered an efficient method of overcoming the difficulty.

In passing, it may be remarked that this practice has given rise to a certain amount of confusion in the industry, owing to a different method of rating transformer ratios. As a general rule it is found that the secondary winding of a transformer is not limited by any consideration of the valve, but rather by the self-capacity of the winding which becomes appreciable after a certain point. If the self-capacity is large the currents produced in the secondary tend to short circuit through the capacity instead of doing useful work outside. The secondary winding therefore is made as large as can be managed, without causing an undue increase in the self-capacity.

Matching Valve Impedance

The primary winding of the transformer is then wound to an impedance suitable for the valve with which it is to be used. Thus, in the first stage of a note magnifier, immediately following the detector valve, we require a high-impedance winding because the detector valve is usually of high internal resistance. Subsequent stages of the amplifier usually employ a low-frequency or power valve which has considerably lower impedance than the detector valve, and consequently the primary winding of the associated transformer must be made to have a lower impedance, that is to say, with fewer turns.

The Correct Method

Obviously, if both transformers have the same number of turns on the secondary, the second will have a higher ratio of step-up than the first stage. This is the correct method of designing a low-frequency amplifier, and the use of transformers having the same standard

NEUTRODYNING YOUR NOTE MAGNIFIER

(Continued)

primary winding with different number of turns on the secondary is now rapidly falling into disuse.

At the present time, by suitable design of the primary winding, and the elimination of stray capacity

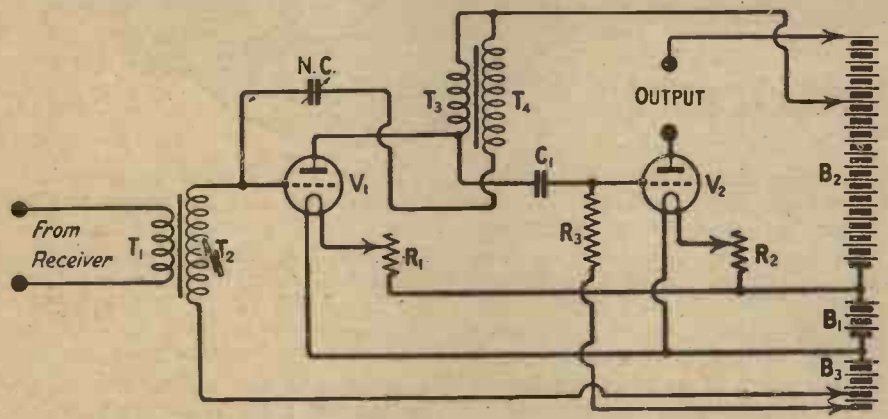


Fig. 2.—This circuit is the low-frequency counterpart of the Cowper neutrodyne.

effects both across the windings and between the primary and the secondary, the tendency to oscillation has been reduced very considerably. In any amplifier employing given intervalve transformers and given valves, there is a certain range of frequency over which oscillations can be generated and maintained. If the natural frequency of the transformers (that is to say, the frequency to which the transformer windings, together with their associated capacities, will tune) lies within this range of possible oscillation, then low-frequency howling will be set up.

Adjustment of Natural Frequency

A good transformer, employing a generous proportion of iron and copper in its design, can be so constructed that the natural frequency of the arrangement falls outside the oscillation band, so that the tendency to oscillate is fairly well under control. There are occasions, however, when oscillations do occur, particularly if more than two stages of amplification are being employed, and in such cases it is usually found that no cure for the oscillations can be found other than resorting to a damping arrangement, such as dimming the filament or placing a suitable leak across the transformer. In many cases this arrangement results in a loss of signal strength, so that the amplifier is not behaving as efficiently as is possible.

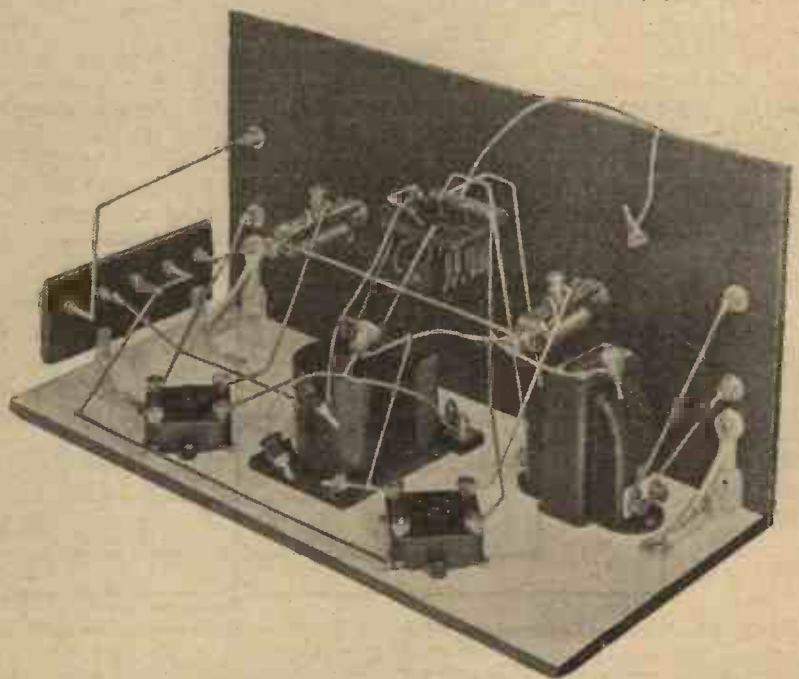
Causes of Self-Oscillation

Now, this oscillation does not necessarily occur as a result of any stray magnetic coupling existing between the two transformers. The tendency to oscillation arises in many cases through the coupling between the anode and grid of the valve, and in order to overcome this, the possibility of neutrodyning immediately suggests itself.

It might be thought that since we are now dealing with low frequencies that the ordinary circuits which apply at high frequencies would no longer be satisfactory. Possibly, the values of the condensers which have to be employed would turn out to be too large for convenient use. A little consideration, however, will show that this is not the case. The very small amount of energy which is transferred back through the inter-electrode capacity of the valve can be satisfactorily neutralised by an equal and opposite amount of energy through an exactly similar condenser placed external to the valve. The principles of neutrodyning, therefore, which obtain at high frequencies may be applied without any fundamental alteration to low-frequency amplifiers.

A Simple Scheme

Some circuits for achieving these results are shown accompanying this article. One of the simplest circuits is that shown in Figure 1. There a neutrodyne condenser is connected between the grids of the valves V_1 and V_2. Any voltages developed in the anode circuit of V_1 are transferred through the inter-electrode capacity of the valve back to the grid circuit. Coupled to the primary of the transformer, however, is the secondary winding, and the E.M.F. developed at the grid end of this transformer can be arranged to be opposite in direction to that on the anode of the valve V_1.



An expedient sometimes adopted to secure stability is to use different methods of coupling between successive stages.

Neutralising Potentials

Consequently, if we connect a small condenser between the grid of V_2 and the grid of V_1, we obtain a neutralising effect. In order for this to be so, it is necessary that

NEUTRODYNING YOUR NOTE MAGNIFIER
(Continued)

the winding of the secondary shall be in the correct direction, and the connections may have to be reversed in order to achieve this satisfactorily.

It will be found that by placing a neutrodyne condenser at a suitable reading, the low-frequency oscillations will be checked, just as is the case with a high-frequency circuit. A deviation of the neutrodyne condenser on either side of this zero will produce oscillation, showing that the arrangement is behaving as a correct neutrodyne circuit.

Reversing Connections

In some cases it is found that a whistle can be cured by reversing the connections of the transformer. It may be found that by leaving the connections as they are, and connecting a neutrodyne condenser as shown in Figure 1, that improved results may be obtained free from any whistle. Whether this is the case or not depends entirely upon the transformers, the valves, and the actual lay-out of the circuit in use. It is a comparatively simple matter to connect such a neutrodyne condenser in the position shown for purposes of trial.

The Secondary for Neutralising

Another method of using a transformer is shown in Figure 2. Here the primary winding of the transformer is used as a choke and the anode of the valve V_1 is connected through a condenser to the valve V_2, a suitable leak being provided to the grid bias battery. The secondary winding in this case is used as a neutralising winding, the one end being connected to the high-tension side of the primary winding, and the other end being connected to the grid of the previous valve. As in the previous circuit, it is necessary to ensure that the secondary winding is in the right direction.

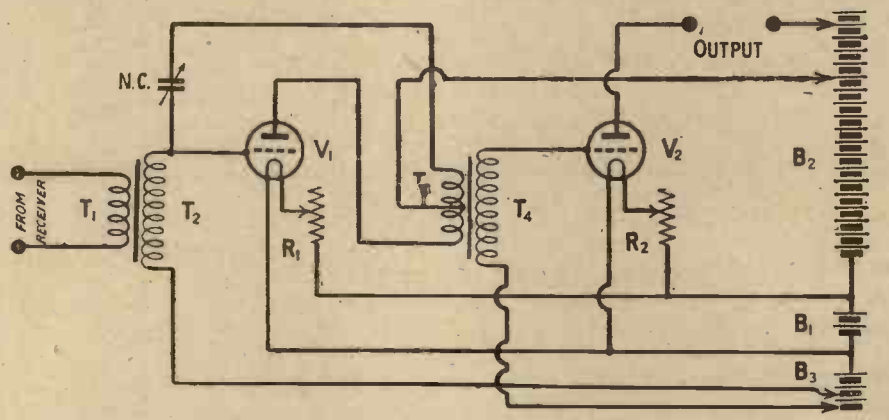


Fig. 3.—A centre-tapped or similar L.F. transformer is needed in this circuit.

A Centre-tapping Scheme

Where a centre-tapped transformer is available we may obtain various other forms of neutralising circuit. Figure 3 shows one circuit in which the primary of the transformer is centre-tapped, and the high-tension connection is taken to the centre tapping. One end of the primary goes to the anode of V_1 and the other end is connected through a neutrodyne condenser to the grid of V_1. Readers will recognise in this one of the most frequently-used neutrodyne circuits.

The circuit shown in Figure 4 is one employing a split secondary.

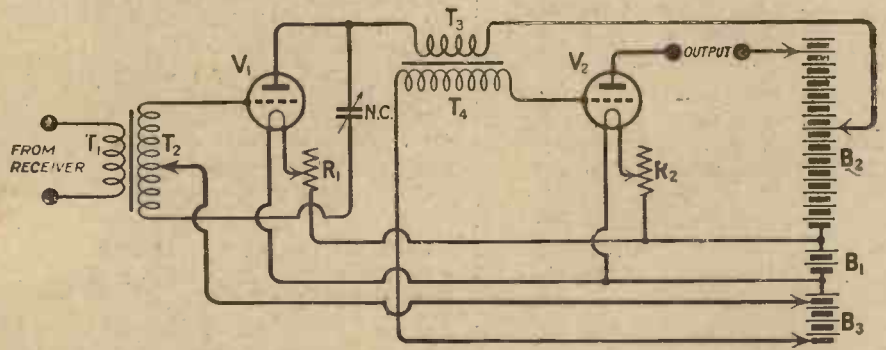


Fig. 4.—The use of a tapped transformer is indicated here in the grid circuit of the first valve.

Here, the filament connection of the first valve is taken to the centre tapping of the transformer, and the end of the winding remote from the grid is connected through a neutrodyne condenser to the anode. This is a sister circuit to that shown in Figure 3, and will again be recognised as one of the familiar high-frequency circuits.

A Practical Solution

The experiments which have been carried out indicate that neutralisation of valve capacities is quite possible at low frequencies as well as high frequencies, and where oscillations in a low-frequency amplifier are taking place, due to feed-back, then neutralisation can be effected by any of the usual methods. It should not be forgotten, however, that there are other sources of oscillation in low-frequency amplifiers, such as resistance in the high-tension battery leads or in the battery itself, so that it does not necessarily follow that all low-frequency oscillations can be cured by the methods described in this article. The majority of the methods given, however, can be tried fairly readily and in many cases they will be found quite effective.

The new R.I. transformer can be applied to neutrodyned L.F. circuits.

WORKING YOUR SET

Smooth working with vernier dials—A reaction tip—The spare valve problem—A valve rack—Directional effects

MANY of the slow-motion drives for variable condensers which are becoming so popular take the form of a self-contained dial mechanism which can be added to almost any condenser, and most of these make use of some means of gripping the face of the panel as a fulcrum, as it were, for the mechanism. In several of these dials, the necessary purchase is obtained by the pressure of three or more spring fingers against the panel, and these springs are often shod with thin slips of cork, or other material of a similar nature.

A Tiresome Noise

When the slow-motion drive is being used, the cork-tipped springs grip the panel and afford a purchase for the driving mechanism, but when the dial is turned direct by hand, the cork faces should slip over the ebonite with reasonable freedom. A little trouble is sometimes experienced with these arrangements, in that the cork or other material grips the panel in a jerky fashion, rendering it rather unpleasant to turn the dial direct, and when this is done, an accompaniment of creaking and scratching noises may be heard. Although this may seem a trifling point, it is capable of becoming decidedly annoying when one is searching for faint signals, and since a simple remedy exists, it may as well be applied whenever the trouble is noticed.

The Remedy

All that is necessary is to remove the dial from the spindle and rub a little French chalk upon the cork surfaces, replacing the dial carefully so as not to dislodge the chalk which is adhering. Upon now turning the dial round a few times, it should be found that all trace of squeakiness has disappeared, and yet the cork surfaces are able to obtain the requisite grip on the ebonite surface when required. This remedy is somewhat to be preferred to the alternative one of smearing a trace of vaseline upon the panel, since this latter method rather impairs the power of the cork surfaces to obtain a proper grip on the ebonite.

A Reaction Tip

It is becoming something of a habit in these days to regard all mechanical methods of adjusting reaction by means of a slow-motion coil-holder, etc., as being not quite comparable in effectiveness with the more purely electrical method of the use of a variable condenser as the control, and consequently we are perhaps rather apt to neglect the various dodges for obtaining fine control by means of the ordinary coil-holder. Every now and then, however, one finds that it is necessary to make use of a set furnished merely with the ordinary plain coil-holder with a knob for revolving the spindle which carries the moving socket, and unless certain tips are known in this connection, working that set is likely to be rather a painful business.

One of the most effective, and certainly almost the simplest way of achieving fine adjustment with such a simple type of coil-holder is obtained by means of one of the very simple extension handles which so many dealers supply, consisting of a rod carrying upon its end some clip or other device which can be clamped over the knob of the variable condenser dial. If one of these is placed upon the knob of the coil-holder, a really surprising degree of fine adjustment can be obtained, and a very little manual skill will give results which are likely to be surprising to those people who are rather inclined to assume that Reinartz or some similar form of reaction is the only one for delicate control.

THE NEXT CALIBRATION TESTS

Measurements for calibration purposes of the frequencies of B.B.C. stations will take place at Elstree on April 7th. Full details will be given in our next issue, so that our readers may avail themselves of the facilities so provided.

Those Spare Valves

The problem of how to keep spare valves with the maximum degree of safety and easy accessibility is not a very easy one to solve, especially now that valves are of such varied shapes and sizes. At one time, when valve types were few in number, the ex-government padded boxes with nests for three valves were ideal, but these are really no longer adequate, since they will not hold the larger types of which we now have so many. Just how to keep one's valves safely is a matter which the individual experimenter will probably desire to settle for himself, but one or two suggestions may be useful.

A Valve Rack

One scheme which will appeal to those who are making frequent changes of valves and carry a considerable stock ready at hand at all times, is to obtain a piece of inch-thick board of a suitable size, say 6 ins. wide and 18 ins. long, and bore in this with a wood auger the necessary number of holes of such a size that the four pins of a valve will just slip into the hole, so that the valve rests upon its cap. In this way valves can be stood upon the board quite safely, so long as one can preserve them from the dusting activities of the household authorities.

A slightly more secure scheme is to use a valve marking-out template, and drill, instead of a single

large hole to accommodate all the valve pins, four separate small holes, one for each. With this arrangement the valve stands up rather more securely, and is less liable to be knocked over.

A Travelling Box

A more elaborate scheme which confers a much greater degree of safety upon the valve, is to make or otherwise obtain a wooden box about 6 ins. deep, and mount at the bottom of this an adequate number of valve-holders of some shock-absorbing variety, into each of which one spare valve can be placed. In this way the valves will be perfectly safe, provided that a wise choice is made of the valve sockets. By this it is meant that the valve sockets should be ones which grip the valves really firmly so that they cannot jump out when the box is carried about. This scheme has the particular attraction that it forms a perfectly secure travelling case for the necessary number of valves, especially if they are held down with a sheet of felt or similar material inside the lid of the box to eliminate any remote possibility of their jumping out of their sockets.

That "Directional Effect"

Users of frame aerial sets, that is to say, superheterodynes, are sometimes rather puzzled by the fact that the directional effects which they obtain are exceedingly erratic, *i.e.*, upon some occasions all the stations they are able to receive appear to be in one direction, which is usually the same whenever this happens, while at other times each station appears to require the correct setting of the frame aerial, agreeing, very roughly, with the compass bearing of that particular transmitter. This generally means that there is, somewhere in the immediate neighbourhood, a collector of signals which occasionally acts as a local re-radiator towards which the frame aerial must be set to obtain the loudest results, and no doubt in nine cases out of ten this will prove to be, upon investigation, simply the outside aerial in the same house.

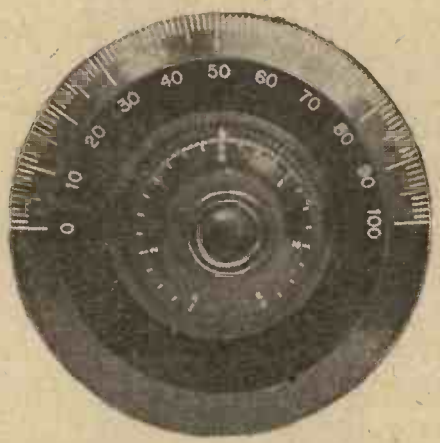
Reason for Erratic Results

Why it should sometimes act in this way and not at others is apt, at first, to seem something of a mystery, but the explanation will usually be found in the fact that it is sometimes tuned to some frequency upon the broadcast band

WORKING YOUR SET
(Continued)

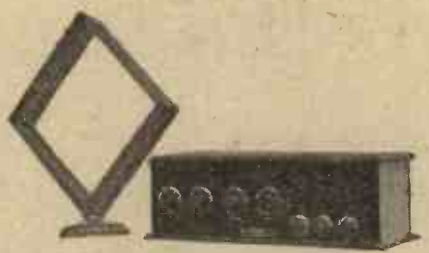
and at other times the aerial may be disconnected from earth, tuned to Daventry, or otherwise put out of action in so far as the stations on the ordinary broadcast band are concerned.

As a matter of fact, some very interesting results can be obtained if a superheterodyne working upon a



Many slow-motion dials are fitted with spring fingers bearing on the surface of the panel.

frame aerial is tuned to some given distant station, and then the tuning of a set upon the outside aerial is varied till it coincides with that of the distant station. As a rule, a very remarkable increase in signal strength will be observed upon the superheterodyne, but this is not an



When your frame aerial indicates that all stations lie in the same direction, suspect the presence of some local re-radiator, such as an outdoor aerial near by.

invariable rule. Much seems to depend upon whether reaction is being used upon the outside aerial, and therefore any tests which are made to determine whether this is the cause of a serious lack of directional effects should be carried out by means of a simple tuned circuit upon the aerial and earth system with no actual set connected, or if it is necessary to use a set of some sort, the valves should be turned out.

Separate Oscillators

One hardly ever sees a separate oscillator being used these days by a short-wave experimenter, yet there are numerous advantages connected with its employment which are worthy of more serious consideration than they usually receive. It is true that a separate oscillator for C.W. reception upon the really high frequencies does not yield any appreciable improvement in signal strength, yet in readability of the signals there may be a very real improvement. So much general noise, mush, and so on is picked up by the use of a self-oscillating circuit that signals of quite fair strength are often rendered really difficult to read for no other reason. Now, if a separate oscillator is used, it is possible to set the reaction control so that the receiver is a little below the oscillation point, and then by swinging the oscillator dial the station can be picked up once more, usually with a really delightful improvement in background, although at slightly reduced strength.

Dial Indicators

Everyone who has endeavoured to pick up a distant station from recorded readings must have noticed that the average indicator for the condenser dials is a far from satisfactory little appliance. The main trouble arises from the fact that the figures and divisions on the dial stand off from the panel perhaps a sixteenth of an inch or more, whereas the dial indicator lies flat upon the surface of the ebonite, and consequently what is called in optics "parallax" exists, that is to say, if the head is moved from side to side, the apparent reading on the dial will alter by a degree or so. A simple remedy for this state of affairs is to be found in the use of a dial indicator packed up with washers behind it in such a way that it is flush with the edge of the dial, or, when such an indicator is not available, the use of a small cheese-headed screw for the purpose, mounted in the correct position against the edge of the dial, and set so that the slot in its head provides the necessary indicating line. If, after the screw is inserted in the panel, this slot is filled in with white wax or white enamel, a very effective indicator results.

Pitfalls of the . . Reinartz . . Circuit . .

By G. P. KENDALL, B.Sc.

The Reinartz circuit is capable of giving exceedingly good results, but its apparent simplicity is apt to be misleading, and unless certain requirements are satisfied it may be very disappointing in practice.

THE circuit usually associated with the name of Reinartz is one incorporating two features which, although they are undoubtedly capable of giving very excellent results, are yet also capable of causing a good deal of puzzlement and worry to those who try them without quite understanding how they function. The two features in question are tight inductive coupling to the aerial circuit and a form of capacity-controlled reaction which is actually magnetic in nature, the condenser providing merely a simple means of graduating the amount of the reaction taking place.

How Reaction is Obtained

Since a very special feature of the circuit is the delightful smoothness of its reaction control when it is functioning correctly, we will take first the question of the reaction arrangements. The scheme employed is a very simple one, being merely to provide a shunt path from the anode of the valve to its filament

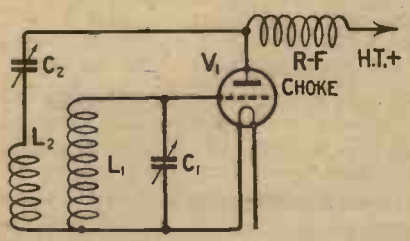


Fig. 1.—The reaction circuit provides a parallel path to filament for the H.F. component of the anode current.

for the high-frequency component of the anode current. The scheme, in fact, is precisely the same as that which has been adopted in coupling a high-frequency valve to the succeeding circuits by means of what is called the " parallel feed " arrangement. For its success this method depends upon the existence in the plate circuit of something which offers a very high impedance to the high-frequency component of the anode current, so that this component will be glad to take the rela-

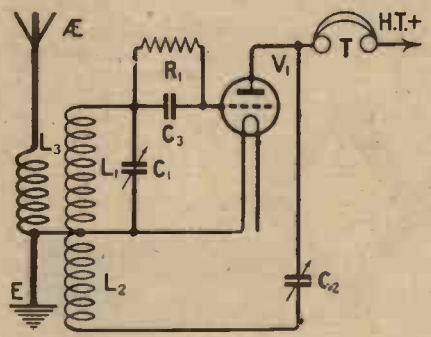


Fig. 2.—In the earlier versions the telephones were used as an H.F. choke.

tively easy path to the filament circuit provided by our reaction-coupling arrangements.

An Analogy

The parallel path consists simply of a variable condenser and a small coil in series therewith, these two being connected straight between plate and filament. The coil is arranged to couple magnetically with a coil in the grid circuit of the valve, and hence if the direction of these two windings is correctly arranged, the high-frequency cur-

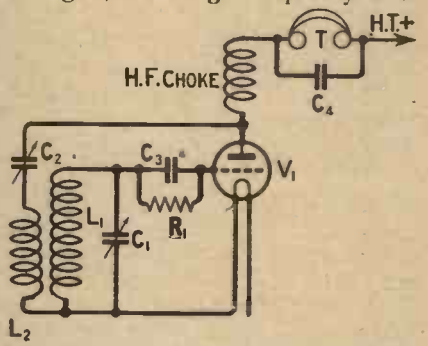


Fig. 3.—Better results are obtained by including a choke in series with the 'phones.

rents in passing from anode to filament will produce the desired reaction effects, and the strength of these effects can be graduated to a nicety by adjusting the capacity of the variable condenser. Furthermore, the adjustment of reaction will have practically no effect on the tuning of the other circuits, so that the operation of the receiver becomes delightfully easy.

Reaction Details

The essential details of this reaction scheme are shown in Fig. 1, where it will be seen that a high-frequency choke is indicated in the anode circuit of the valve to provide the desired impedance to the high-frequency component of the anode current, and the shunt path between plate and filament consists of a variable condenser C2 and the coil L2, which is coupled to the grid coil L1. For these schemes to work

Pitfalls of the Reinartz Circuit—*continued*

properly, it is imperative that there shall be an adequate impedance of some sort in the anode circuit, and herein we find one of the points at which the beginner may go wrong.

The earlier forms of the Reinartz circuit usually depended upon the impedance of the telephones to act in the capacity for which the high-frequency choke was provided in Fig. 1, and the essential portions of one of these circuits are given in Fig. 2. The shunt plate to filament circuit again consists of a variable condenser C2 and the coil L2 coupled to the coil L1, but there is now no high-frequency choke, but only a pair of telephones.

Limitations

Now, if these telephones are of suitably low capacity, fairly satisfactory working will result, inasmuch as the reaction arrangement will function, but there are a number of undesirable features which follow in the train of the use of telephones in this way. In the first place, we are dependent upon the exact nature of the telephones for our reaction control, and some telephones may not be suitable for the purpose, having too large a capacity, either in their windings or in their leads. Even assuming that the telephones are of sufficiently low capacity, there are other undesirable effects. For example, since the 'phones are being used as a high-

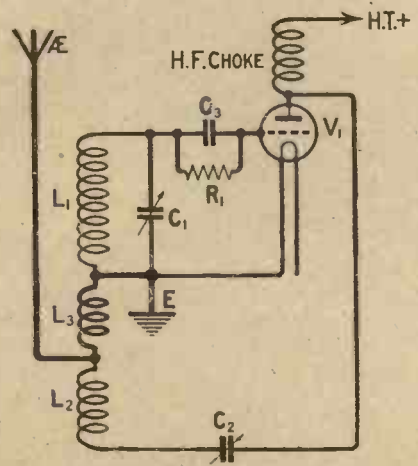


Fig. 4.—In the first Reinartz circuits two windings (L2 and L3) were provided for reaction and aerial coupling.

frequency choke, one side of them will be at high-frequency potential to earth, and there will almost certainly be very annoying body-capacity effects.

A Better Scheme

A very much better arrangement is to make the high-frequency choke a permanency in all these Reinartz circuits, connected up in series with the telephones, as indicated in Fig. 3. In addition, a by-pass condenser should be provided across the telephones of the conventional value of .001 or .002, to make sure there will be no tiresome body-capacity effects. An additional advantage of this arrangement is that when a low-frequency amplifying valve or

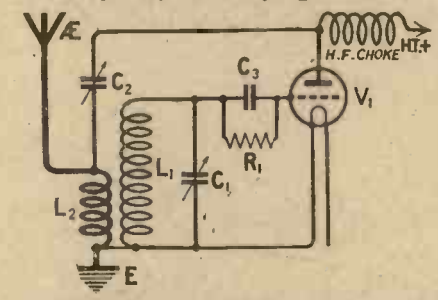


Fig. 5.—When coils of fairly low resistance are used it is possible to use a combined aerial and reaction winding.

valves follow the detector and some switching scheme is provided so that one or both can be cut out of circuit, no alteration of the reaction control is needed. With the preceding scheme, on the other hand, when the telephones are removed from the anode circuit of the detector valve and replaced by a low-frequency transformer primary, the reaction adjustments will probably be completely upset and the set will have to be readjusted every time this is done.

The Couplings

We next come to the question of the arrangement of the aerial coupling and reaction winding, and this is a decidedly important point. The original scheme was something like the circuit shown in Fig. 4, in which will be seen that the aerial and reaction windings are in series with each other, these being the coils L2 and L3. Both act as reaction coils, but the coil L3 alone is included in the aerial circuit.

It was soon found, however, that if we make the tuning coil in the grid circuit, that is to say, the coil L1, of reasonably low resistance, quite a small number of turns would suffice upon the reaction coil, and the number required was, in fact, much of the same order as that needed for aerial coupling. It was therefore found possible to dispense with the additional winding L2 of Fig. 4 and to use one common winding for both aerial coupling and reaction. This is done in Fig. 5, where it will be noted that the reaction and tuning arrangements are those of the later forms of the circuit.

Hand-Capacity

One of the drawbacks of this arrangement is that the reaction condenser C1 has both sets of plates at high-frequency potential to earth, and consequently hand-capacity effects may be troublesome. Evidently, what is wanted is to place the condenser with one set of plates at earth potential, and at first glance it might be thought that this could be done by placing it between the coil L2 and the connection which goes to the filament circuit. This, however, is not a desirable expedient, since it has the effect of insulating the batteries from earth, and leads to trouble when low-frequency stages are added to the receiver. Alternatively, it may be placed in series with the coil L2 at a point above that which would insulate the batteries from earth, but this again is not practicable since it would then be in series with the aerial circuit, and would have some slight effect upon the tuning when it was adjusted.

Remedies.

Attempts have been made to overcome this difficulty by using auto-coupling to the aerial circuit, i.e., by

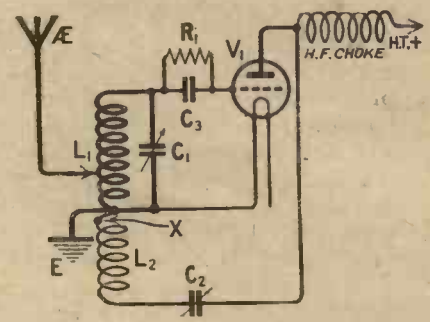


Fig. 6.— Auto-coupling is sometimes used to enable the reaction condenser to be inserted at the point X, but this is not advised.

tapping the aerial upon a suitable point on the grid coil L1 and using a separate winding for the reaction. Such a scheme is shown in Fig. 6, where the point X is indicated as

(Continued on page 229)

PRACTICAL TOPICS

By G. P. KENDALL, B.Sc.

In this section Mr. Kendall will discuss at intervals those problems and difficulties which come within the experience of every experimenter. This week the subject considered is the knotty problem of whether to make a portable set really self-contained or not.

THIS is a time when many of us are devoting much hard thought to the problems of next season's portable sets, and we have already had an article from Mr. Harris on some of the problems of design involved. Probably most of us require a set capable of giving loud-speaker results (who would wear headphones upon a picnic?), and there must at least be a large proportion of portable set users who do not want the trouble of erecting an aerial, and therefore desire to work upon a frame. To work upon a frame aerial and get loud-speaker results with a choice of stations means that to give an adequate factor of safety something like six valves with a superheterodyne circuit must be regarded as a minimum, and then some serious problems regarding batteries arise at once.

Should it be Self-Contained?

My own requirements are very similar to those just defined, and after much planning and scheming it seems that one very important question must be decided at the outset, and that is whether the set is to be really and truly self-contained or not. Now, to feed six valves, even of an economical type, involves batteries of quite appreciable size. The filament current, for example, assuming .06 valves for the first five and a power valve taking one-tenth or thereabouts of an ampere for the low-frequency valve, will be in the neighbourhood of half an ampere, and dry batteries for this supply are entirely ruled out upon the score of bulk and weight. A small 4-volt accumulator will probably be the most satisfactory solution, and will weigh several pounds and occupy a space of something like 50 cubic inches.

The H.T. Load

The anode current, again, will probably be between 6 and 10 milliamperes, and this is a load which the smaller types of high-tension battery will not endure for long without protest. As a matter of fact, such a load really calls for one of the larger-sized batteries, such as the very substantial Columbia units. To get satisfactory results from the low-frequency stage, something like 90 to 100 volts is usually regarded as the minimum value for the high-tension supply, and one is at once faced with the problem of a large and bulky battery for this purpose.

If the portable set is a superheterodyne it is almost essential to use fairly large capacity H.T. units, especially when one or more power valves are used.

Large Batteries

Setting on one side for the moment the question of the loud-speaker, it appears that the batteries will account for at least half the weight of the finished set, and very nearly half its bulk. Is it, therefore, a wise proceeding to try and corporate these actually inside the set itself? If one does so, it inevitably becomes a decidedly bulky affair, somewhat heavy, and a very awkward proposition from the transport point of view.

Undoubtedly, it is possible to get all the batteries inside the case of the set, especially if one employs the smaller size of H.T. battery and faces the fact that its useful life will not be a very long one. To do so, however, seems undesirable, since these batteries nearly always give trouble after the first short period of newness and freshness, noises and other annoyances soon making their appearance. Moreover, many superheterodynes work decidedly better if valves of the dull-emitter type consuming considerably more H.T. and L.T. current are used, and with these it is practically essential that a fairly substantial H.T. battery be provided.

Separate Units

It really seems, then, that it would be wise, on the whole, to make the set itself one unit only of the complete installation, including, perhaps, the grid bias battery only, and then devising some other means of transport for the H.T. and L.T. batteries, the loud-speaker and the folded-up frame aerial. In this way it is quite an easy matter to get the set down to the dimensions of a moderate-sized despatch case, of a quite modest weight, so that one unit, at least, of the whole installation will be easy to carry about.

The Auxiliaries

As regards the auxiliaries, the final decision will no doubt depend upon the particular requirements of each user. It seems to me, however, that most users of truly portable sets will be those who wish to take them on motoring and boating expeditions, and in a case of this sort the main requirement is that each separate unit of the installation shall be readily handled and stowed into a not too large space.

My own needs, for example, are that a set and its auxiliary units shall be easily handled and shall be capable of being stowed into a locker in a car with a certain amount of other luggage. In this case, therefore, a practical solution is to be found in the use of a long and narrow but rather shallow crate, somewhat like a glorified accumulator crate, carrying the L.T. and H.T. batteries in a lower tray and stowing above these the folded-up frame aerial. A carrying strap completes this unit, which is a little longer than the set, but not so wide, and a little deeper.

APPARATUS WE HAVE TESTED

Conducted by the Radio Press Laboratories Elstree.

Filament Rheostat

We have received from Messrs. The Penton Engineering Co. a bright-emitter filament rheostat for test.

One-hole fixing is provided for, while contact on the resistance element is made by means of a three-leaf spring, the tension of which can be adjusted as desired.

The resistance element is firmly wound on an insulating strip, which is then bent round a moulded insulating mounting. Connections are made to one end of the winding and the slider by means of small screws passing through metal lugs.

The resistance of the rheostat is 6.6 ohms at its maximum value, and considerably less than .1 at its minimum. It is, therefore, entirely suitable for use with bright emitter valves. The action of the moving contact is positive, and a continuous variation of the resistance from its maximum to its minimum value is possible.

Neutrodyne Condensers

Messrs. Gambrell Bros., Ltd., have submitted for test a sample of their Neutrovernia condenser.

A special point is made in the Neutrovernia condenser that the capacity change is proportional to the rotation of the knob throughout the entire adjustment. The minimum and maximum capacities are stated to be 1 micro-microfarad and 28 micro-microfarads respectively, and the total adjustment is accomplished in six complete revolutions of the knob.

This neutrodyne condenser consists of an ebonite cylinder about 2½ in. long by ½ in. diameter. The knob of the condenser is milled, and is about 2 in. long, so that when adjusting the condenser the hand is over an inch away from the nearest metal part, thus reducing hand capacity effects. On taking the condenser to pieces it was found to consist of two brass cylinders, one of which was able to slide up and down within the other.

The Neutrovernia condenser is a product of Messrs. Gambrell Bros., Ltd.

It was found on tests that the minimum of this condenser was between 1 and 2 micro-microfarads, while its maximum capacity was approximately 29 micro-microfarads. Its insulation resistance was found to be infinite. A very pleasing feature is the almost entire absence of backlash in this condenser. The movement is also very smooth and easy, and all connections were found to be in good order.

A Coil

Messrs. Clear Hooters, Ltd., submitted to us at our Elstree Laboratories a sample of their "Clear Speaker" Aperiodic Coil for test and report.

This bright emitter rheostat, submitted by the Penton Engineering Co., is of sturdy construction.

The following qualities are claimed for this coil:—

1. Selectivity.
2. Reduction of interference from ship and spark stations.
3. Cutting out the local broadcast station.

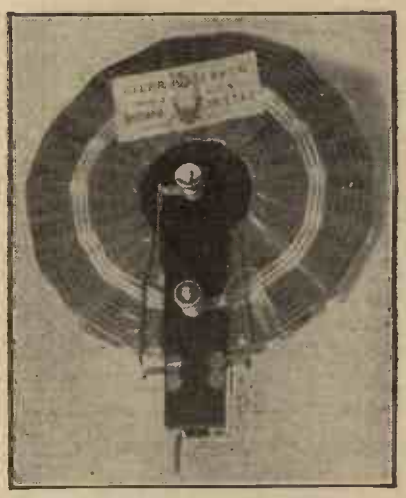
This coil is basket-wound on a number of wooden pegs, and is mounted between two strips of ebonite clamped together at their two ends. At the centre they are fixed by means of a screw to which is attached a nickel-plated terminal. Another terminal is mounted about halfway down the strip, these two terminals serving as taps for the aerial.

It was found on test that the inductance of this coil was 210 microhenries, while its high-frequency resistance at the frequency of 2LO was 23 ohms. The natural wavelength was 130 metres. On testing in a set it was found that signals were about the average obtained with other coils when using the whole of the coil. When employing one of the aerial taps provided, it was found that selectivity was greatly improved.

Cosmos Lead-in Tube

Messrs. Metro-Vick Supplies, Ltd., have sent us a Cosmos Lead-in Tube for test and report.

This consists of a threaded brass rod 6 in. long carrying two insulating bushes, which are conical in shape, and having heavily milled heads over 1 in. in diameter. These insulating bushes have a metal nut moulded into them which screws on the rod, and they can, therefore, be adjusted to any distance apart.



The "Clear Speaker" Aperiodic Coil, for which good selectivity is claimed.

When mounting this component, the conical portions serve to lock the bushes in position, while the metal rod is carried through the centre of the hole, being surrounded only by air, thus reducing its capacity to earth.

Terminal nuts and washers are provided at each end for the necessary connections. The insulation resistance of the bushes was found to be infinity.

This is a very easily fitted lead-in tube, suitable for use where the material through which it is to be carried is not more than 4 in. thick, although the substitution of a longer threaded rod would enable it to be carried through materials considerably thicker than the dimension given.

Fixed Condenser

Messrs. The British Sangamo Co., Ltd., have submitted to us for test a sample of their Sangamo Mica Condenser. It is claimed that this condenser is moulded throughout in bakelite, and its capacity is guaranteed

Apparatus We Have Tested

(Continued)

under varying conditions of temperature, moisture and pressure.

This condenser is made of brown insulating material, and is rectangular in shape, except for its ends, which are rounded off. Its overall length is 1⅞ in. and its width 1⅜ in. At each end of the condenser a screwed metal bush passes right through it and evidently makes contact with the appropriate set of plates inside. No soldering tags are provided, but both the makers' name and the rated capacity are marked on the case. The condenser is hermetically sealed.

The condenser was found to be of the rated capacity within a sufficient degree of accuracy, and its insulation resistance was infinite. Both these qualities were found to be unaffected by exposure, the condenser having been left for a night in the open under particularly adverse atmospheric conditions.

Loud-Speaker

Messrs. Gent & Co., Ltd., have submitted one sample of their range of loud-speakers for test at our laboratories. This particular one is called the "Concert Model," and the accompanying photograph indicates quite

The Tangent "Concert Model" loud-speaker is of pleasing design.

clearly the shape and style of the model. The reproducing mechanism is enclosed in a cylindrical case, and special feet enable the loud-speaker to rest on the table. The horn is so shaped that it turns back on itself in one sweep, the trumpet being made of cast aluminium and the flare of spun aluminium.

Adjustment of the mechanism is provided for through the medium of a milled nut, a pleasing feature being the very delicate movement made possible.

This loud-speaker appears to have been carefully designed to give faithful reproduction of speech, special care being paid to the acoustic properties of the material employed.

On test, the reproduction left little to be desired, the loud-speaker handling a large power quite adequately.

Grid-Bias Battery Holders

Mr. A. G. Brine has sent us a sample pair of the "Secure" grid cell holders for examination.

The holders consist of two right-angled metal brackets made from aluminium just under 1/16 in. thick. Each has a vertical strip of metal 2 in. by ¾ in., with two side flanges ¾ in. square, and a metal base of the same dimensions. By means of a countersunk screw hole at the centre of this base the holders are fixed into position on the baseboard. The holder is pressed into shape, and the distance between the insides of the flanges (⅞ in.) just allows an ordinary Ever-Ready 9-volt grid-bias battery to slip into position, these holders having been primarily designed for this cell. The feet are turned inwards with the object of economising space, and when mounted on the baseboard conveniently accommodate the grid-bias battery, the length of that battery being immaterial as long as the width does not exceed ⅞ in.

These holders should prove useful to constructors.

Operating Notes on the "Screened Coil" Receiver

(Continued from page 211)

be changed to the centre point of the first coil, this constancy of adjustment has to be sacrificed to some extent.

The Potentiometer

Since the potentiometer winding is connected across part of the grid-bias battery, it is desirable that a high-resistance instrument be used. One of the special Lissen high-resistance type is suitable, and the maximum life will then be assured for the grid-bias battery.

Test Report

In undergoing its tests at Elstree this set gave good signals from Nottingham, Liverpool, Hull, Cardiff, London, Manchester, Bournemouth, Dublin, Newcastle, Hamburg, Glasgow, Rome, Barcelona, Birmingham and Aberdeen.

Selectivity was good, Manchester and Bournemouth being entirely free of London. Ease of operation was found very good.

B.B.C. Hours

SIR,—I fear that the effect of experimenting on your correspondent Mr. Watts, whose letter on "B.B.C. Hours" you publish in your issue of March 24, has been far from beneficial to him. If his expression of opinion represents the present generation as it should be in Mr. Watts' view, then give us the present generation "weakened by luxury."

I fail to see how short-wave reception is affected by the activities of the B.B.C., unless one presupposes inferior apparatus. As to DX reception on the broadcast frequencies, if Mr. Watts is so keen on this, surely he is enthusiastic enough to construct for himself a receiver selective enough to give him what he wants during broadcasting hours. After all, the B.B.C. programmes are intended for the benefit of the majority, and those who do not want to hear them should adapt their apparatus to their requirements and not expect the B.B.C. to make special arrangements for the benefit of a small minority.

I should like to ask, too, what "canned stuff" is? If gramophone records are meant, I think your correspondent is seriously misinformed. If he refers merely to jazz music, then I would ask him to realise that there are many who appreciate and enjoy this form of entertainment, even if he himself finds no pleasure in it.—Yours faithfully,

J. L. BENNETT.

Forest Hill, S.E.23.

SIR,—May I be permitted to add my name to the opinions expressed by Mr. Watts in your issue of March 24? As an experimenter myself, engaged in daily business like most other people, I find it impossible to sit up for half the night in order to wait for the closing of the B.B.C. stations.

I admit that there are no doubt thousands of listeners who enjoy the dance music or other programmes which go on till a late hour on most nights, but I think that the serious experimenter has some claim to at least an occasional silent period. The case for the experimenter might well have been put much more forcibly before the Broadcasting Committee. Even so, I consider that the Committee should have made some recommendation on this important matter instead of merely noting it down for the consideration of the proposed Commission.—Yours faithfully,

A. BARTON.

Stoke Newington, N.16.

"Why Do We Use Symbols?"

SIR,—Although I see from your Editorial Note that Mr. Barton-Chapple is to reply to the criticism offered him by Mr. H. S. Fletcher in your issue of March 24, may I be permitted to express my views on this subject in advance?

I will not deal with your correspondent's personal remark about the author of the article in question, except to say that besides being irrelevant, it appears to me quite uncalled for. His subsequent humility leaves a distinct flavour of Uriah Heep in the mouth.

It seems to me that Mr. Fletcher's scheme of using the small and capital letters of the alphabet would lead to appalling confusion. The arrangement of symbols at present in force at least has the merit of being reasonably clear. The troubles arising from different styles of handwriting would be quite enough to lead to ludicrous errors in scientific treatises. There is another aspect of the question, too, which your correspondent overlooks. This is that it was the intention to frame a series of symbols which shall be available for international use. This in itself should be sufficient reason for the use of Greek and other characters.—Yours faithfully,

C. DIXON.

Wolverhampton.

SIR,—It was gratifying to note that your correspondent, Mr. H. G. Fletcher, was interested in my article on "Why do we use Symbols?" in the March 17 issue of *Wireless Weekly*, but to suggest that my remark *re* people with patriotic inclinations was a sneering one is surely wide of the mark and savours rather of uncharitable fault-finding.

Now, to turn to his other comments and his suggestion. When drawing up this table it was meant to infer that it was complete insofar as it applies to wireless, but if your correspondent refers to the original table as published by the I.E. Commission, he will find that other symbols are introduced which may be enlightening to him. The only letters of the English alphabet not used in either small or capital form are O U Y, but even if these were used, it would not fill the gap if Greek letters were omitted.

Let us examine the statement concerning the use of small and capital letters and see where it falls short. *As far as possible*, as Mr. Fletcher will observe if he examines the table carefully, the symbol employed is the initial letter of the quantity or unit which naturally is of considerable assistance in committing them to memory, but unfortunately many commence with the same letter, and this is where a compromise is effected. Let me quote one instance to illustrate my point. We have Current, Conductance and Capacity amongst the various quantities, coulomb in the units and centi in the prefixes. What a confusion would exist if we used the small and large C's.

Other instances could be quoted, but I will not take up more of your valuable space except to remind Mr. Fletcher that the Committee who drew up this table after considerable deliberation consisted of experts drawn from all the interested industries and institutions, and it is usual to give such representative bodies full credit for their unenviable task, and this your correspondent will no doubt do if he gives more careful thought on the matter without jumping to somewhat hasty conclusions.—Yours faithfully,

H. J. BARTON-CHAPPLE.

FORTNIGHTLY FEATURES.

In response to inquiries it is pointed out that the following regular features of "Wireless Weekly" are now appearing fortnightly:—

Circuits for the Experimenter.
Short-wave Notes and News.
Operating Notes.
Jottings by the Way.
Interview.

READERS' COMMENTS
(Continued)

Oscillating Neighbours

SIR,—With reference to Mr. J. R. Clyne's letter dealing with a persistent oscillation fiend in his vicinity, I have a neighbour that does exactly the same. When I vary my tuning his set suddenly bursts into oscillation, causing him to re-tune (he does not stop oscillating, but merely tunes to the silent point). If then I tune my set in accurately again, he immediately starts up another piercing squeal.

I have found that the only remedy is to cause my own set to oscillate, which brings a temporary relief by fetching the gentleman in question round to my front door to know what I mean by spoiling the programme.

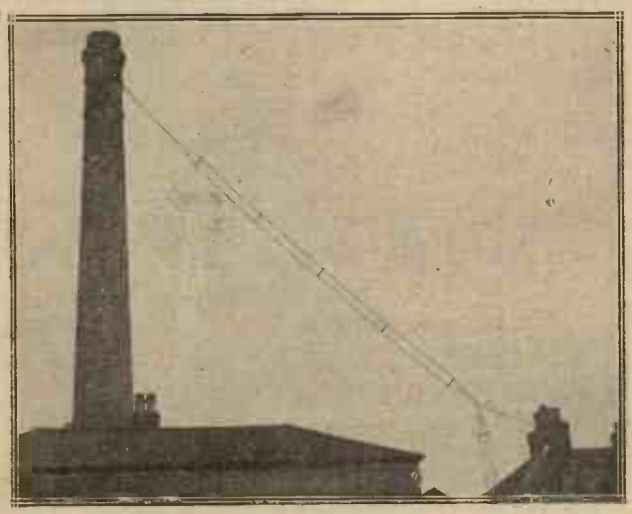
Repeated explanations have been useless. Can any of your readers suggest a practicable remedy?—Yours faithfully,

Croydon. S. W. ASHLEY.

THE POSITION OF THE HOME CONSTRUCTOR

The Marconi Company is at present issuing a "Warning" regarding the home construction of wireless sets and royalties stated to be payable in such cases. It is to be noted that the Company expressly state that they have no intention of withdrawing certain concessions given to the *bona-fide* experimenter or amateur.

We have asked the Marconi Company to give us a definition of "*bona-fide* experimenter," and await this with interest. We refrain at the present juncture from further comment, but we regard the purport of the notice to be of such importance to the home constructor as to warrant a very full investigation, and we shall return to the subject in an early issue.



The Nottingham relay station is being heard at surprising distances, despite the fact that the surroundings of the aerial are far from ideal.

PITFALLS OF THE REINARTZ CIRCUIT
(Continued from p. 223)

being the position at which the reaction condenser should be introduced if it is desired to minimise hand-capacity effects.

This scheme, again, is not satisfactory since the full benefit of reaction is not obtained for reasons with which I do not propose to trouble the reader. The only practical expedient would seem to be using a reaction winding connected as in Fig. 6, with the condenser at the point X, and then a separate aerial coil coupled to L1, but in no way related to the reaction coil.

Aerial Turns

Perhaps the most dangerous pitfall of the Reinartz circuit is the one which I have reserved for the last, namely, the number of turns upon the aerial coil. It must be realised that we have here our old friend, the so-called "aperiodic" aerial circuit, and all the remarks which have been made in the past regarding the correct number of turns apply with equal force to the Reinartz circuit. As a matter of fact, all the dangers of flat tuning and so on, if too large a number of turns is used, which I have explained in past numbers of *Wireless Weekly*, are present here, and I would strongly urge everybody who uses a Reinartz receiver to make tappings upon his aerial winding for purposes of adjustment.

Things That Matter in a Valve

(Continued from page 207).

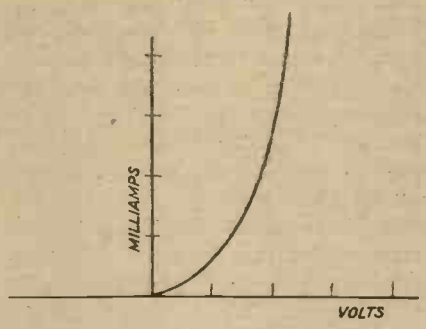
electrode valve, but suppose we put volts on the plate only, then, if the grid is earthed, it acts as a kind of screen, only letting part of the volts of P get to the filament and the closer the mesh of the screen the less the volts that get to the filament.

We can then say that due to the grid screening effect, to get the same volts acting on the filament (and its electrons) from the plate, as one volt on the grid would give, we shall need "M" volts, M getting bigger as the grid gets finer and finer in mesh. If our basic graph of the valve was approximately R_1 resistance between the grid and filament, then as it takes M times the volts to get the same current to the plate, the resistance will now be M R_1 between plate and filament.

Amplification Ratio

When we were only talking of the basic graph, I said that the resistance depended inversely on length of filament and nearness of electrode to filament, and I must now add a third factor, the "M" value. You will notice that makers issue a particular type of valve and then they issue a B and C edition of apparently the same valve. The factors of length of filament and distance of grid usually remain exactly the same, the alteration is merely to the closeness of the mesh of the grid, so that if we had a basic curve like Fig. 5 and the M value, we should know all we want to know.

We could, from these basic graphs, judge one maker's valve against another maker's at once. If the basic curve of one maker's valve is better than that of another, then if those two makers issue two valves of the same "M" value, the one with the better basic curve will be the better valve. Of course, the makers would have to give us a suitable selection of M values for our different purposes. Then, in addition, we should have to think of the life of the valve—its filament current consumption and the H.T. voltage it would stand.



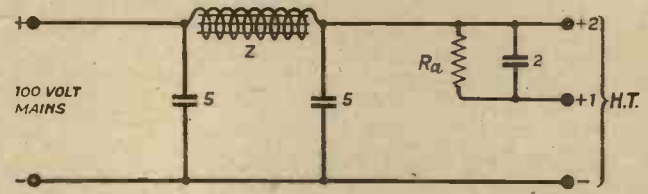
Basic graph of valve type :
M value =
(To obtain actual valve curve multiply volts scale by M.)
Fil. volts =
Fil. current =
H.T. limits :
Power limit = H.T. × milliamps. =

Fig. 5.—Captain Round gives here the scheme which he considers valve manufacturers might well adopt in giving valve data.

Using the Mains for H.T.

"My house lighting supply is direct current at 100 volts, and I am successfully obtaining my high-tension supply therefrom, utilising the usual smoothing arrangement consisting of a high impedance choke coil and two Mansbridge condensers of 5 microfarads each. The arrangement results in applying the voltage of the mains to my high-frequency and detector valves as well as to the note magnifier and I am desirous of reducing the voltage on the first two valves to the order of half the mains voltage, but at the same time I do not want to have to use two lamps in series as a potential dividing arrangement, together with a further smoothing circuit. Can you suggest how to overcome the difficulty?"

In practice a lower voltage for the high-frequency and detector valves can be obtained quite easily and at only small expense. The circuit to employ is given in the figure below. Here it will be observed that the ordinary standard arrangement is employed, except that a further resistance and a 2 microfarad condenser are required.



The simple device of a series resistance can be used to obtain a special voltage for the H.F. and detector valves.

The negative side of the mains is joined directly to the high-tension negative terminal of the receiver, whilst the positive side is connected through a high-impedance choke coil Z, which may be one of the chokes normally employed in an ordinary choke-coupled amplifier, to the H.T. + 2 terminal, at which practically 100 volts will be available for the note magnifiers. H.T. + 1 is the high-tension terminal for the H.F. and detector valves, and the voltage available here is that of the mains, less the voltage dropped across the resistance. The resistance must, of course, be shunted by a large condenser, for which purpose 2 microfarads proves suitable in practice, in order that it may exert no coupling effect between the H.F. and detector valves, which will give rise to instability.

On considering the position of the resistance Ra in conjunction with the circuit diagram of the receiving set, it will be seen that it is in series with the internal resistances of the two valves, which latter are in parallel. If now a suitable value is chosen to equal the resultant resistance of the two valves, it follows that half the voltage of the mains will be dropped across the resistance and the remainder will be applied across the valves, which is the desired condition we wish to obtain.

To make the matter clear, let us consider the case where an H.F.

Is Your Problem Here?

(Continued)

valve with an internal resistance of 60,000 ohms is followed by a general-purpose type valve for the detector, which has an internal resistance of 30,000 ohms. The resultant resistance of the two valves in parallel is given by the simple formula

$$R = \frac{R_1 \ R_2}{R_1 + R_2} = \frac{60{,}000 \times 30{,}000}{60{,}000 + 30{,}000} = 20{,}000 \text{ ohms.}$$

Where R = Resultant resistance of valves in parallel
R_1 = Internal resistance of the H.F. valve
R_2 = Internal resistance of the detector valve.

The resistance Ra should therefore be of 20,000 ohms, and one of the wire-wound type should always be used in order to ensure silent working. Where the resistance required is not of a standard value, certain firms, such as the Mullard Radio Valve Co., will wind one to any required resistance.

It should be clearly understood that a given resistance will only be suitable to give the required voltage when valves of a given internal resistance are employed and that alteration of these latter figures will require an altered value of anode resistance. Where it is desired to obtain a high-tension supply which is any given fraction of the mains supply, a very simple sum in proportion will give the necessary figure for Ra. As the value of the latter is increased the voltage applied across the valves decreases.

Adjusting Capacities

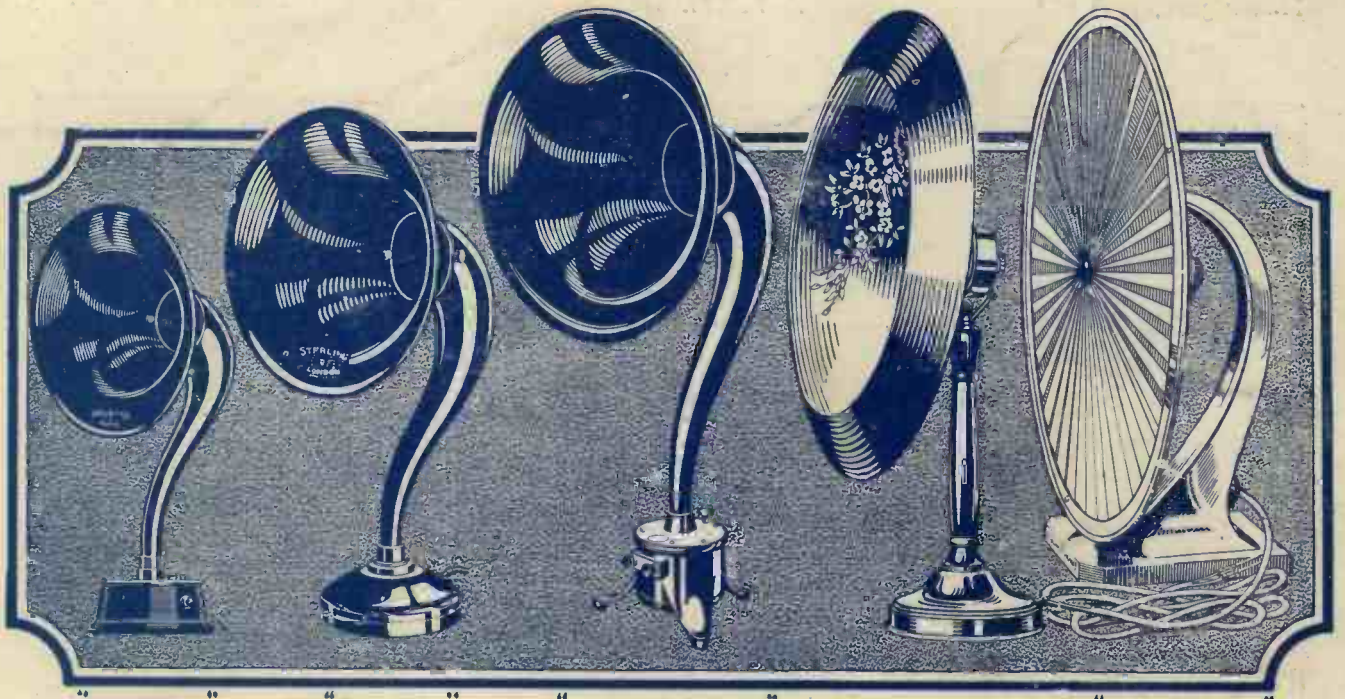
"I have several excellently-made variable condensers which are, however, of .001 and .0005 capacity, whereas in the receiver I am about to build capacities of .0005 and .00025 are specified. Would you advise me to try to reduce their capacities by removing plates from both the fixed and moving vanes, or must I purchase new condensers, which I can ill afford?"

In practice, unless you are mechanically inclined, you will probably not find the alterations to the condensers simple to carry out, and we think you would do best to leave them as at present, but to connect in series with each a suitable fixed condenser. When two condensers are connected in series, the resulting capacity of the combination is always less than that of either alone. We can usefully utilise this principle in the present case, and if in series with the condensers of .001 fixed condensers of similar value are connected, the maximum capacity of the combination will then be .0005. Similarly, by connecting .0005 condensers in series with variable condensers of the same value the resulting maximum capacity will be halved. An advantage of this arrangement is that the minimum capacity of the combination is a little less than that of the variable condensers alone.

Grid Bias

"Which is correct, to connect grid bias positive directly to L.T. negative or to the negative filament of the valve which is being biased?"

Both systems are correct, but with the former the drop across the filament resistance is added to the voltage of the biasing battery, whilst with the second arrangement this drop is not utilised. With the latter, however, although a filament resistance may be placed in the negative filament lead, adjustment thereof does not alter the bias of the grid of the note magnifier concerned. On this account it is to be preferred, but it should be realised that, in practice, the slight alteration which will occur through adjustment of the filament resistance is slight, since it is generally satisfactory to alter the biasing voltage by 1 or 1½ volt steps at the time.



"DINKIE" "BABY" "AUDIVOX II" "MELLOVOX" "PRIMAX"

Each one the best in its class *for* tone and volume

THE fundamental principle embodied in the design of a loud speaker is similar to that in the telephone receiver. Sterling Telephones have been foremost for over a quarter of a century and the loud speakers illustrated incorporate the vast experience gained during that period—that is why each Sterling Loud Speaker is the best in its class. They reproduce music, song and speech in all their *natural* forms. For tone, volume, design and exquisite finish they are unparalleled.

STERLING Loud Speakers

Write for descriptive folder No. 390D.

THE MARCONIPHONE COMPANY LIMITED

(Sole Agents for Sterling Telephone & Electric Co., Ltd.).

Head Office :—
210-212, Tottenham Court Rd., London, W.1.

Regd. Office :—
Marconi House, Strand, W.C.2.

STERLING "DINKIE"
"The little fellow with the loud voice." Comfortably loud for the average room, attractively finished in brown **30/-**

STERLING "BABY"
The best of all junior loud speakers. Ample in volume and perfect in tone. In black enamel or brown tinted finish **50/-**

STERLING "AUDIVOX II"
For home or public use. Unsurpassed for tone fidelity and reproduction. In black enamel finish.. .. **£4:10:0**

STERLING "MELLOVOX"
The popular hornless model. Faultless reproduction, mellow in tone, extremely artistic. Brown, blue, mauve or black with gold floral diaphragm **48/-**

STERLING "PRIMAX"
The loud speaker "de luxe," "The Very Soul of Music." Bronze finish .. **£6:0:0**

Published by RADIO PRESS, LTD., Bush House, Strand, London, W.C.2, on Wednesday of each week, and printed for them by THE AVENUE PRESS (L. Upcott Gill & Son, Ltd.), 55-57, Drury Lane, W.C.2. Address for Subscriptions and Editorial Communications :—Bush House, Strand, London, W.C.2. Address for Advertisements :—ADVERTISEMENT MANAGER, "Wireless Weekly," Bush House, Strand, London, W.C.2. Registered as a newspaper and for transmission by Canadian Magazine Post. Subscription rates :—U.K., Canada and Newfoundland, 17/4 per annum; other countries, 19/6 per annum. Sole Agents for Australasia :—GORDON & GOTCH (Australasia) LTD. For Canada :—IMPERIAL NEWS, LTD. For South Africa :—CENTRAL NEWS AGENCY, LTD.