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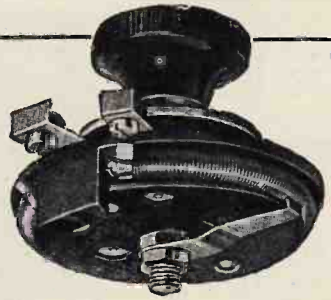

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THE

WIRELESS WORLD

AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN.

No. 255. (No. 14. Vol. XIV.) JULY 2nd, 1924. WEEKLY

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The WIRELESS WORLD AND RADIO REVIEW

CERTIFIED TESTS.

ON the occasion of a recent visit to the Testing and Research Departments of the National Physical Laboratory the idea immediately occurred to us that something might be done with regard to subjecting wireless apparatus and component parts to certain routine tests for the purpose of indicating their reliability and that they are built to conform to certain standards.

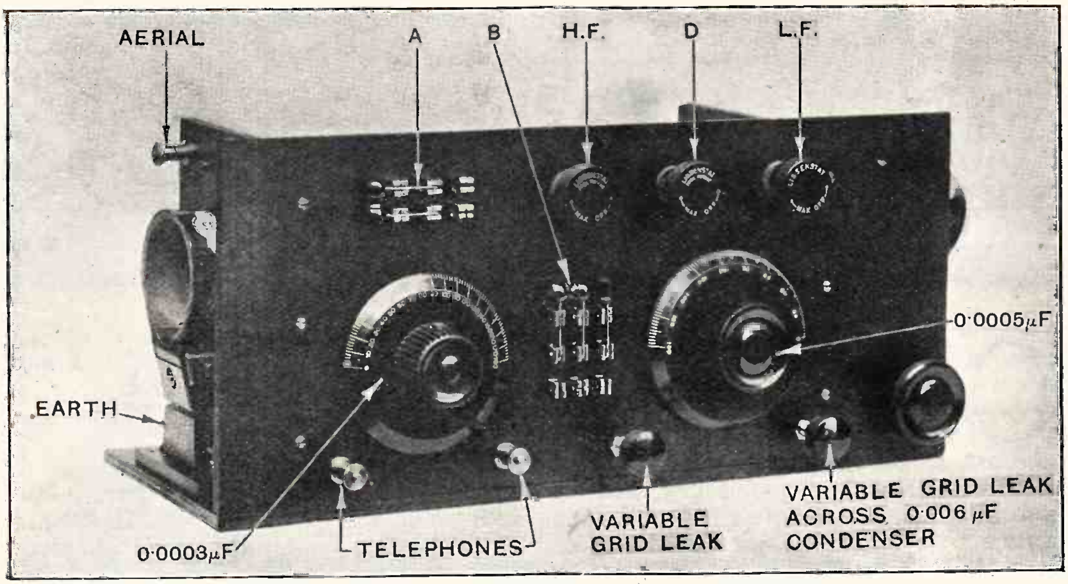
Wireless, like all other new sciences in their day, is victimised to a great extent by individuals who make wild claims concerning the merits of their own products, whilst the manufacturer of correctly designed apparatus which represents honest value has very little means at his disposal for obtaining an endorsed statement concerning the operation of his goods. He may thus be placed in a position by which unfair competition arises, but he is not the only sufferer. The user, in being guided by unqualified statements, may find that he has an instrument which is not necessarily the best of its class and for which he may have paid a top price.

Now it would seem to us that the testing of the many wireless component parts is just as important as the testing of the merits of the component materials used in general electrical work. Apart from the scientific interest, wireless components are not always handled by essentially skilled individuals of the scientific class but are purchased by those without testing facilities, and just as a clinical thermometer may be certified to be correct over a portion of its scale, so should an intervalve transformer be certified to function with reasonable accuracy of magnification over the band of usual note frequencies.

Testing work of this sort is carried out by the National Physical Laboratory, yet how often does one see stated the results of such tests? For although these tests may be carried out on behalf of the manufacturers who are interested in putting the best apparatus on the market, one cannot go to the National Physical Laboratory and inspect the amplification curve of a particular transformer.

It may be said that testing work of this nature could be carried out by a wireless journal whose technical accuracy is beyond dispute, but it will at once be appreciated that this work could not be done without conspicuously drawing attention to the relative merits of various instruments, and such tests might be a little unfair. In our Test Department we have carefully examined the performance of various valves and these results have been published for the benefit of readers, but it would not be possible to extend such test work to anything else other than valves, for the valve manufacturers are few in number and their products in every case represent the greatest technique that it is possible to introduce into their products.

The testing of apparatus by an authoritative body would appear to be a service that every wireless user needs, whether experimenter or broadcast listener.



Flewelling Receiver with optional H.F. and L.F. amplification.

THREE-VALVE SET INCORPORATING A FLEWELLING CIRCUIT.

Many experimenters favour the Flewelling circuit, and details are given here for extending the scope of this super circuit by the addition of high and low frequency amplifiers. The Flewelling arrangement, when preceded by a high frequency circuit of the type described, is found to be quite stable and give consistently good results.

By STANLEY CURSITER, O.B.E.

THE set described in this article was designed to give results under particular circumstances. A relay station at two miles or so and a main B.B.C. station at between 30 and 40 miles could both be got on one valve, but other stations at 100 miles or more made a second, and for longer distances, a third valve desirable. This also suggested the necessity for switching so that the detector alone or with either one stage of H.F. or L.F., or all three could be used as required. In making up the set one or two features of the design are capable of adaptation to any three-valve set of the same order, and in describing this set in particular their application to other circuits need not be lost sight of.

In the first instance a single valve Flewelling circuit was experimented with and the excellence of the results prompted the hope that it might be extended further. In Figs. 1 and 2, two versions of the circuit

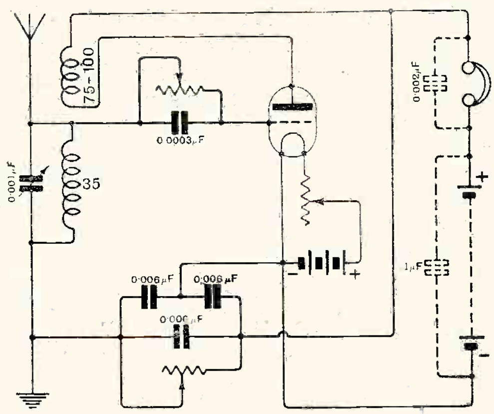


Fig. 1. The original single valve Flewelling circuit from which the circuit of the three-valve receiver is developed.

are given, Fig. 1 being the original form as given by Flewelling, and No. 2 a simplified circuit which he subsequently published. In the end the original form with the bank of three 0·006 condensers was adopted—not because of any superiority of results, but because it seemed that the extra condenser capacity gave a richer and fuller tone, an effect which was added to by the addition of condensers across the phones and H.T. battery (shown dotted), but which in reality only repeat the function of one of the 0·006 condensers.

The single 0·006 condenser version is an excellent circuit though very critical, and it will be found that results depend largely on the quality of the components.

The next stage was a simple L.F. note magnifier. As this does not differ from the accepted practice it calls for no particular description. The circuit is given in Fig. 3. It makes a splendid receiver, but requires to be used with care and a proper respect for the reaction coil.

The problem of adding a stage of H.F. presented some difficulties and various means of coupling to the detector were tried. A three-coil arrangement as indicated in the *Wireless World and Radio Review* of October 31st, 1923, page 156, was first adopted but it was not completely successful

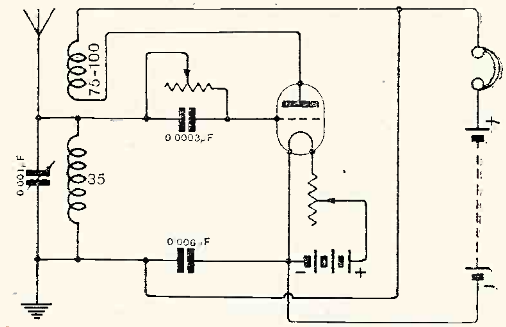
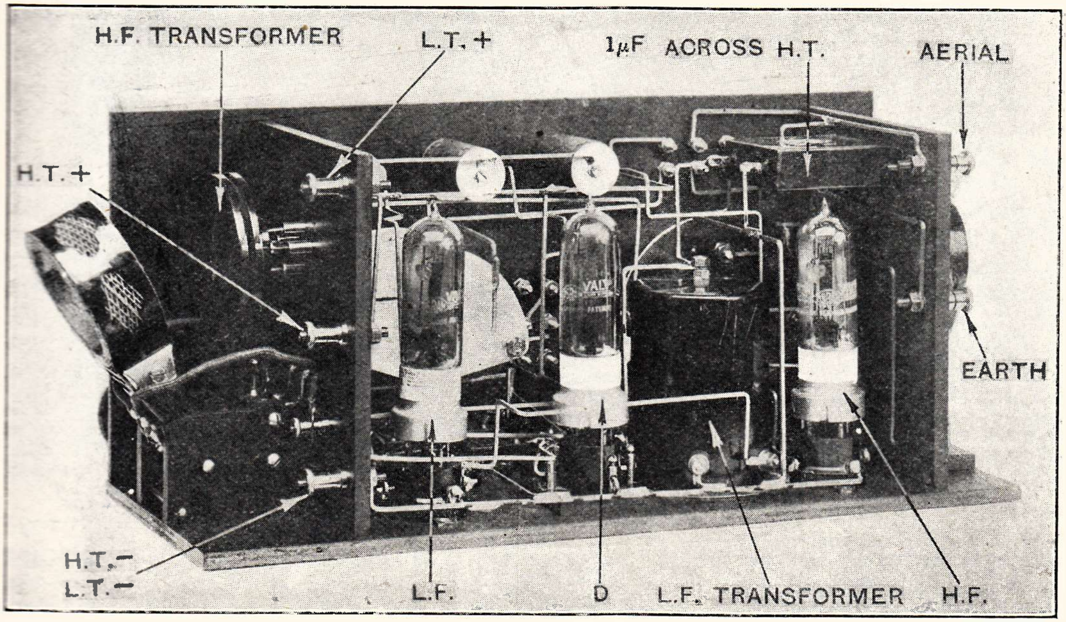


Fig. 2. Simplified Flewelling circuit.

as it was found necessary to tune both the primary and secondary transformer coils and also vary their inductance by the coil holder, making a series of adjustments too complicated for easy manipulation. A variety of transformers were tried using coils of different types, including basket, lattice, honeycomb and duo-lateral, wound on top of each other and side by side. For convenience these were mounted in an



Rear view. The vertical brackets not only support the front panel, but carry several of the components.

ordinary coil mount to plug into the aerial coil holder of the Flewelling detector with leads from the one coil to the plate and H.T. + of the H.F. valve. (At this stage winding led to standard pin transformers of the flat type being used and, as arranged in the set, reaction is obtained on the transformer with perfectly satisfactory results.

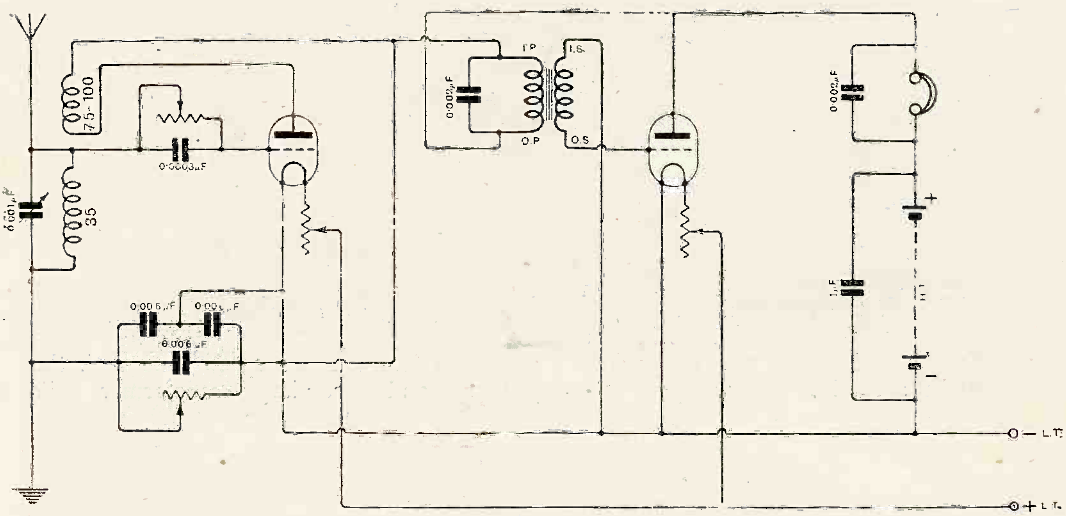


Fig. 3. Flewelling circuit with note magnifier.

the three units were in separate parts and linked up in the usual way in a table layout).

It was found that a transformer of two lattice coils wound on top of each other was in many ways most satisfactory, but in the end the desirability of using standard parts which would allow a large range of wavelengths without undue exertions in coil

In Fig. 4 the circuit and switching are shown and the values of the components noted. In the lay-out, which the photographs make clear, it will be seen that the set is built on a front panel, baseboard and two end pieces. The end-pieces carry at one side the aerial coil and at the other the two-coil holder, the latter carrying the aerial coil for the detector if the H.F. is switched off.

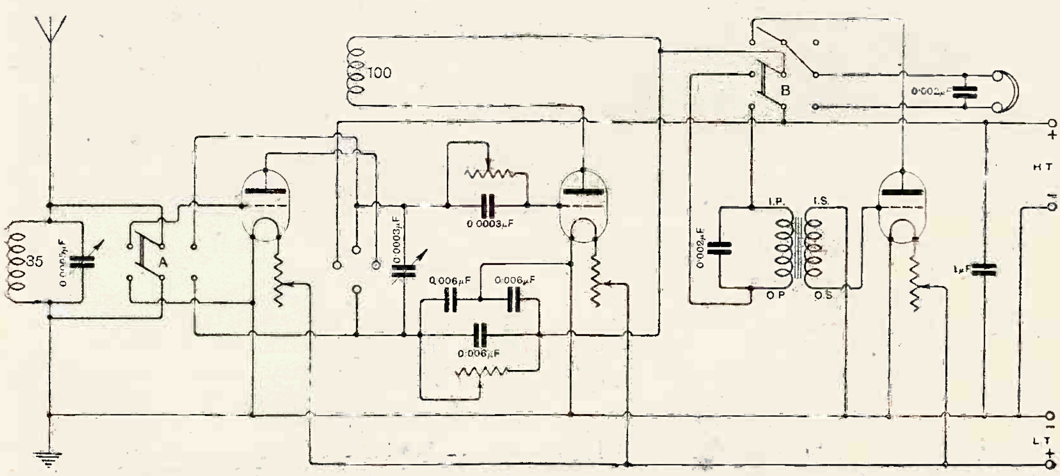
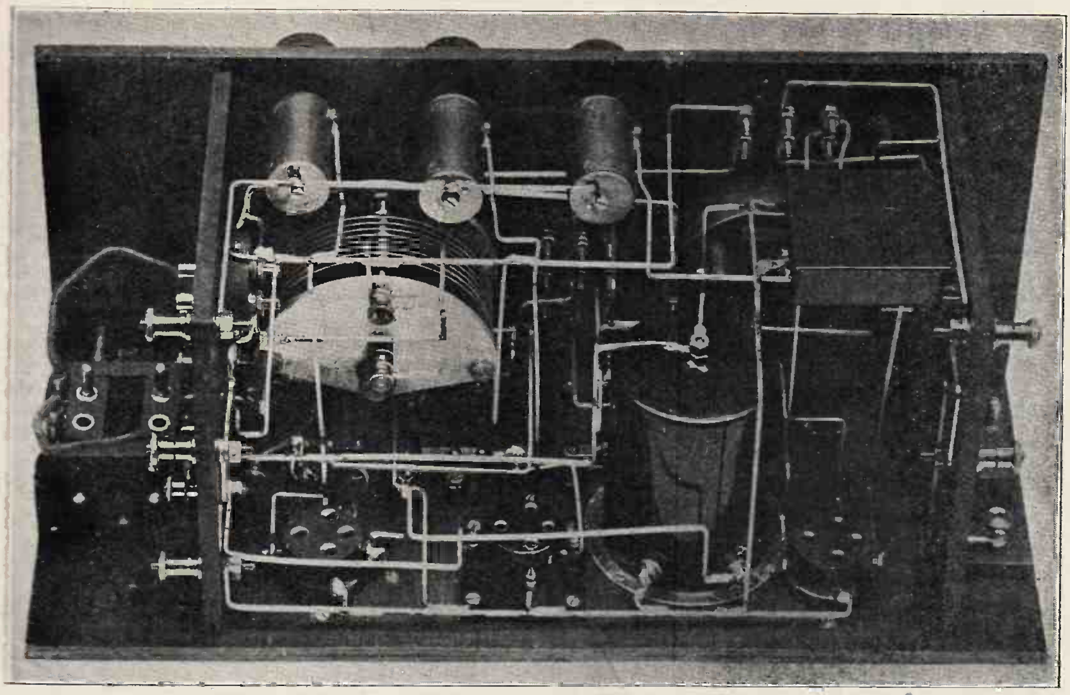


Fig. 4. Flewelling circuit showing method of adding H.F. amplification. Switches are introduced for bringing the H.F. and L.F. circuits into operation.

The moving unit carries the reaction coil. In line with the centre of the reaction coil, on the end-piece, is the valve socket into which the pin transformer is plugged. The front panel is continued beyond the end-pieces so that with the reaction coil closed up the whole set is within the parallelogram of the front panel.

The aerial coil is connected to the 0·0005 variable condenser and the centre points of the double-pole switch "A," by which it will be seen that the condenser can be connected to the H.F. valve. With the H.F. transformer in their methods of winding and it is wise to make some preliminary trials to see if the connections given fit the type of transformer used. Also the connections to the reaction coil and to terminals from the plate of the detector and middle point of switch "B" on the end-piece should be of flex. This allows the connections to be reversed when the aerial coil is used to replace the transformer; an extra switch could be arranged to do this, but the use of terminals and flex is simpler and saves some complexity of wiring.



Another view of the back of the instrument, showing the arrangement of the components.

cut-out, the 0·0005 and 0·0003 condensers are placed in parallel to tune the detector and L.F. With the switch "A" to the left and the transformer in place, the H.F. is in circuit. With the switch to the right, the transformer removed and the aerial coil in the fixed unit of the two-coil holder, the reaction is directly on to the aerial coil and the two variable condensers in parallel give the finest shades of tuning.

Here it should be noted that the connections to the pin transformer are shown as seen from the back or looking at the legs; but all makes of transformers do not agree

However, all these replacements are not necessary. By simply turning switch "A" to the right and leaving the aerial coil and pin-transformer in their original positions, the transformer becomes a sort of extension of the aerial coil and gives quite good results at a very small sacrifice of signal strength.

The $1\mu F$ fixed condenser across the H.T. battery is at the opposite end of the set from the H.T. terminals and this has some advantages in the distribution of energy.

Some attention has been given to the placing of the wire, and with the terminals all to the back, the most direct routes have been selected. The switches made for some complexity and the fact that the set was designed in an almost too compact form made the assembly a matter of alternate hope and despair. The writer recommends a table lay-out as a preliminary ; the intending constructor can then adopt any plan that suits the form of the components.

It is a debatable question whether the Flewelling used in this way has any demonstratable advantages, but even if it has no value above that of a well balanced single-valve circuit it has no disadvantages. Used as a one-valve receiver or with the valve and L.F., it is a most acceptable circuit and of the greatest interest to the experimenter.

It is not perhaps a circuit for the novice, but in the hands of an experienced operator it need not be the cause of the slightest interference, and with a stage of H.F. it seems to have less disagreeable ways than many variations of the tuned anode arrangements.

WIRELESS IN A MINE.

Bristol Society's Interesting Experiments.

Above : A group of members listening-in 1,500 feet below the surface.

Below : Mr. L. W. J. Silcocks **(5 KM)** *operating his transmitter at the pit head.*

Interesting experiments in the transmission of wireless messages into a coal mine at Midsomer Norton were carried out by members of the Bristol and District Radio Society on Saturday, June 21st.

A R.A.F. transmitter was used with a short aerial run over some coal trucks. The bottom of the mine is 1,500 feet below the surface and at the foot of the shaft the first aerial was slung up, another being fixed in a pump room. In addition to the Club receiver a number of portable sets with self-contained or loop aerials were used by individual members.

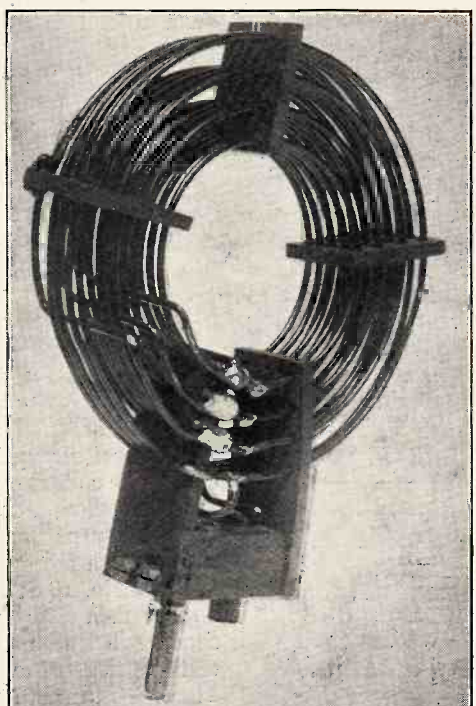
Transmissions from the surface were carried out by Mr. W. J. Silcocks (**5 KM**) and Mr. W. A. Andrews (**5 FS**) on a power of 2 watts, and signals were received with a fair measure of success.

LOW LOSS INDUCTANCE COILS

A new form of interchangeable inductance coil having low losses and of simple construction. Air dielectric coils are becoming increasingly popular, and in order to minimise losses dead-end turns must be avoided. The loss due to the plug and socket holder is inappreciable, and the plug-in coil is convenient for the purpose of coupling.

By F. H. HAYNES.

ATTENTION has recently been devoted to the construction of tuning coils having minimum losses and in this connection experiments have been made with various forms of inductances for the purpose of determining those patterns which deliver a maximum energy to the detecting or amplifying apparatus. It is admitted, of course, that the ratio of inductance to capacity employed in the tuning circuit to produce maximum efficiency will depend upon the wavelength to which the circuit is to tune and upon the constants of the aerial system to which it is connected, but apart from such considerations as these, there are certain fundamental aims in the design of the tuning inductances themselves which lead to improved reception.



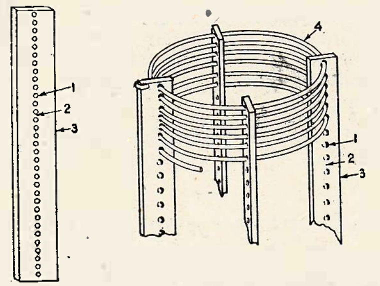
Low loss plug-in coil of strong construction wound with No. 16 enamelled wire.

Foremost among the causes of loss of efficiency in tuning inductances is the capacity which is present between the turns and the dielectric loss brought about by the insulating material. The writer has made tests with coils of various designs which show conclusively that coils having air dielectric are superior to those in which solid dielectrics are employed and particularly is this the case when tuning to short wavelengths, say below 600 metres.

The difficulty in the construction of an air dielectric coil is that of rigidly supporting the turns without adopting a design embodying a great deal of precision in instrument work. A description has already been published of solenoid coils making use of insulating strips for supporting the turns.* The construction consisted of shaping the turns of wire by bending round a former of suitable size and threading the spiral thus produced on to four insulating strips with uniformly spaced holes. Such a coil is not very difficult to construct, but as the number of turns increases it will be found that the friction between the strips and the turns of wire increases so much that the finished solenoid is apt to be tapering towards one end. It will be observed moreover that there is almost a limit to the number of turns that can be threaded on to the strips, for as the number of turns increases,

* Page 613, February 13th, 1924.

the friction becomes proportionally greater and there is difficulty in forcing the strips along the wire. Another objection exists inasmuch as the drilled strips are very liable to break, owing to their thinness and



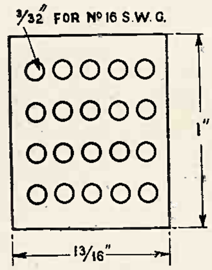
An air dielectric solenoid inductance, made by threading the drilled strips on to a wire spiral.

the weakening of them by the drilling of the holes.

Solenoids thus built up can be easily tapped out to tune to the required wavelength, but it became apparent that by making use of only a portion of a tuned coil that a loss of efficiency might arise and it is therefore desirable to use coils embodying exactly the required number of turns. This leads one to make use of interchangeable plug-in coils and although it may be suggested that the customary form of mounting with pin and socket is not good, tests reveal that providing the socket connection is well designed, the losses arising through this cause are almost negligible, whilst the great advantage is secured of interchangeability with standard coils, and inductances of various sizes. A single layer solenoid coil too, requires more turns to produce a given inductance than a coil of more compact design, and bearing this and the foregoing points in mind, a plug-in air dielectric coil of the type shown in the accompanying illustrations was designed.

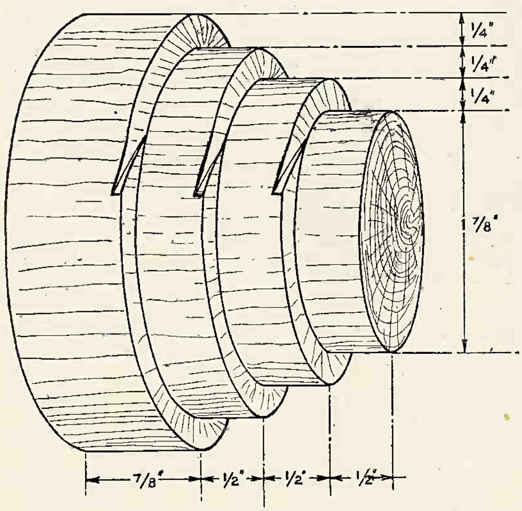
In this coil the long supporting strips with a tendency to snap are dispensed with and replaced by rectangular pieces. The difficulty of building a long single layer coil, owing to friction between turns and insulating pieces, is also overcome as considerably fewer turns are employed for each layer, whilst the finished inductance is much more compact and is interchangeable in a standard holder with other inductances.

The gauge of the wire selected for winding such a coil is governed primarily by the



The supporting pieces. Being almost square they are much stronger than the strips formerly employed and are easier to wind.

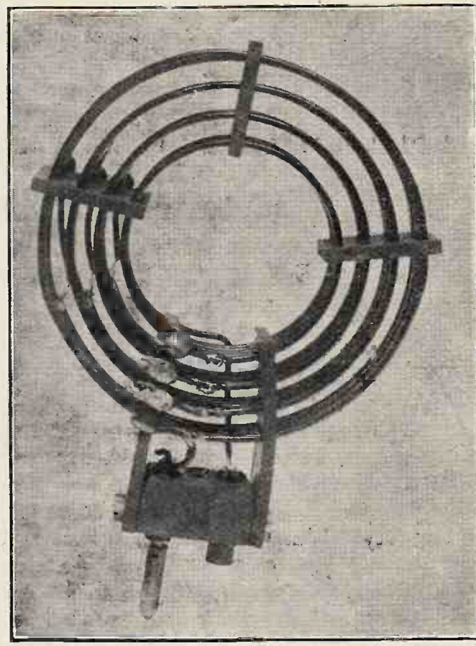
mechanical strength required in the finished coil. The coils shown are for tuning to wavelengths below 200 metres and have only twenty turns and consequently it was necessary to employ a heavy gauge wire such as No. 16 S.W.G. Wire as fine as No. 20 S.W.G. might be used where the spacing between the turns is less and the coil consists of a larger number of turns. The holes through which the wire has to pass should be about a third as large again as the diameter of the wire in order to simplify construction, for it will be found that the turns will lie quite uniformly together and remain quite evenly spaced as the turns will probably engage on one particular side of the holes.



Former for shaping the turns for the several layers.

To shape the wire, a wooden former was made, having in this instance, four rings of decreasing diameter and of the requisite total width. Rotating this former it was only necessary to wind each face full and then continue on to the next smaller face by passing the wire over a small cut to prevent the turns slipping. With all the four surfaces wound full the wire is allowed to run slack and is cut up into four coils each comprising the same number of turns. It is quite easy now to thread the ebonite spacing pieces on to the smallest coil and then to proceed to fit the other coils on to the ebonite pieces in turn. All four coils are thus wound in the same direction and they are connected in series by linking across the finishing end of one with the commencing end of the next.

A method of attachment for the pin and socket holder can be seen from the photograph and the tension put upon the ebonite strips which causes them to bend, produces a very firm grip upon the turns of the inductance. The wire employed in this instance, as with the coils previously described, has an enamel covering in order that the surface may not become oxidised, which would give rise to an increase in the high frequency resistance of the winding.



Another view, showing the spacing between the layers.

THE CRYSTAL DETECTOR IN THEORY AND PRACTICE—V.

THE DIRECTION OF RECTIFIED CURRENT IN CRYSTAL DETECTORS.

By JAMES STRACHAN, F.Inst.P.

A VERY large majority of crystal rectifiers give a rectified current which is constant in direction with reference to the loose contact. This may be either + *ve* or —*ve*, according to the composition and nature of the crystal. A few crystalline substances give both + *ve* and — *ve* currents from different spots on the same crystal, but in these cases it has been observed from repeated experiments that the current is much stronger in one direction than the other—generally three to four times stronger—so that even in such cases when the detector is adjusted to work at its maximum efficiency we may regard the direction of the rectified current as constant.

In dealing with this subject it is necessary for convenience to describe a crystal as + *ve* or —*ve* according to the direction of the rectified current flowing across it. A positive crystal is one in which the crystal is + *ve* and the metal point or " catwhisker " — *ve* with reference to the rectified current flowing across the loose contact, while a negative crystal is the reverse.

In the case of crystals which are both + *ve* and —*ve*, all of which are natural minerals, it is interesting to note that any attempt to associate the + *ve* and — *ve* spots with particular crystal faces or planes of symmetry failed absolutely, and it was frequently found that + *ve* and — *ve* spots occurred on the same sensitive plane.

Table I. gives a number of such crystals and shows how much stronger the current is for one sign than the other. These figures are based on experiments with a number of specimens in each species.

It will thus be noted that for all practical purposes natural galena and zincite are — *ve*, while molybdenite is + *ve*.

All other crystals examined gave only one sign. It is interesting to observe the signs of natural and synthetic galena and various compound sulphides containing lead sulphide (Table II.).

TABLE I.

Name of Crystal.	Composition.	+ve current m.a.	—ve current m.a.
Galena ..	Pb S ..	·25	·75
Molybdenite	Mo S_2 ..	·5	·1
Zincite ..	(Zn Mn)O ..	·3 to ·5	1 to 1·5
Jamesonite..	2 $PbS{\cdot}Sb_2S_3$	·75	·25
Stromeyerite	$Cu_2S{\cdot}Ag_2S$ ..	·3	·1

TABLE II.

Name of Crystal.	Composition.	Sign.
Galena (natural)	Pb S ..	— ve (+ ve weak)
Galena (synthetic)	Pb S ..	+ ve
Galena (synthetic) with traces of tin sulphide.	Pb S with traces Sn S	— ve
Galena (synthetic) with traces of silver sulphide	Pb S with traces Ag_2 S	+ ve
Sulphide of lead and silver.	Pb S·Ag_2 S	+ ve
Jamesonite ..	2 Pb S·Sb_2 S_3	+ ve (— ve weak).
Bournonite ..	3(Pb Cu_2)S·Sb_2 S_3.	— ve
Frieslebenite ..	5(Pb Ag_2)S·2 Sb_2 S_3.	+ ve

It will thus be seen that the sign of lead sulphide is affected by its composition. Similar variations have been observed in the cases of lead selenide (Pb Se) and lead telluride (Pb Te) in combining these substances synthetically with other metallic tellurides, selenides and sulphides. It may be noted in passing that all the galena-type proprietary crystals examined, including all the well-known brands, were constantly and strongly + *ve* in sign.

Table III. gives the sign for a selection of the more useful crystals or those frequently referred to in the literature of the subject.

TABLE III.

Name of Crystal.	Sign.
Galena (natural)	— ve (+ ve weak).
Galena (synthetic)	+ ve
Zincite	— ve (+ ve weak).
Iron pyrites	— ve
Iron pyrites (marcasite)	— ve
Copper pyrites (most specimens)	+ ve
Copper pyrites (a single example)	— ve
Tin pyrites (stannite)	+ ve
Covellite (copper sulphide) ..	+ ve
Silicon (fused)	+ ve
Carborundum	— ve
Molybdenite	+ ve (— ve weak).
Graphite	+ ve
Tellurium	+ ve
Cassiterite (tin binoxide) ..	— ve
Magnetite	+ ve
Cerium oxide	+ ve
Ilmenite	+ ve
Lead and silver telluride ..	— ve
Lead and gold telluride.. ..	+ ve

Thus out of a fairly representative selection of crystals about 60 per cent are + *ve* and 40 per cent — *ve* in sign.

The above signs are, of course, taken with reference to a metallic point or "catwhisker." In the case of zincite-crystal combinations the other crystal may be regarded as the "catwhisker," and as already observed, this crystal should not be a pronounced rectifier, but a good conductor. Bornite, which has been found to be very weakly — *ve* in sign, is ideal for this purpose and a sharp point of this crystal may be used advantageously in conjunction with any other crystal of approximately the same degree of hardness. It is not subject to rapid atmospheric oxidation, and in this respect is better than copper or bronze points.

With regard to crystal-crystal combinations generally, it is found that two different crystals, both being good rectifiers and of opposite sign, oppose each other in rectification, while two of the same sign give at best only about fifty per cent. of the rectified current obtainable from one only with a metal point. Crystal-crystal combinations therefore are only effective when one of the crystals is neutral, or nearly so, and thus takes the place of the "catwhisker."

The sign of a crystal may of course be most easily found out by including a galvanometer (a milliammeter or microampmeter) in series with or switched in shunt across the phones, but where a galvanometer is not available the sign may be determined by placing a crystal detector of known sign in series with the one to be tested. When the two rectified currents oppose each other the one neutralises the other more or less completely, and reception is nil, or very weak, but when the two rectified currents are flowing in the same direction reception is normal. The detector of known sign should be reversed several times in order to make certain of these directions.

A knowledge of the direction of the rectified current in a crystal detector is useful and necessary to obtain the best results from this apparatus.

In a simple crystal circuit it will be found that with good 'phones slightly better results are obtained by connecting the latter up in a particular direction. In the majority of standard makes of telephones the terminal leads are marked + *ve* and — *ve* for this reason, and also because the passage of even a weak current through the 'phones in the wrong direction gradually weakens the permanent magnets of the receivers. In the case of sets situated near to a B.B.C. station where it is possible to work a loud speaking telephone with fair results, this effect is most marked.

In the case of a crystal circuit using an applied potential through a potentiometer the best results are obtained when the applied potential is directed in the natural direction of the rectified current from the crystal. When the applied D.C. current is passed in the reverse direction, a slightly higher potential is necessary, the crystal is not quite so sensitive to reception and just about the neutral point where the applied potential is neutralising any rectified current flowing in the crystal circuit serious distortion may result.

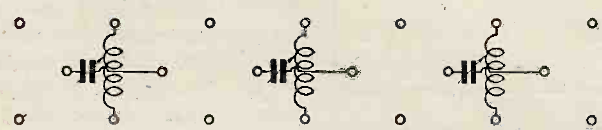
In the case of the addition of a low frequency amplifying valve to a crystal set it is obvious that a knowledge of the direction of the rectified current is essential to obtain the best results. This is more marked in the case of dual circuits where one valve amplifying both H.F. and L.F. is followed by a crystal rectifier. In several cases I have seen an L.F. transformer getting the blame of distortion which was caused by the crystal detector being inserted in the wrong direction. In all valve-crystal circuits the current flow should be checked up to various points with a galvanometer.

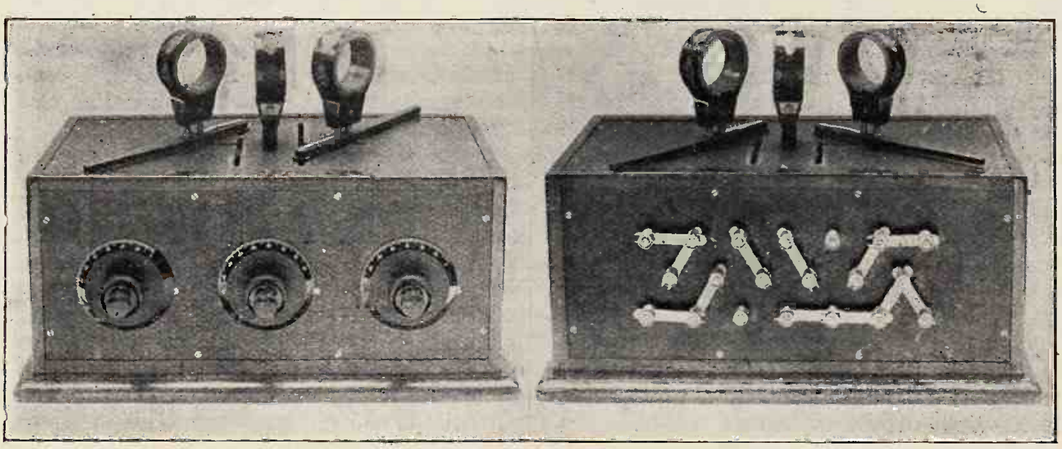
The makers who supply proprietary crystals would be well advised to mark their packages with the sign of the crystal, and to give all the information they can about its properties. Particularly in the case of synthetic galenas is this necessary, because the $+ve$ sign of many of these crystals is reversed by heating them for too long a time or at too high a temperature in fusible alloy, and the resulting $-ve$ crystal is generally no better than natural galena in its rectifying powers.

CHAPPELL TUNER.

The tuner shown in the accompanying photograph has been arranged to combine the greatest variety of uses with the simplest design. There are no complications such as series parallel, tuned stand-by or reaction reversing switches.

The three tuning coils and the three condensers are connected to a terminal board on the back of the instrument, the terminals being spaced so as to form the vertices of equilateral triangles in accordance with the accompanying diagram. By means of the connectors, any single, loose coupled or variometer circuits can be quickly set up. Extra terminals facilitate connections to aerial, earth, grid, etc. The coil holder shown here is the Ward-Heatly, which allows of a 180 degrees movement to each of the two moving coils by means of elliptic trammel mechanism. Condensers are Sterling square-law, fitted with vernier.





REFLEX RECEIVERS.

A description of reflex receivers arranged and connected in a different manner to that ordinarily employed by experimenters.

By W. JAMES.

PROBABLY the majority of the readers of this journal are acquainted with the reflex circuit of Fig. 1. The aerial is connected to a coil L_1, which is tightly coupled to the secondary tuning coil L_2. A variable condenser C_1 is connected across this tuning coil and tunes it and the aerial circuit. It should be noted that the use of a coil in the aerial circuit in this way does not make the aerial aperiodic.

Tuning may be made fairly sharp by correctly proportioning these coils; in general, as the number of turns in L_1 are reduced, tuning becomes sharper and the signal strength less. The best number of turns depends largely on the constants of the aerial, and can be found experimentally. If a large aerial is used, L_1 may consist of about 15 turns of No. 20 D.C.C. wound over one end of L_2. When a small aerial such as an indoor aerial is employed, it is generally better to dispense with L_1, and to connect the aerial to the grid end of the secondary coil L_2; L_2 may consist of 60 turns of No. 22 D.C.C. wound on a former $3\frac{1}{2}$ ins. in diameter. This connection is recommended because a small aerial naturally lends itself to selective reception, and the use of coil L_1 would result in very weak signals.

The anode circuit contains a tuned circuit C_2 L_3, which has the usual values, namely 0·0002 microfarad and 350 microhenries (80 turns No. 26 D.S.C. $2\frac{1}{2}$ ins. diameter), and across a portion of the anode coil are connected the crystal detector and primary winding of the reflex transformer.

Notice particularly that the detector is connected across only part of the anode coil L_3. Most crystal detectors of the wire contact type, which are the sort usually employed by experimenters, have a fairly low resistance, and if they are connected across the whole of the anode circuit, the anode circuit is heavily damped, and besides the signal strength being less than it need be, the selectivity is reduced. The disadvantage of employing ordinary plug-in coils in a circuit of this kind lies in the difficulty in securing reasonable selectivity because the crystal is usually connected across the ends of the plug-in coil.

The secondary winding of the reflex transformer is connected between the filament battery and the tuned grid circuit, a by-pass condenser C_3 being employed to carry the radio frequency currents between this circuit and the filament.

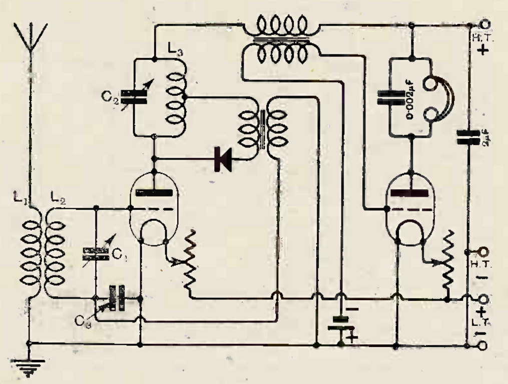


Fig. 1. A simple reflex receiver giving one stage of H.F. amplification and two of L.F. amplification. Notice that the crystal circuit is connected across only part of the anode coil L_3.

The operation of this circuit is as follows: Incoming signals flowing in the aerial are transferred to the secondary circuit by the coupling between coils L_1 and L_2, and are applied to the grid and filament of the valve. Amplified signals appear in the tuned anode circuit C_2 L_3, are rectified by the crystal detector, and transferred by the reflex transformer coupling to the grid circuit. The low frequency signals are then amplified and pass to the second valve through the intervalve transformer.

It will be noticed that the purpose of the condenser C_3 is to provide a break in the grid circuit so that the L.F. voltages may be applied between the grid and filament, but yet to provide a path of low impedance to the H.F. currents. If no condenser were connected here, the H.F. currents would reach the filament through the capacity of the secondary winding of the reflex transformer, and a proportion might pass through the capacity between the windings of the transformer to the anode circuit.

The value of condenser C_3 is usually fairly critical, and depends a good deal on the constants of the transformer. If it is too large, the higher frequency elements of the speech frequency voltages set up across the secondary of the reflex transformer may send currents through it.

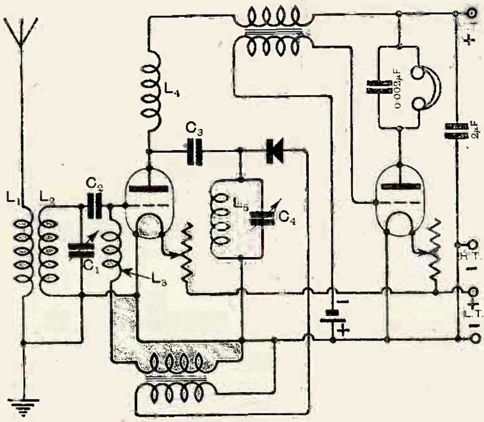


Fig. 2. A reflex receiver giving one stage of H.F. and two of L.F. amplification. It is usually easier to operate a receiver connected in this way than that of Fig. 1.

Difficulty is sometimes experienced in stabilising a circuit of this type, and it is essential that the experimenter should experimentally determine the best value of condenser C_3 and the most suitable proportion of the coil L_3 across which to connect the crystal detector circuit. When the circuit is carefully proportioned, very good results may be obtained.

It is, however, generally easier to operate a circuit of the type shown in Fig. 2. In this circuit, the incoming oscillations are applied to the grid of the first valve through a small capacity condenser, C_2. The anode circuit contains the high frequency choke coil L_4, which is connected to the positive terminal of the anode battery through the primary winding of the intervalve transformer, and a second tuned circuit comprising coil L_5 and tuning condenser C_4, which is joined to the anode through the fixed condenser C_3 and to the filament battery. Incoming oscillations are therefore amplified and appear in the coil L_4 and the tuned circuit L_5 C_4.

The degree of amplification is determined by the efficiency of the choke L_4 and the tuning of L_5 C_4.

As explained in connection with Fig. 1, the crystal detector is connected across as much of L_5 as is consistent with good signals and selectivity.

Rectified signals are applied to the grid of the first valve through the high frequency choke coil L_3. Condenser C_2 should have such a capacity that it will pass the high frequency currents to the grid of the valve without hindrance, but yet will not pass low frequency currents. Coil L_3 must pass the low frequency currents, but not allow high frequency currents to leak to the filament.

The amplified low frequency signal appears in the anode circuit, which includes the primary winding of the intervalve transformer, and is amplified by the second valve.

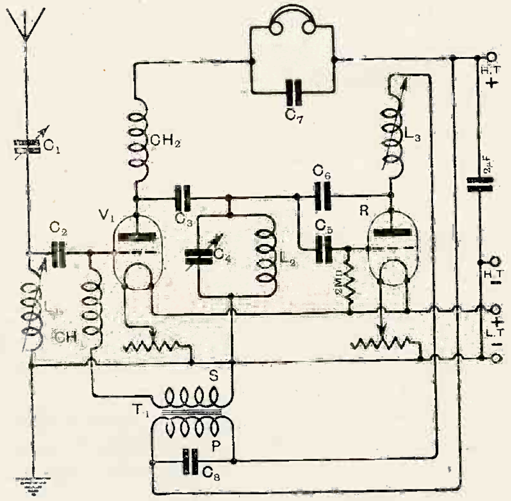


Fig. 3. A reflex receiver similar to that of Fig. 2, but a valve detector is employed, and reaction introduced into the intervalve H.F. coupling.

In place of the crystal detector we may connect a valve detector as in Fig. 3. The high frequency oscillations are then led to the detector valve, which has a grid condenser C_5 and a 2 megohm leak. In this circuit a condenser, C_1, is connected in series with the aerial circuit, and L_1 is a variometer.

To obtain reaction effects a condenser C_6 is connected between the anode of the detector valve and the top of the tuned circuit C_4 L_2, and a variometer L_3 is connected in the anode circuit of the detector in series with the primary winding of the reflex transformer. This receiver operates as follows :—

Incoming oscillations flow in the aerial circuit, and pass to the grid through condenser C_2, and amplified high frequency oscillations appear in the anode circuit Ch_2 and C_4 L_2.

A stage of low frequency amplification may be added to this receiver as shown in Fig. 4, where the primary winding of an intervalve transformer replaces the telephones, and the secondary is connected to valve V_3.

- C_1 is a fixed condenser connected in series with the aerial, and may have a value of 0·00025 microfarads.
- L_1 the aerial variometer.
- C_2, the coupling condenser; capacity 0·00025 μF.
- Ch_1 and Ch_2, are high frequency choke coils, and may be Nos. 250 or 300 plug-in coils for experimental work.
- C_3, a coupling condenser, capacity 0·00025 μF.

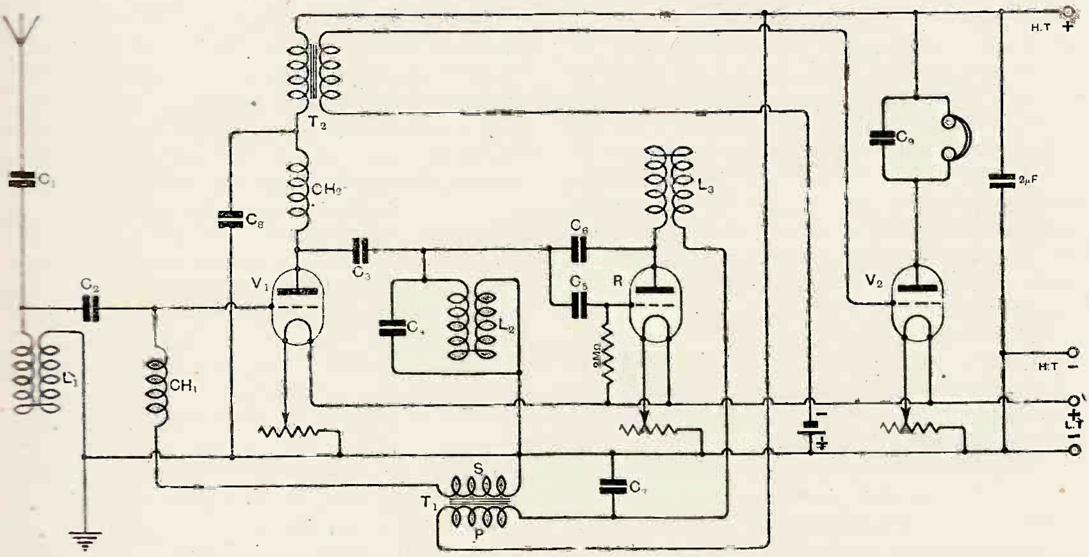


Fig. 4. A reflex receiver provided with a reaction control and giving one stage of H.F. amplification, valve rectification and two stages of L.F. amplification.

The oscillations are rectified by the detector valve and pass through the primary winding of the reflex transformer T_1; the secondary winding is connected between the filament and the grid of valve V_1.

Valve V_3 then amplifies the low frequency signal which appears in the telephones.

Condensers C_2 and C_3 are both of such capacity that they will pass high frequency currents but not low frequency currents.

The degree of reaction is controlled by altering the inductance of the variometer L_3.

- L_2, a variometer similar to L_1.
- C_4, a fixed condenser of about 0·00025 μF connected across the variometer.
- T_1, the reflex transformer.
- C_5, a grid condenser of 0·00025 μF.
- C_6, a reaction condenser about 0·0001 μF, but the best value should be found experimentally.
- L_3, is the reaction variometer.
- C_7, a by-pass condenser, capacity 0·002 μF.
- C_8, a by-pass condenser, 0·002 μF.
- T_2, an intervalve transformer.
- C_9, a telephone condenser, 0·002 μF.

TUNER EFFICIENCY.

Having viewed with some concern the tendency of the experimenter to incorporate variable condensers in conjunction with plug-in coils in his receiving gear as a means of tuning the aerial, the writer recently conducted a series of experiments with a view to establishing the efficiency or otherwise of various methods of tuning. The results are, in many cases, surprising.

By Ashton J. Cooper.

It is a recognised fact that the human ear is a very poor piece of mechanism for gauging or comparing any degree or volume of sound, and in order to illustrate the points at issue properly, a horizontal galvanometer was used. This instrument is, as far as I know, one of the most sensitive obtainable, is dead beat, and has no mechanical lag. The fixed coil is stated by the makers to be wound from the centre to a resistance of 1,000 ohms with copper wire 0·0049 in. to 0·0051 in. thick (single silk covered), and that a deflection of 10 deg. on the needle should be given by a current of 1/40,000th of an ampere, or 25 micro-amperes, the whole scale reading of 40 deg. representing 100 micro-amperes.

The needle is magnetic, and is carried in bearings of agate with sapphire points similar to the needle of a mariner's compass, and before commencing operations the needle (which is inside the coil and not projecting, the projecting needle being the scale indicator) is aligned with the earth's magnetism.

The tests were carried out in one evening on signals emanating from **2 LO**, which station is about 10 miles from my aerial, and the crystal used was a good specimen of Hertzite with resistance wire contact. On the evening previous to that on which the tests were carried out, signals from **2 LO** were closely observed as to their consistency in strength, and no variation or fluctuation was noticeable save for, perhaps, 0·5 deg. of modulation caused by the impression of speech, music, etc., on the carrier wave. The detector crystal was placed in such a position that the sensitivity was not altered from one end of the evening to the other, and a tapped coil tuner was used as a standard for comparison throughout. After each test the instrument and detector were switched to the tapped coil in order to confirm that the crystal sensitivity had not altered. This is mentioned in order that it might be quite clear that the tests were carried out as carefully and under as uniform conditions as possible.

The first test was carried out with a series condenser tuner, with a plug-in coil arranged as shown in Fig. 2. This is a type of tuner which is very much in vogue at the present time, and after setting the crystal to maximum sensitivity and securing sharp tuning the galvanometer deflection was recorded as 5 deg.

The instrument and detector were now switched back to the tapped coil, and the reading noted after securing maximum sharp tuning, but it is not intended to disclose this reading until a later stage. The reading of the first test was confirmed as 5 degrees.

Test No. 2 was a smaller plug-in coil with variable condenser in parallel, as illustrated in Fig. 2. The galvanometer read 3 degrees. The standard reading was checked off and the reading again taken on circuit Fig. 2 as being 3 degrees.

Test No. 3 was on a tuner arranged as in Fig. 3. Here we have a coupled tuner, tuned with plug-in coils and variable condensers. The closed circuit condenser was, as shown, of small value. The galvanometer reading was 5·5 degrees with a tight coupling.

Test No. 4 was with a circuit as shown in Fig. 5, which is a coupled circuit with the aerial tuning condenser in series with the aerial. The deflection was 10 degrees, a marked improvement.

No. 5 test was again with a circuit as is shown in Fig. 1. In the first test, a 0·001 variable condenser was used, and this was made up from bought parts. Test No. 5, however, was with one of the very best built up condensers available, one in which the vanes were solid with the supports. The reading was 9 degrees. This test was made in order to check the advantages of purchasing best quality condensers, and, as will be seen, there is a decided advantage.

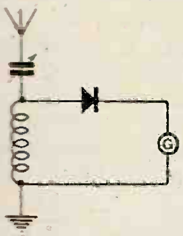


Fig. 1. *This circuit gave* 5° *deflection on the galvanometer.*

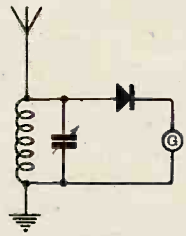


Fig. 2. *Gives* 3° *deflection.*

The sixth test was on a variometer of one of the most efficient types, the windings being cotton covered without former, but held together by the aid of some form of glass hard varnish. A very tight coupling exists between the rotor and stator. The circuit arrangement was as Fig. 5. The reading was 18 degrees. A built-up variometer was tested and gave a reading of 14 deg., the loss probably being due to the fact that the coupling was not so tight and the tuning less sharp.

The seventh test consisted of a series of

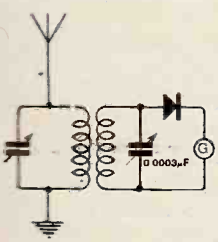


Fig. 3. 5·5° *obtained with tight coupling.*

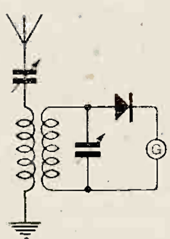


Fig. 4. *This circuit gave* 10°.

trials with condenser in series with the aerial lead on the best variometer.

The results were :—

0·0003 mfd. variable condenser	..	3·5°
0·001 mfd. variable condenser	..	11°
0·001 about 20° scale reading	..	3·5°

(All moving vanes in engagement with the fixed vanes.)

It will therefore be seen that when a variable condenser is used in series with a given coil that the maximum efficiency is obtained on the higher condenser readings, and that the smaller the condenser reading the lower the efficiency. It becomes apparent that variable condenser tuning is for this reason alone hopelessly inefficient as compared with other methods, especially on the end of the scale.

Test No. 8 was carried out with two coils wound with bare No. 16 and No. 20 wire, and mechanically supported by strips of ebonite, the coils being made to slide one within the other so as to form a sliding variometer. The arrangement was as shown in Fig. 7. The galvanometer reading was 24 deg. This is, to say the least of it, a

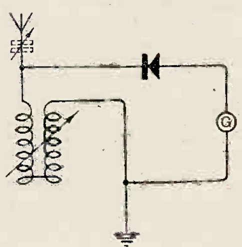


Fig. 5. *Gave* 18° *deflection.*

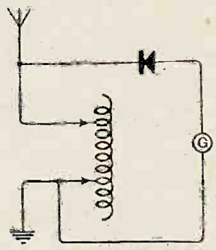


Fig. 6. *Tapped air spaced coil which gave* 20°.

huge increase in efficiency, this reading representing approximately 55 micro-amperes.

The ninth test was on the tapped coil, the readings of which had been taken as the standard all the evening (Fig. 6). This reading was 20 deg. A four-wire counterpoise substituted for the earth lead reduced the reading to 19 deg., and a 0·0005 fixed condenser placed across the instrument leads reduced the reading from 20 deg. to 12·5 deg., although the tuning was adjusted. This condenser would, if telephones had been connected up, constitute the blocking condenser often seen on crystal sets, and the reason for which has never been apparent to the writer.

The substitution of twisted telephone cords for single No. 20 D.C.C. to the instrument reduced the reading from 20 deg. to 16 deg. A 0·0003 variable condenser (all in) placed in series with the aerial and the earth lead reduced the readings from 20 deg. to 4 or 5 deg. in each case.

This then concluded a very interesting series of experiments, from the results of which the reader may draw his own conclusions. The outstanding fact is that the addition of capacity in any shape or form in a tuner results in a certain loss of efficiency when dealing with this band of wavelengths. These losses would obviously become increasingly serious as we get on to high frequencies. Apart from a special bare wire, or skeleton type of tuner, the tapped coil proved the most efficient. One noticeable fact might be mentioned in passing, and that was that the use of the tapped coil in conjunction with valves, but without reaction, provided signals perfectly clear and as loud as those obtained with a plug-in coil tuner and full reaction on the aerial. Another point was that the addition of reaction to the tapped coil did not result in a gain in strength as would be expected and as is generally obtained with plug-in coils; presumably dead-end effects and the lack of condenser damping and losses (to be otherwise made up for by reaction) was the reason for this. One fact is perfectly plain, and that is that ten miles from **2 LO** and with two valves (one detector and one low frequency) there is no need whatever to use reaction for loud speaker effects if a reasonably good outdoor aerial is obtainable.

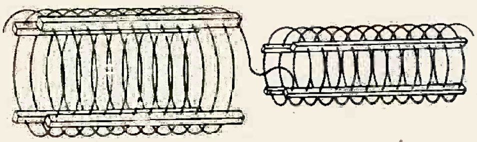


Fig. 7. Air spaced coils with variometer gave 24°.

No new discovery is claimed as a result of these experiments. In fact, it has long been known that capacity, when working on short waves, is an unwanted ingredient in the tuner, but I don't think that the matter has ever been brought to notice quite so forcibly.

One might expect to sacrifice selectivity for efficiency when working with low capacity coils in the ordinary way, but it is thought that a properly designed tuner minus any unwanted capacity, is not an impossible matter. In any event, these figures and facts are passed to fellow experimenters as the basis perhaps, for more extensive research and inquiry into tuner efficiency.

A.C. BATTERY CHARGER.

Wireless users in districts served by alternating current are seriously handicapped in the matter of accumulator charging. Where only one or two batteries are to be charged occasionally, there is no justification for the installation of a motor generator set or perhaps even a synchronous rotary rectifier. The battery charger shown in the accompanying illustration has recently made its appearance on the market and operates on the principle of a polarised interrupter, while it is of durable construction and simple to manipulate. On test it was found to run on full rated load for long periods with scarcely any sparking at the contacts. The battery on charge may be connected in any direction and fuse protection is provided.

The Runbaken Battery Charger.

A POLARISED BUZZER.

FOR ENERGISING A WAVEMETER OR OTHER OSCILLATORY CIRCUITS.

Greater stability, economy in battery power and ease of adjustment are obtainable by the use of a polarised buzzer in place of the ordinary buzzer in which the armature returns to its normal position by the operation of a spring. Practical constructional details of a useful instrument are set forth in this article.

By MAURICE CHILD.

THE polarised buzzer possesses many advantages over the usual non-polarised type, the chief of which being great stability in working, economy in battery power and ease of adjustment. In the ordinary type of non-polarised buzzer, the armature is caused to return to its normal position by virtue of the elasticity of the spring, and it is found that the springs vary in their tension from time to time, thus causing considerable irregularity in the frequency of armature vibration. Again, the contacts having to carry a fairly heavy current, sparking generally occurs, and they thus become oxidised and the buzzer fails to operate satisfactorily. All these disadvantages are largely overcome in the polarised buzzer. Firstly the making and breaking of the battery circuit is forced by a definite magnetic stimulus to the armature and the elasticity of the springs have very little effect on the note which is produced when once the contacts have been adjusted. Again, the amount of current necessary to make the armature operate satisfactorily is very small ; (in the instrument about to be described it is in the neighbourhood of about 1/10th ampere using a battery of two or three dry cells), therefore, with the provisions made for eliminating sparking, there is no likelihood of this being the cause of unreliability.

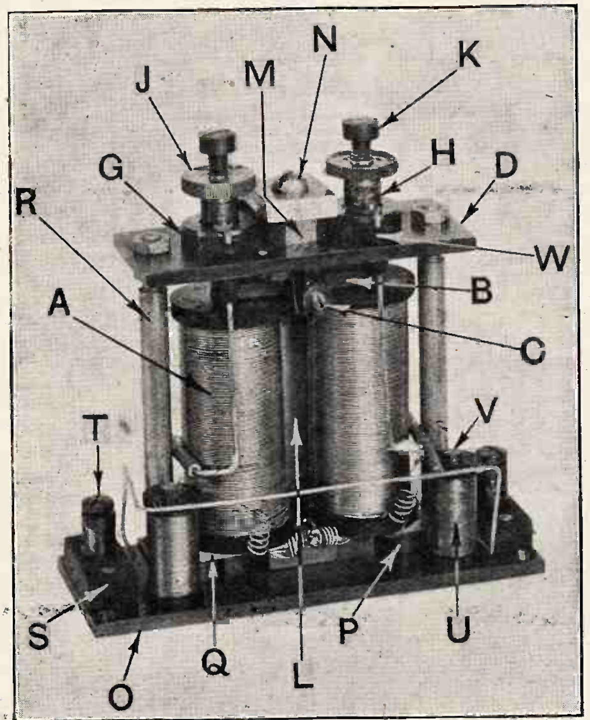


Fig. 1. The complete buzzer.

The photograph, Fig. 1, shows the complete instrument which in this particular case has been built up by employing some of the parts of an electric bell of the magneto type ; these will no doubt be familiar to most readers, as they are fitted with two gongs and are used by the Post Office in the standard telephone system. The original windings were removed and the bobbins subsequently wound differentially with No. 26 D.S.C. copper wire. Prior to rewinding, the cheeks near the free end of the cores were pushed up somewhat and the length of the iron core filed down to that of the bobbins marked A, Fig. 2. In winding differentially the two wires from separate bobbins are wound carefully together in layers and, in order to keep the winding even, a thin wrapping of paper is placed between every second layer of wire, thus two

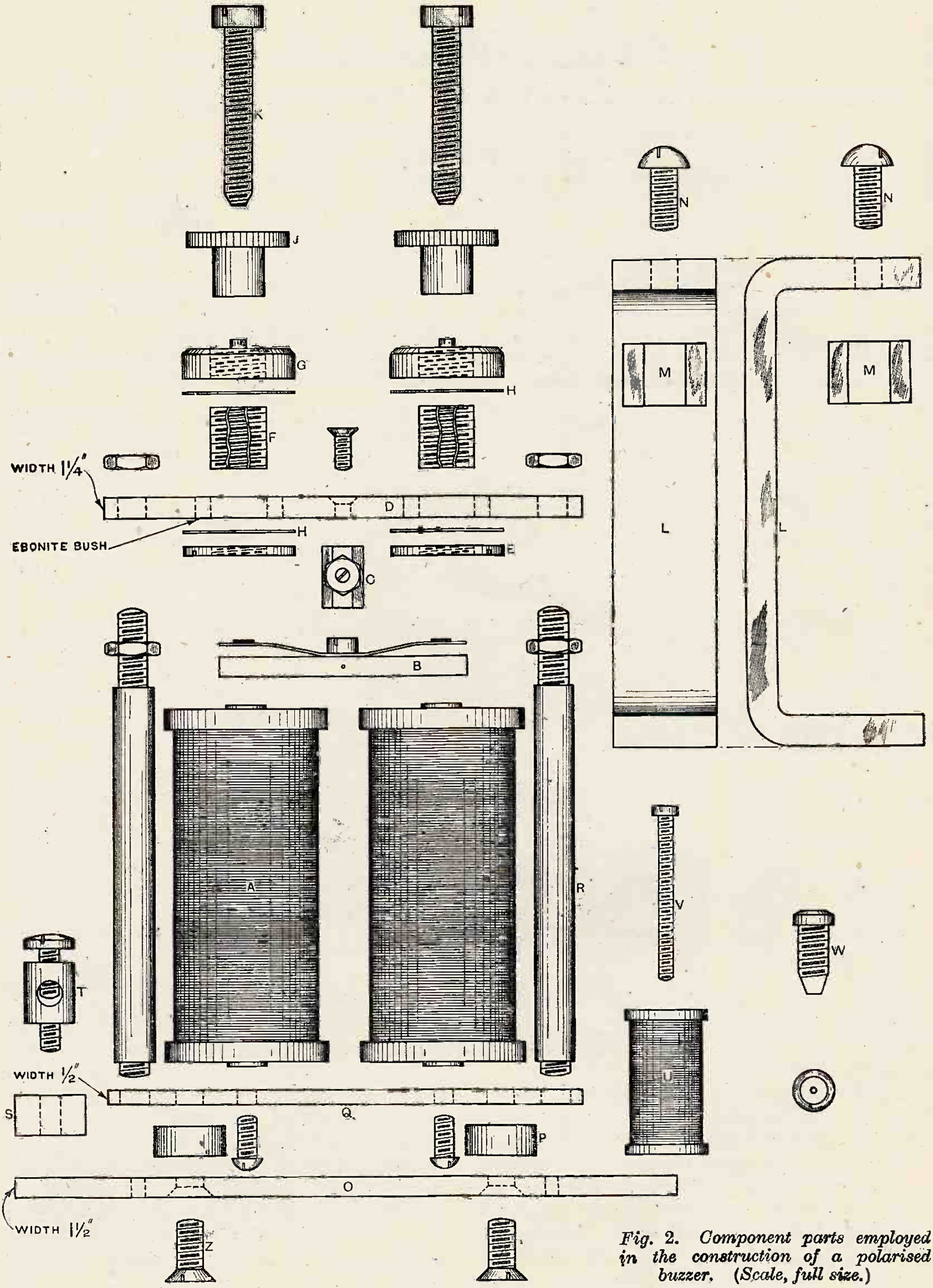


Fig. 2. Component parts employed in the construction of a polarised buzzer. (Scale, full size.)

bobbins with two inner ends and two outer ends each, together with their iron cores are constructed. The back bar (Q) is modified somewhat as regards shape at the ends, as in the standard instruments these are provided at one end with a hole and at the other with a slot for fixing to the instrument box; these holes and slots are cut away, leaving a plain straight back bar with the uprights marked R in Figs. 1 and 2.

A base (O) and top (D) of brass $\frac{1}{8}$ in. thick and of the dimensions shown are next prepared, together with two ebonite blocks $\frac{1}{4}$ in. thick and terminals (T), one of which is screwed into a block, the other passing through a clearing hole and screwing into the brass base. The latter terminal is shown on the right-hand side of the photograph, that marked T being insulated and attached to the stiff copper wire which is shown passing across the lower portion of the instrument and which is mechanically supported at the other end by passing it through a small hole in the right-hand ebonite block. Two rather massive brass collars (G) are fixed in holes drilled in the top plate, and they are insulated from the latter by ebonite bushes (F) and washers in the ordinary way. They are locked in position by their lock nuts E. Brass screws (K) carrying silver tipped contacts and provided with lock nuts (J), work in these brass collars, and it will be observed on reference to the photograph that there are two small screws to which stout copper (No. 18 S.W.G.) wires are attached and which pass through ebonite bushes (W) in the top plate. The permanent steel magnet from the bell mechanism is provided with a hole at one end and a screw (N) passing through this originally attached it to the back bar. In the present use of the magnet the undrilled end of it is gripped between the back bar and the brass base, when the countersunk screws (Z) passing through the spacing washers P are tightened up. The drilled portion of the magnet is fitted with a small piece of iron (X) by means of the screw N, and this acts as a pole-piece and projects through the central opening in the top plate and very nearly touches the central screw of the armature B.

Supporting armature pivot bearings are made from $\frac{1}{4}$ in. hexagonal brass and are marked C on the diagram. Two No. 6 B.A. steel grub screws have one end turned down to form a fairly long taper point which engages in a small hole shown in the centre of the armature B. The armature is provided with a contact spring bent up at each end in the form shown, the contacts being of silver which are quite easily soldered on to the springs before assembly. Two small bobbins (shunts) of ebonite (U), must be turned up and are wound non-inductively with a single layer of No. 40 D.S.C. Eureka resistance wire, the ends being brought out through two small holes drilled in one of the

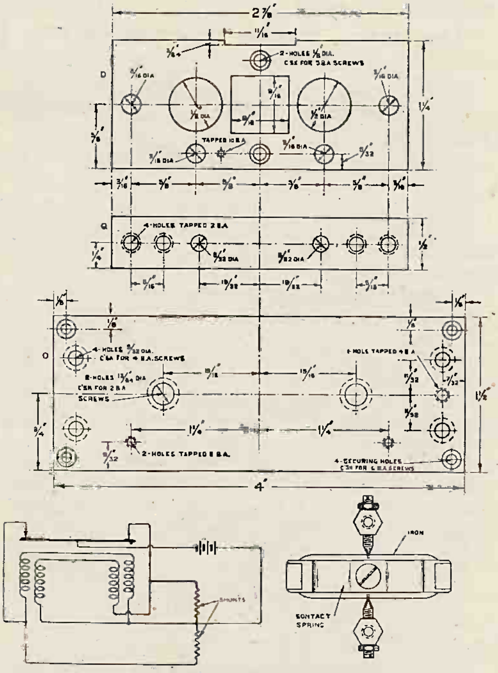


Fig. 3. Drilling dimensions and circuit adopted.

cheeks and available for subsequent connection. Two long No. 6 B.A. brass screws (V) pass through the centre of these bobbins and fix them to the brass base in the positions shown in the photograph. The diagram of connections is shown in Fig. 3.

A small spiral of No. 36 copper wire should be soldered to a tag fixed under the armature centre screw, the other end being fixed under a small screw (the position of this can be seen as a white dot slightly to the left of M) in the top plate. This connection is important as it ensures the armature being in reliable electrical contact with the frame. Pivots themselves are most unsuitable for this purpose.

The method of adjustment is as follows. Screw down one of the contacts K until it is just touching the armature, which should be temporarily held in an equal-distance position from the magnet cores. The battery should now be connected up and if the connections are correct, on completing the circuit the armature should be attracted towards that core immediately underneath the contact screw which has been adjusted. Should this not be the case, the battery must be reversed.

The second contact screw must now be brought down until it just touches the spring, the previous contact screw having been removed. The battery circuit should now be completed once again and the armature should be attracted to the core immediately underneath the contact screw. If this does not occur, the connections of one of the coils must be reversed. Subsequently both contact screws may be adjusted until the best note is given by the armature. It is of some assistance at first, to place a low reading ammeter in series with the battery, and adjust the contacts so that the current is at a minimum with the greatest steadiness of note.

Correspondence.

Fine Wire Coils.

To the Editor of The Wireless World and Radio Review.

Sir,—My attention has been drawn to a misconception of the scope of the fine wire coils I described* and I shall be obliged if you will allow me to correct it.

The coils are not for all-round use but are merely supplementary to the normal commercial type. They were investigated, developed and used in the reception, by loud speaker, of the nearest B.B.C. station, *i.e.*, in circumstances where the ample volume of sound available permits a certain amount of loss of efficiency; this margin is made use of by broadening resonance with increased ohmic resistance. I am still at work trying to increase efficiency while maintaining the improved definition which I think may now be taken as being amply proved.

J. H. Reeves.

London, S.W.5.

* *Wireless World, April* 30th, 1924, p. 13?.

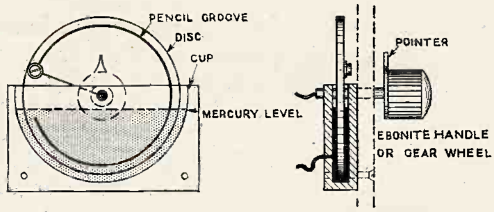
A Variable Grid Leak.

To the Editor of The Wireless World and Radio Review.

Sir,—One hears so many grumbles these days anent variable grid leaks that I venture to suggest that some of your readers may find, in the following device, a solution of their troubles.

It is an arrangement on which I fell back for precision working, and, as far as I can see, it has the real advantage that it can actually be calibrated to known values which thereafter remain constant for the same position of the pointer.

An ebonite disc of some $2\frac{1}{2}$ to 3 ins. diameter, and about $\frac{1}{8}$ in. thick, has a groove running close to its circumference nearly all the way round.



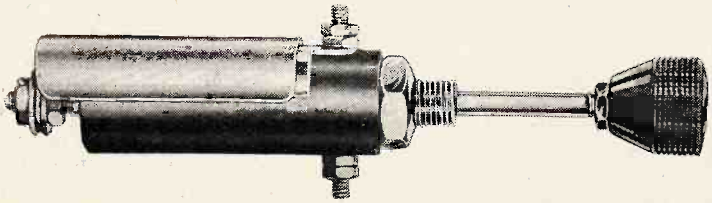
This groove is lightly rubbed round several times with a lead pencil. The centre of the disc works on an axis which is mounted in a bearing and allows the bottom of the disc to dip into a cup containing mercury. The necessary connections are taken from the mercury and from one end of the pencilled groove.

The leak is very useful where one utilises a standard receiver which does not need to be moved about.

D. Sinclair.

A USEFUL LOW CAPACITY CONDENSER.

The spindle has both a sliding and rotary movement, by which it is possible to obtain very critical capacity values. A coarse adjustment is obtained by merely pulling out the knob, whilst extremely fine adjustment is obtained by rotating the knob. A feature of the device is that it may be attached to a panel simply by making one hole and tightening up the nut engaging on the threaded stem.



Courtesy: Radio Communication Co. Ltd.

A NEW LOUD SPEAKER.

The development of wireless telegraphy and its application to broadcasting has turned the attention of a number of engineers to the problem of devising efficient loud speakers which will give faithful reproduction of speech and music. The instrument described here is of German design and embodies new principles.

As this subject of loud speaker design is very much to the fore at the present time and interests everyone associated with wireless, the following notes on a recently produced loud speaker, operating on a somewhat novel principle, will be of general interest.

The apparatus here described is constructed by the well-known firm of Siemens & Halske, and has been developed in Germany by two engineers of that company, K. W. Wagner and Lüschen.

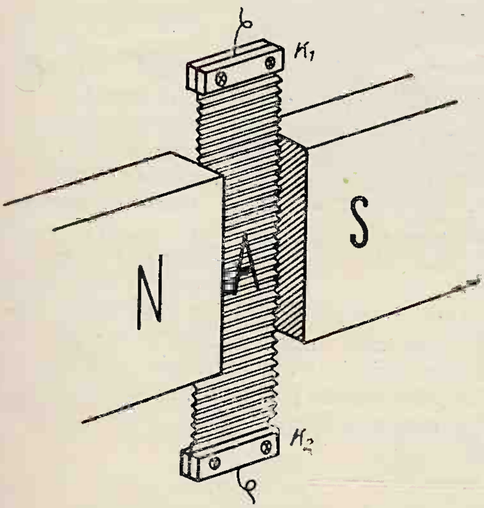


Fig. 1. The crinkled metal strip is the diaphragm of the loud speaker set in a magnetic field.

Nearly every type of loud speaker which has been developed and is of practical value depends for its operation on some means of influencing a diaphragm, the diaphragm being controlled either directly or indirectly by the received speech currents. In addition to having to set the diaphragm vibrating at frequencies corresponding to the frequencies of the speech currents, there is an expenditure of energy in overcoming the inertia of the diaphragm and also in moving the mass of air which the diaphragm displaces in vibrating.

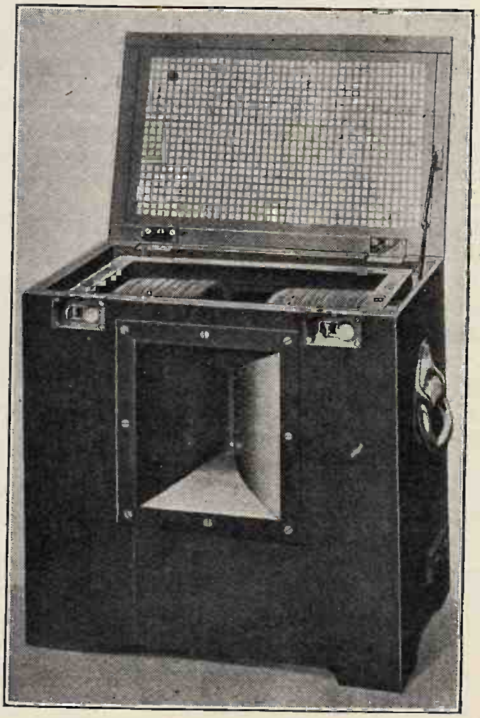


Fig. 2. The complete instrument, which is very compact.

Prof. Schottky, who has made a theoretical study of the problem, has proved that to obtain maximum efficiency the mass of the diaphragm must not exceed that of the air moved by it, and that it is preferable for the mass of the diaphragm to be less. Hence the necessity arises for the diaphragm itself to be extremely thin and light. In the present loud speaker an arrangement has been adopted which resembles the principle of the Sykes-Round microphone for instead of the more usual method of influencing a magnetic field by means of the speech currents and so controlling the movement of the heavy diaphragm, the speech currents are led through the diaphragm itself, which is placed in a powerful magnetic field. In the loud speaker illustrated here this principle has been adopted. Between the poles of the powerful electro-magnet, L.S. Fig. 1, is stretched an extremely thin waved aluminium foil "A," and the output connections of the wireless receiver or amplifier are made to K 1 and K 2. A current carrying conductor placed in the magnetic field is deflected vertically to the direction of the magnetic field, and consequently the aluminium foil will oscillate in a vertical direction at the rate of frequency of the currents passed through it.

Fig. 2 shows the method in which the aluminium foil is mounted in a frame. The external appearance of the loud speaker is shown in Fig. 4, which gives a very good idea of its compactness, and also shows the coils of the powerful electro-magnet which provides the magnetic field. It is stated that this instrument has been demonstrated in various parts of Germany with great success, and has made speech distinctly audible in the open air to 50,000 persons.

The same principle has been applied by the company to the production of a microphone in which the movements of the aluminium strip controlled by speech vibrations acts as a current generator, and this, in conjunction with an amplifier, has given such satisfactory results that it is suggested that all German broadcasting stations will employ this instrument in the near future. The microphone is shown in the upper right illustration of Fig. 3.

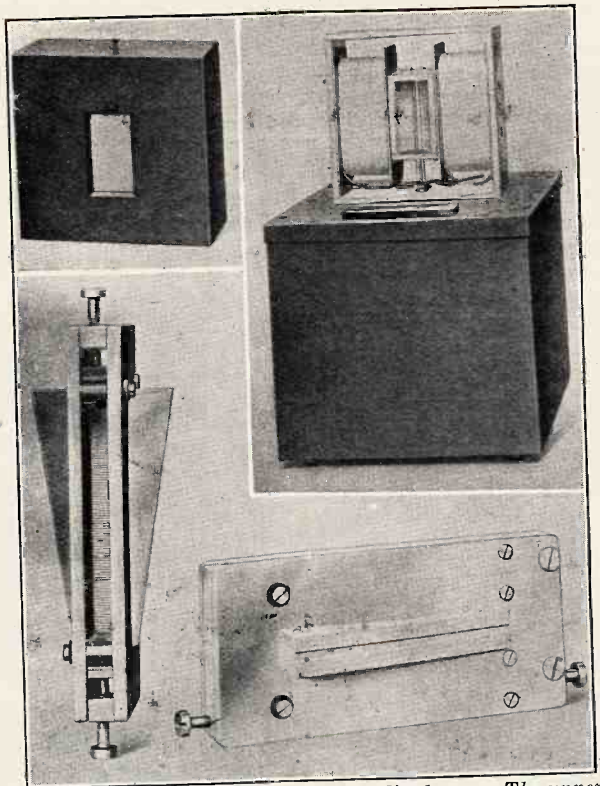
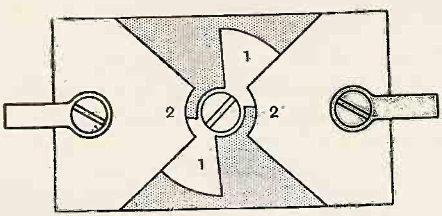


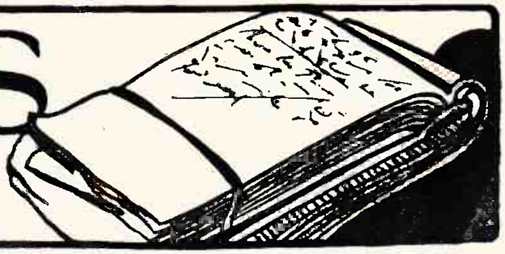
Fig. 3. Details of construction of the diaphragm. The upper right hand figure is a microphone operating on the same principle.

MICRO CONDENSER.



A useful adjustable condenser of small capacity and dimensions, suitable for many purposes in receiver construction, essentially for providing feed back and oscillation neutralising potentials.

NOTES & CLUB NEWS



The opening of the 1,600 metre broadcasting station at Chelmsford (**5 XX**) is expected to take place on or about July [illegible]. It is understood that the preliminary power employed will be 25 kilowatts.

* * * *

In a letter to the Secretary of the Swansea Radio Society, the B.B.C. states that the town will be provided with a broadcast relay station in the Autumn.

* * * *

In addition to Swansea, relay stations are to be erected by the B.B.C. at Hull, Nottingham, Stoke-on-Trent and Dundee.

* * * *

The Admiralty announces that the personnel employed in manning naval wireless and D.F. stations at home shall in future be known as the Royal Naval Shore Wireless Service.

* * * *

Four broadcasting stations are to be established in Brazil at Sao Paulo, Bello Horizonte, Bahra and Pernambuco.

* * * *

Argentine **CB 8** has now been twice received by Mr. W. A. S. Batement, of North-West London.

* * * *

The Leeds-Bradford Relay Station.
The land wires are now complete between **2 LO** and the studio of the Leeds-Bradford station.
The station is to open on Tuesday, July 8th, at 8 p.m.

Wireless Photographs.
On Thursday, June 19th, M. Belin, the well-known French inventor, demonstrated his system of wireless photographic transmission before a number of experts in Paris.
The Paris *Matin* reproduced several of the photographs and expressed confidence that television would soon be an accomplished fact.

Brussels Wavelength.
On June 24th, the Brussels Broadcasting Station reduced its wavelength from 265 to [illegible] metres.
It is hoped by this slight alteration to eliminate a certain amount of interference produced, it is thought, by unknown transmitters working on the former wavelength.

Two-Way Working with Finland.
Mr. W. Guthrie Dixon (**5 MO**), of Rowlands Gill, near Newcastle-on-Tyne, reports that on the 11th June he was in communication with Finnish **I-NA** at Turku, the wavelength employed being [illegible] metres. The Finnish station used straight A.C. supply and his signal strength is reported as consistently good on a detector and one stage of low frequency.

Wireless in Mining Disasters.
Working under the assumption that a wireless receiving set could be successfully operated at 1,000 feet underground, the United Mine Workers of America are investigating radio as a means of life saving in mining disasters.

Committee to Consider Broadcasting Wavelengths.
An International Committee has been set up to consider the subject of wavelengths for broadcasting, as in many districts transmitting on waves of from 300 to 500 metres is rapidly becoming impossible, owing to the interference from Morse transmissions.

Wireless in Turkish Waters.
The Angora Government has issued an order prohibiting vessels of all nationalities from employing radio in Turkish waters without special permission from the Government.

Low Power Transatlantic Working.
5 IK, the station of Mr. B. L. Stephenson, of Manchester, has been heard by Canadian **1 AR,** of Dartmouth, Nova Scotia. The British station employed a power of 8 watts on 200 volts D.C. and the circuit used was a slightly modified Colpitts.
Mr. Stephenson enquires whether any other transmitter has crossed the Atlantic with only 200 volts H.T.

Broadcasting from the French Academy.
An innovation has been introduced into the French Academy in the shape of of a microphone by means of which a speech by a recently elected member—M. Henri Robert—was broadcast.

French Amateur Expansion.
So great has been the growth of amateur radio transmission in France that the staff of the administration of P.T.T. has had to be considerably enlarged. Three experts have been appointed to study the question of organising a permanent control bureau for amateur work.

New Spanish Wireless Association.
The cause of the Spanish amateur is now being championed by a new organisation, the Associacion Radio Espanola, which has just been formed in Madrid.

Wireless and Forest Fires.
To cope with the risk of forest fires in the South of France, a radio station has been installed by means of which it is hoped that speedy relief will be obtainable in the event of conflagrations.

Unidentified Station.
On the night of May 31st, Mr. C.W. Titherington (**5 MU**), of Dorchester, received a station signing **4 WR,** but owing to atmospherics was unable to maintain touch and identify the station. He will be glad if any reader could give the location of **4 WR.**

Ether Poaching.
The call sign **2 QN,** which is owned by Mr. Arthur Hobday, of Flint House, Northdown Road, Margate, is being used illicitly by a transmitter in the West of England.
Information leading to the detection of the offender will be welcomed.

New U.S.A. Broadcasting Proposal.
A plan for the replacement of the present 500 broadcasting stations in the United States by ten powerful stations, was discussed by Mr. Boucheron, a radio expert, speaking at a recent meeting of the Associated Manufacturers of Electrical Supplies.

Victoria Day Will Be A Go-As-You-Please Holiday In Halifax This Year

First with the news / Fearless in views — **THE EVENING MAIL** — Forty six years in the public service

HALIFAX, CANADA, WEDNESDAY, MAY 14, 1924.

ENGLISH RADIO EXPERT GETS SURPRISE IN HALIFAX

POINCARE SAYS HE WILL NOW TAKE A COMPLETE REST

Biggest Ever

COUNCIL HAS NOT POWER TO CHANGE DATE OF HOLIDAY

Dalhousie Graduates After Convocation

ENGLISH RADIO EXPERT TALKED TO HIS ENGLISH FRIENDS FROM HALIFAX

A rousing welcome awaited Mr. Gerald Marcuse, Secretary of the Transmitter and Relay Section of the Radio Society of Great Britain, on his recent arrival in Canada. The above cutting indicates the importance attached to the event in Halifax.

[Photo : Barratts.

Operations over a wide stretch of country were carried out at a Field Day of the Western Metropolitan Association of Affiliated Societies held on Sunday, June 22nd. Transmitters and receivers were erected at Gerrard's Cross, Batchworth Heath and Stanmore, and some successful short-wave work was accomplished. Our photo shows the party at Stanmore.

Such a scheme would be justified on the grounds of efficiency and economy and each station would cover a zone of about 500 miles. The upkeep of these stations would be provided for by a foundation fund to which the radio industry would contribute.

Australian Wireless News to Ships at Sea.

Much has been done in the carrying out of a press news service from Australia to ships at sea and further developments are in progress, stated the Amalgamated Wireless (Australasia), Ltd., recently, in reply to the criticisms of Vice-Admiral Sir Frederick Field.

Early last year the Company commenced the publication of a daily newspaper on board ships and special arrangements were made with the leading press agencies and newspapers in Australia, Great Britain and Canada, for the receipt and transmission of news.

This news is transmitted eve y night across the Pacific to ships at sea from the wireless stations at Pennant Hills, Sydney; Awanui, New Zealand; Suva, Fiji; Estevan, Vancouver Island.

A French Colonial Station.

A new radio station is to be erected in Noumea (French New Caledonia) which will be used for direct relay work from France to Tahiti. At present Noumea is receiving wireless messages through the large station at Saigon.

A Removal.

Messrs. The Watmel Wireless Company state that owing to increased business it has been necessary for them to remove to larger premises situated at 332A Goswell Road, London, E.C.1. Telephone: Clerkenwell 7990.

Fluxite for Case Hardening.

We have received a pamphlet from Messrs. Fluxite, Ltd., manufacturers of the well-known soldering paste, explaining how Fluxite can be employed for case hardening. The pamphlet is obtainable from the Company at Simplex Works, Bevington Street, Bermondsey, S.E.

Change of Address.

Mr. P. H. Dorte (**6 CV**) has moved to Lynwood, Oatlands Park, Weybridge.

A Correction.

Through an unfortunate mistake prices of two models of the Marconiphone Range were wrongly given in the Marconiphone advertisement which appeared on page xii of last week's issue.

The price of the Marconiphone Baby Crystal Receiver is 27s. 6d., not 25s. 6d., and of the Marconiphone V3 De Luxe £80, not £50.

Wanted: Reports.

Reports on the quality of his transmissions are welcomed by Mr. C. S. Frowd (**2 FS**), of Ranamere, Knebworth Road, Bexhill-on-Sea.

Transmissions take place on between 150 and 200 metres and a power of 10 watts is employed.

U.S. Democratic Convention Broadcast

The proceedings of the United States Democratic Convention for the purpose of nominating presidential and vice-presidential candidates, which opened in New York on Tuesday, June 24th, were broadcast at various times by fifteen wireless stations, including **WJZ.**

The Radio Corporation of America would be glad to receive any interesting observations from British listeners who were able to receive any of the transmissions.

If reports are sent to the Secretary of the Radio Society of Great Britain, 53 Victoria Street, S.W.1, they will be forwarded to America.

British Wireless in India.

In the House of Commons on June 24th, Mr. Hartshorn, asked by Mr. Hannon (Moseley U.) whether he was aware that the service of British official wireless news in India had now ceased owing to the superiority of French and German installations, and whether steps were being taken to re-establish the British wireless service, replied that he understood that adverse atmospheric conditions were responsible for difficulty in reception of British official wireless messages. He stated that although German and French Radio

SHORT WAVE TRANSMISSIONS FROM EIFFEL TOWER.

The series of experimental transmissions from the Eiffel Tower is being continued during July under similar conditions to those outlined in our issue of June 11th.

Tests will take place as follows :—

Monday	Tuesday	Friday	Saturday	Wavelength
7	1	4	5	115 metres
14	8	11	12	75 ,,
14	15	18	19	50 ,,
28	22	25	26	25 ,,
	29			

Time (G.M.T.)	Identification Signal.
From—0500 to 0510	f f f f f
0515 to 0525	h h h h h
0530 to 0540	f f f f f
0545 to 0600	h h h h h
1500 to 1515	f f f f f
1520 to 1535	h h h h h
2100 to 2115	f f f f f
2120 to 2135	h h h h h

As hitherto, reports should be forwarded to Chef du Centre Radio-télégraphique de Paris, poste de la Tour Eiffel.

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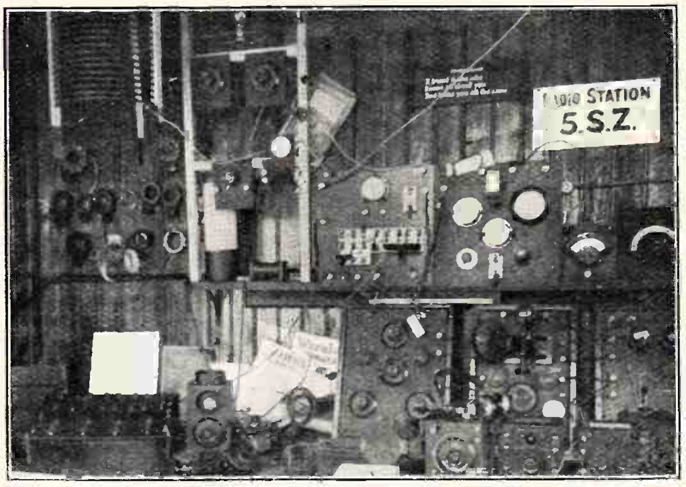
stations were superior to any British stations at the moment the trouble would be remedied with the opening of the new Government station at Rugby.

BOOK RECEIVED.

The A.B.C. of Wireless Television by H. A. Bohringer. (London: Taunton Bros., 89 Shaftesbury Avenue, W.1. 33 pages. Price, 9d. net.).



The equipment at **5 SZ**, *the station of Mr. J. W. Riddiough at Baildon, Yorks, which has now been dismantled owing to the owner's removal to Morecambe, Lancs.* **5 SZ** *will not long remain silent, however, and hopes to commence testing from his new address in a fortnight's time.*

Lewisham and Catford Radio Society.*

On June 12th the Society gave a wireless demonstration to the guests of the East Lewisham Conservative Association at a garden fete, held at Bromley Road.

The success of the demonstration was largely due to the kindness of Messrs. A. Graham & Co., to whom the Society are indebted for the loan of "Amplion" apparatus.

The bi-monthly meeting on June 19th consisted of a short talk by Mr. Harrison N. Orme, of Messrs. "Hightensite," on the subject of "Ebonite."

The lecturer dealt very fully with the processes necessary for the conversion of rubber in the raw state to the finished product known in the trade as "hard rubber," but better recognised by the wireless amateur as ebonite.

The Society is open to receive applications for membership and intending members should apply for particulars to the Hon. Sec., Chas. E. Tynan, 62 Ringstead Road, Catford, S.E.6.

The Hounslow and District Wireless Society.*

The Society held its third annual general meeting on June 5th. The Hon. Secretary, in his annual report, stated the year had been a very successful one. Twenty-five lectures had been delivered and ten demonstrations had been given. The Hon. Treasurer reported a very satisfactory financial position. Among the officers re-elected for the forthcoming year were the President, Vice-Presidents, Chairman and the Hon. Secretary.

The President, Mr. A. R. Pike, moving a very hearty vote of thanks to retiring officers, stated he wished to place on record the yeoman service done to the Society by the re-elected Secretary, Mr. A. J. Myland, and also by the retiring Treasurer, Mr. H. W. Parker.

It should be noted that it is the new Committee's intention to hold weekly meetings through the coming summer months, an excellent programme having been arranged. All local enthusiasts should note that all particulars of membership can be obtained on application to the Hon. Sec., A. J. Myland, 219 Hanworth Road, Hounslow.

Newcastle-on-Tyne Radio Society.*

On Monday, June 16th, "Electricity and Magnetism" was the title of a lecture given by Mr. R. Torry. The lecturer had evidently taken considerable care in the preparation of his demonstrations, which were observed with great interest and appreciation by all present.

It has been decided to continue the Monday evening meeting throughout the summer, and it is hoped that a number of members will take advantage of this.

Hon. Sec., Colin Bain, 51 Grainger Street, Newcastle-on-Tyne.

West Bromwich Engineering Society (Radio Section).

On Friday, June 20th, an interesting loud speaker test was conducted by the Asst. Hon. Secretary. A large number of loud speakers were brought by the members for comparative tests and a highly instructive evening was spent in discussing the merits of the various types.

Wireless enthusiasts in the West Bromwich district are invited to write for particulars of membership to H. C. Richardson, Asst. Hon. Sec., 57 Birmingham Road, West Bromwich.

The Birmingham Wireless Club.

An informal meeting was held on Friday, June 13th, when several members of the Technical Committee overhauled the Club's aerial, which, owing to its awkward position, has not been touched for several years.

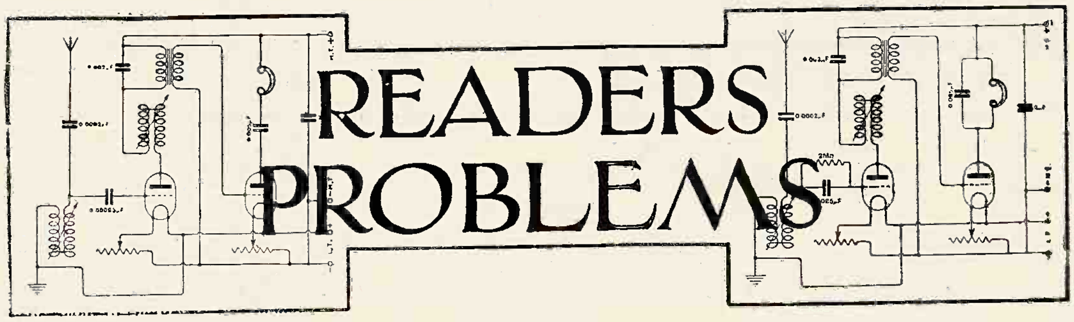
A portable set was afterwards tested on the aerial and it was noticed that results had somewhat improved.

Hon. Sec., H. G. Jennings, 133 Ladywood Road, Birmingham.

The Clapham Park Wireless and Scientific Society.

The second session of this Society ended on Wednesday, June 18th. A full programme of lectures on various wireless and general scientific subjects has been enjoyed during the winter and spring months, and the Society has had no small measure of success in its second year.

With the advent of Summer the enthusiasm for indoor meetings slackens off very noticeably, and it was decided that the best policy to adopt was to close down until the Autumn. The Society will therefore recommence meetings on the first Wednesday in October, when it is hoped all members and intending members will be present. Meanwhile all enquiries should be addressed to the Hon. Sec., H. C. Exell, 41 Cautley Avenue, S.W.4.



READERS PROBLEMS

1. All questions are answered through the post. A selection of those of general interest is published. 2. Not more than four questions may be sent in at any one time. 3. Every question should be accompanied by a postal order for 1/-, or 3/6 for four questions, and by a coupon taken from the current issue. 4. A free coupon appears in the first issue of each month, and if this is sent in together with coupons from the three previous issues, the reader is entitled to have one question answered free of charge.

" *F.R.*" (*Bristol*) **asks for a circuit diagram of a Reinartz short wave receiver with one stage of L.F. amplification.**

The circuit is given in Fig. 1. A radio-frequency choke coil is connected in series with the primary winding of the intervalve transformer to prevent leakage to earth of H.F. currents by way of the self-capacity of the transformer winding and H.T. battery.

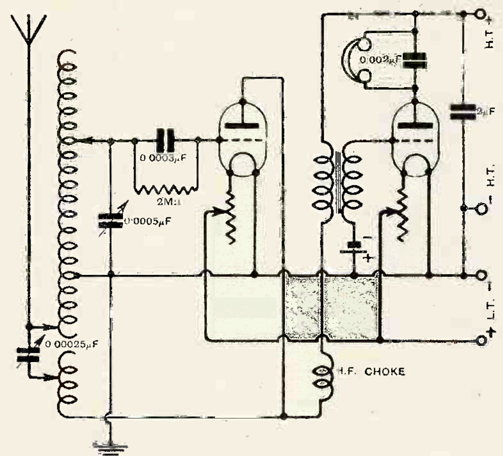


Fig. 1. " *F.R.*" (*Bristol*). *A Reinartz receiver with one stage of L.F. amplification*

" *A.W.*" (*Macclesfield*) **asks what adjustments to make in order to eliminate " backlash " from the reaction coupling of his receiver.**

When oscillations start and stop abruptly, and when the coupling required to start oscillations is greater than the coupling at which oscillations cease, it will generally be found that the reaction coil is too large, or the grid leak has too low a value for the particular capacity of grid condenser in use. In general it is best to use a reaction coil having a natural wavelength slightly lower than the lowest wavelength which it is required to receive. With a grid leak variable between 1 and 5 megohms, you should have no difficulty in obtaining the exact value corresponding with the characteristics of the valve and the capacity of the grid condenser, which will enable oscillations to start and stop smoothly.

" *W.T.*" (*Bradford*) **asks what is the usual method of connecting intervalve transformers.**

The majority of makes operate best when the I.P. terminal is connected to the anode of the preceding valve, and O.P. to +H.T., and when O.S. is connected to the grid of the succeeding valve and I.S. to −L.T. However, it is always best to find the correct connections by trial. The secondary winding should be connected permanently in the manner indicated above, and the effect should then be tried of reversing the primary winding.

" *A.R.T.*" (*London, W.C.*1) **asks if it would be possible efficiently to extend the range of a variometer by connecting a fixed condenser in parallel with the windings.**

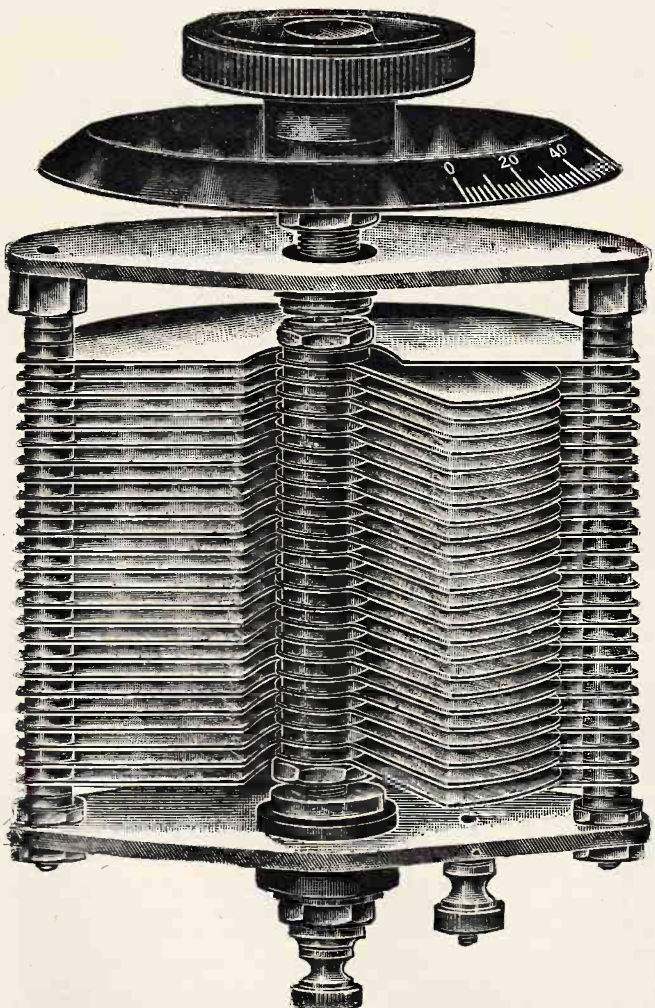
This method is quite practicable, provided that the capacity necessary to reach the wavelength required does not exceed 0·0005 μF. A much better method of increasing the wavelength would be to connect a load coil in series with the variometer.

" *T.C.*" (*Liverpool*) **submits diagrams of several proposed aerial systems, and asks which arrangement will give the best results.**

We do not recommend the use of a " T " type aerial in your particular case, as the distribution

RODEO RADIO THRILLS

A good line—a worthy mount—the thrill of satisfactory results—all guaranteed to those who steer clear of doubtful issues and select an



Ormond's No. 2 Condenser.

Unassembled.		Assembled.	
·001	.. **5/6**	·001	.. **8/-**
·00075	.. **4/6**	·00075	.. **7/-**
·0005	.. **3/6**	·0005	.. **6/-**
·0003	.. **2/6**	·0003	.. **5/6**
·00025	.. **2/6**	·00025	.. **5/-**
·0002	.. **2/-**	·0002	.. **4/6**
·0001	.. **1/6**	·0001	.. **4/-**
·00005	.. **1/6**	·00005	.. **4/-**

The above prices for Unassembled Condensers do not include knobs and dials, but these can be supplied at 1/6 per pair extra if required.

We specialise in turning Brass and Steel Screws and Machined Parts of all descriptions ***and*** *accessories.*

Write for Catalogue.

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Telephone : Clerkenwell 6652 & 7833

Sole Agents for Ireland :
PETTIGREW & MERRIMAN, Ltd.
8 Corporation Street, Belfast

of surrounding objects is not symmetrical about the centre of the aerial. The electrical midpoint of the aerial would not, therefore, coincide with the geometrical mid-point, and you would have great difficulty in determining the correct position for the lead-in wire. We recommend that you use an inverted "L" type aerial and take the lead-in from a point several feet from the house end of the aerial, in order that the lead-in may not have to be bent back over the roof of the house. It is important that the insulators at the house end of the aerial should be placed immediately after the points from which the down leads are taken. These leads should be spaced as far as possible from the side of the building.

As you intend to use not less than three valves, it is probable that less distortion will take place if the resistance capacity or choke method of coupling is employed. The latter method of coupling has the advantage that the H.T. voltage required is considerably less than that required with resistance capacity coupling. On the other hand, the iron used in the construction of choke coils must be of very high quality, in order to reduce the distortion caused by hysteresis losses, etc. The considerations involved in the choice of a suitable method of L.F. coupling were fully dealt with in an article entitled "Resistance, Choke, or Transformer Low Frequency Coupling," in the issues of February 6th and 13th.

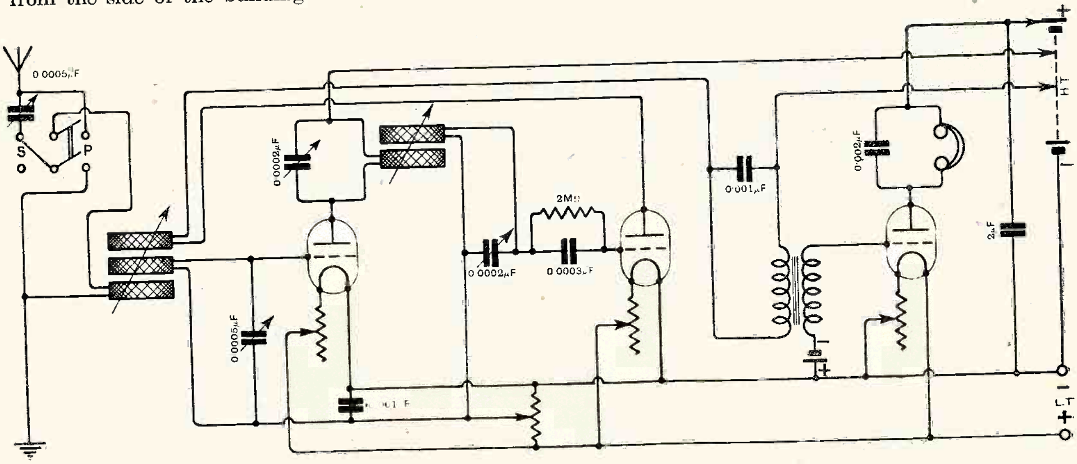

Fig. 2. "G.G." (Northwich). A selective three-valve receiver tuned throughout by plug-in coils and condensers.

"*J.H.T.*" (*Birmingham*) **has been experimenting with smoothing choke coils and condensers in the H.T. leads to his transmitter, and finds that in all cases the terminal voltage at the transmitter is reduced.**

There can be little doubt that the condensers which you are using are not designed for high voltage work, and are leaking badly. Condensers in which the dielectric consists of waxed paper are of little use for this purpose, and mica condensers of good quality should always be used when the voltage exceeds, say, 500 volts.

"*E.N.C.*" (*London, S.E.*19) **asks how to construct a coupling transformer for use between the detector valve and the H.F. amplifier in a supersonic heterodyne receiver.**

The transformer may consist of two multilayer coils of equal size tightly coupled together. It is not necessary to tune the windings by means of variable condensers. If you use two Igranic No. 1,500 coils, the natural wavelength of the transformer will be in the neighbourhood of 6,000 metres.

"*E.S.W.*" (*Richmond*) **asks questions regarding the coupling of L.F. amplifying valves.**

"*G.G.*" (*Northwich*) **asks for a diagram of a selective three valve receiver, in which the tuning is carried out by means of plug-in coils and variable condensers.**

The diagram is given in Fig. 2. It will be seen that transformer coupling is employed between the H.F. and detector valves, the primary and secondary windings consisting of plug-in coils, each tuned by means of a 0·0002 μF condenser. Separate H.T. tappings are provided for each valve, and the grid potential of the H.F. valve is controlled by means of a potentiometer. With this receiver a high degree of selectivity will be obtained if the coupling between the tuning coils is kept as loose as possible, and if the A.T.C. is connected in series on short wavelengths.

"*A.Z.*" (*Bognor*) **asks questions about the resistances used in the anode circuits of a resistance coupled L.F. amplifier**

We do not think that the type of carbon resistance to which you refer would function satisfactorily when passing a current of 12 milliamperes. Even if the resistance did not actually break down, the heating of the carbon resistance element would seriously affect its effective resistance. We think you would be well advised to use the wire wound resistances referred to in your letter.

Calls Heard

Contributors to this section are requested to limit the number of calls sent in to those heard in the previous three weeks, these being of greater interest and value to transmitters than earlier records. The repetition of the same call sign in consecutive lists is not recommended. Contributors will also assist by kindly arranging reports in alphabetical order. Full address (not for publication) should be given to enable correspondence to be forwarded.

Hanley.
2 BG, 2 FQ, 2KO, 2 LX, 2 MY, 2 NO, 2 OD 2 OQ, 2 OX, 2 OS, 2 RS, 2 SD, 2 SO, 2 SY, 2 WN, 2 YQ, 2 YX, 2 QR, 5 DD, 5 JN, 5 KO, 5 KX, 5 LP, 5 NI, 5 RI, 5 UN, 5 UQ, 5 VK, 5 QX, 6 BH, 6 GW, NS, 6 QS, 6 XQ, 6 XX, 8 AP, 8 AQ, 8 DQ, 8 DR, 8 RS, 9 NY, B 7, A 0 D. (I—V—I.) (W. M. Bakewell and C. Ashton, **6 UZ**).

Leigh, Lancs. (April 20th to May 25th).
2 AAC, 2 AAF, 2 AAL, 2 AAN, 2 ADH, 2 ADP, 2 AF, 2 AG, 2 AHT, 2 AR, 2 ASF, 2 BF, 2 EB, 2 EI, 2 FO, 2 II, 2 IN, 2 KE, 2 QJ, 2 UF, 2 VF, 2 ZK, 2 ZU, 5 AY, 5 BF, 5 CR, 5 DC, 5 FW, 5 KL, 5 LH, 5 NX, 5 OT, 5 VF, 6 BQ, 6 CF, 6 FV, 6 HS, 6 IK, 6 IL, 6 LC, 6 LF, 6 LM, 6 LY, 6 NI, 6 SD, 6 SP, 6 TD, 6 YB. All telephony. (O—V—I.) (W. R. Stainton.)

Southgate, London, N.14 (May 4th to 25th.).
2 AF, 2 AQ, 2 AU, 2 BO, 2 DX, 2 FK, 2 FM, 2 HF, 2 JV, 2 KT, 2 LT, 2 LZ, 2 MC, 2 MK, 2 NM, 2 OW, 2 PB, 2 PX, 2 QC, 2 QZ, 2 SH, 2 SK, 2 SY, 2 TA, 2 TS, 2 UV, 2 VJ, 2 VS, 2 VW, 2 VY, 2 WJ, 2 XD, 2 XO, 2 XR 2 YK, 2 YR, 2 ZO, 2 ABR, 2 ABZ, 2 ACZ, 2 AIF, 2 AKS, 2 AMA, 2 ARX, 2 ATS, 5 AC, 5 AS, 5 BT, 5 CB, 5 CF, 5 CP, 5 CS, 5 CV, 5 DS, 5 DT, 5 DY, 5 FC, 5 FL, 5 GF, 5 IO, 5 LF, 5 LH, 5 LP, 5 LT, 5 OY, 5 PZ, 5 QV, 5 PZ, 5 TR, 5 UL, 5 UV, 5 WM, 5 XD, 6 BT, 6 BY, 6 GM, 6 HP, 6 HY, 6 IM, 6 IV, 6 PD, 6 PY, 6 QA, 7 QO, 6 QV, 56 TO, 6 VO, 6 XC, 8 BM, 8 DU. (O—I—V.) (B. C. Cowper.)

New Southgate, London (May 2nd to 26th.).
2 BCF, 2 CC, 2 NA, 2 RH, 2 SV, 2 UF, 2 VI, 2 VO, 2 ZU, 5 RF, 6 UD, 8 BP, 8 CC, 8 CN, 8 DU, 8 JC, 0 FN, 0 PC, 3 NB, 4 YS, 5 ALD. (O—V—I). (W. D. Keiller, **6 HR**).

Northampton (April 21st to May 25th).
Telephony: **0 MR, 2 ASH, 2 JR, 2 JX, 2 OP, 2 QQ, 2 QZ, 2 WQ, 5 AJ, 5 CP, 5 MF, 5 OY, 5 YW, 8 AP, KFI.** Morse: **9 OAA, 0 BA, 0 BQ, 0 FN, 0 GG, 0 HD, 0 KY, 0 NN, 0 ST, 0 XF, 0 XP, 0 XQ, 0 XY, 1 ER, 1 LA, 1 MT, 2 AC, 2 ACU, 2 AGT, 2 ATI, 2 BCF, 2 CC, 2 DF, 2 DR, 2 FN, 2 LH, 2 MG, 2 NA, 2 NM, 2 OD, 2 OQ, 2 SH, 2 TR, 2 UF, 2 VJ, 2 VQ, 2 VS, 2 VW, 2 WJ, 2 XA, 2 XAR, 2 YQ, 5 AD, 5 BA, 5 CC, 5 CX, 5 DN, 5 FS, 5 GL, 5 GX, 5 HN, 5 ID, 5 JX, 5 LF, 5 LV, 5 NN, 5 RQ, 5 SI, 5 UG, 5 UQ, 5 VN, 5 WI, 5 WM, 6 BT, 6 BO, 6 CV, 6 DF, 6 DW, 6 DZ, 6 EA, 6 FG, 6 MK, 6 NO, 6 OM, 6 RC, 6 UU, 6 XG, 6 XJ, 6 YJ 8 AE 3, 8 AQ, 8 AZ, 8 BN, 8 BV, 8 CM, 8 CZ, 8 DA, 8 DC, 8 DI, 8 DP, 8 DX, 8 ÉB, 8 ÉM, 8 ÉN, 8 ÉP, 8 ÉU, 8 GG, 8 JB, 8 JM, 8 KP, 8 ML, 8 MN, 8 NA, 8 PX, 8 RO, 8 TK, 8 ZM, FL, PCRR, 7 ZM, 9 AB, 4 C 2, 4 TU.** (O—V—O). (P. H. Brigstock Trasler.)

Near Nelson, Lancs. (during May).
2 AD, 2 ADM, 2 ADU, 2 AHT, 2 AS, 2 AW, 2 IN, 2 JO, 2 KF, 2 KS, 2 LI, 2 SO, 2 US, 2 YW, 2 ZK, 2 ZU, 5 AD, 5 AF, 5 AY, 5 BD, 5 BE, 5 BF, 5 BH, 5 CF, 5 CR, 5 DC, 5 HF, 5 HM, 5 ID, 5 LB, 5 LI, 5 MH, 5 ML, 5 NX, 5 OM, 5 RY, 5 WY, 6 BL, 6 BR, 6 CL, 6 DI, 6 FA, 6 FH, 6 FI, 6 HF, 6 IC, 6 IK, 6 IS, 6 LD, 6 LF, 6 LI, 6 SH, 6 UB. (I—V—I). (A. Robinson.)

Holland Park, London (January, 1924, to April, 1924).
2 AGT, 2 LIX, 2 AJ, 2 BO, 2 BT, 2 BZ, 2 FU, 2 FQ, 2 GO, 2 KG, 2 KZ, 2 ML, (?) 2 MO, 2 OB, 2 OM, 2 PY, 2 PZ, 2 QC, 2 ST, 2 UC. 2 VJ, 2 XX, 2 XZ, 2 ZA, 2 ZO, 5 BT, 5 BV, 5 CB, 5 CP, 5 DK, 5 IO, 5 OB, 5 OF, 5 PD, 5 PO, 5 PU, 5 VR, 6 GT, 6 IM, 6 KI, 6 PU, 6XX.

(C. L. Bradley.)

Broadcasting.

REGULAR PROGRAMMES ARE BROADCAST FROM THE FOLLOWING EUROPEAN STATIONS:—

GREAT BRITAIN.

ABERDEEN, 2 BD, 495 metres; **BIRMINGHAM 5 IT,** 475 metres; **GLASGOW 5 SC,** 420 metres; **NEWCASTLE 5 NO,** 400 metres; **BOURNEMOUTH 6 BM,** 385 metres; **MANCHESTER 2 ZY,** 375 metres; **LONDON 2 LO,** 365 metres; **CARDIFF 5 WA,** 351 metres; **LIVERPOOL 6 LV,** (Relay), 318 metres; **PLYMOUTH 5 PY** (Relay), 335 metres; **EDINBURGH 2 EH** (Relay), 325 metres; **SHEFFIELD** (Relay), 303 metres. Tuesdays, Thursdays and Fridays, 1 p.m. to 2 p.m. (**2 LO** only). Regular daily programmes, 3 to 7.30 p.m., 8 to 11.30 p.m. Sundays, 3 to 5 p.m., 8.30 to 10.30 p.m.

FRANCE.

PARIS (Eiffel Tower), FL, 2,600 metres. 7.40 a.m. Weather Forecasts, 11.0 a.m. (Sunday); 10.45 a.m., Cotton **Prices;** 12 noon, Market Report; 12.15 to 12.30 (Weekdays), Time Signal **and** Weather Forecast; 3.40 p.m., Financial Reports; 5.30 p.m., Bourse Closing Prices; 6.15 p.m., Concert; 8.0 p.m., Weather Report; 9.0 p.m. (Wednesday and Sunday), Concert; 10.10 p.m., Weather Forecast.

PARIS ("Radio Paris"), SFR, 1,780 metres. 12.30 p.m., Cotton Prices, News; 12.45 p.m., Concert; 1.30 p.m., Exchange Prices; 4.30 p.m., Financial Report; 5.0 p.m., Concert; 8.30 p.m., News and Concert.

PARIS (Ecole Superieure des Postes et Telegraphes), 450 metres. 3.45 p.m. (Wednesday), Talk on History; 8.0 p.m. (Tuesday), English Lesson; 8.30 p.m., Concert; 9.0 p.m., Relayed Concert or Play.

PARIS (Station du Petit Parisien), 340 metres. 8.30 p.m., Tests

BELGIUM.

BRUSSELS, BAV, 1,100 metres. At 2 p.m. and 6.50 p.m., Meteorological Forecast.

BRUSSELS ("Radio Electrique"), 265 metres. Daily, 5 p.m. to 6 p.m., Concert; 8 p.m. to 8.15 p.m., General Talk; **8.15 p.m.** to 10 p.m., Concert.

HOLLAND,

THE HAGUE, PCGG, 1,070 metres. 4 to 6 p.m. (Sunday), 9.40 to 11.40 p.m. (Monday and Thursday), Concerts.

THE HAGUE (Heussen Laboratory), PCUU, 1,050 metres. 10.40 to 11.40 a.m. (Sunday), Concert; 9.40 to 10.40 p.m., Concert; 8.45 to 9 p.m. (Thursday), Concert.

THE HAGUE (Velthuisen), PCKK, 1,050 metres, 9.40 to 10.40 p.m. (Friday), Concert.

HILVERSUM, 1,050 metres. 9.10 to 11.10 (Sunday), Concert and News.

IJMUIDEN (Middelraad), PCMM, 1,050 metres. Saturday, 9.10 to 10.40 p.m., Concert.

AMSTERDAM, PA 5, 1,050 metres (Irregular), 8.40 to 10.10 p.m., Concert.

AMSTERDAM (Vas Diaz), PCFF, 2,000 metres, 9 a.m. and 5 p.m., Share Market Report, Exchange Rates and News.

DENMARK.

LYNGBY, OXE, 2,400 metres. 8.30 to 9.45 p.m. (weekdays), 8 to 9 (Sunday), Concert.

SWEDEN.

STOCKHOLM (Telegrafverket), 440 metres. Monday, Wednesday and Saturday, 7 to 9 p.m. Sunday, 11 to 12 a.m.

STOCKHOLM (Radiobolaget), 470 metres, Tuesday and Thursday, 7 to 9 p.m. Sunday, 6 to 8 p.m.

GOTHENBURG (Nya Varvet), 700 metres. Wednesday, 7 to 8 p.m.

BODEN, 2,500 metres. 6.0 to 7.0 p.m., Concert.

GERMANY.

BERLIN (Koenigswusterhausen), LP, 2,370 metres (Sunday), 10.40 a.m. to 11.45 a.m., Orchestral Concert. 4,000 metres, 7 to 8 a.m., Music and Speech; 12.30 to 1.30 p.m. Music and Speech; 5.0 to 5.30 p.m., News.

EBERSWALDE 2,930 metres. Daily 1 to 2 p.m. Address and Concert; 6 to 7.30 p.m., Address and Concert; Thursday and Saturday, 7.20 p.m., Concert.

BERLIN (Vox Haus), 430 metres. 11 a.m., Stock Exchange; 1.55 p.m., Time Signals; 5.40 to 7 p.m., Concert; 7 to 8 p.m. (Sunday), Concert.

BRESLAU, 415 metres.

HAMBURG, 392 metres.

STUTTGART, 437 metres.

KONIGSBERG, 460 metres.

FRANKFURT AM MAIN, 467 metres. 7.30 to 10 p.m. Tests, Gramophone records.

LEIPZIG (Mitteldeutsche Rundfunk A.G.), 452 metres.

MUNCHEN (Die Deutsche Stunde in Bayern), 485 metres.

AUSTRIA.

VIENNA (Radio-Hekaphon), 600 metres

CZECHO-SLOVAKIA.

PRAGUE, PRG, 1,800 metres. 8 a.m., 12 a.m. and 4 p.m., Meteorological Bulletin and News; 4,500 metres, 10 a.m., 3 p.m., and 10 p.m., Concert.

KBELY (near Prague), 1,150 metres. 7.15 p.m. and 10 p.m., Concert and News.

SWITZERLAND.

GENEVA, 1,100 metres (Weekdays). At 3.15 and 8 p.m., Concert or Lecture.

LAUSANNE, HB 2, 780 metres. Daily, 9.15 p.m., Concert and Address.

SPAIN.

MADRID, PTT, 400 to 700 metres. 6 to 8 p.m., Tests.

MADRID (Radio Iberica), 392 metres. Daily (except Thursdays and Sundays), 7 to 9 p.m. Thursdays and Sundays, 10 to 12 p.m., Concerts.

MADRID, 1,800 metres. Irregular.

CARTAGENA, EBX, 1,200 metres, 12.0 to 12.30 p.m., 5.0 to 5.30 p.m., Lectures and Concerts.

ITALY.

ROME, ICD, 3,200 metres. Weekdays, 12 a.m. 1,800 metres, 4 p.m. and 8.30 p.m., Tests, Gramophone Records.

THE WIRELESS WORLD EXCHANGE AND MART

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